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Optimized Algorithms For Securing Iris Recognition System- A Systematic Review

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Abstract: Human Being's eyes are recognized as the most efficient biometric trait. Because of its great accuracy, reliability as well as originality iris recognition is included in numerous fields associated with access control as well as security. For efficient working of the iris recognition system the researchers have to face many challenges in designing an effective system. In this paper the author discusses the new way of individual identification depending upon the iris recognition developed by many researchers. It includes various techniques used by them and their effectiveness in iris recognition process.

Keywords: Gabor filter, Log Gabor filter, Genetic Algorithm, K-Mean Clustering, Artificial Neural Network (ANN)

I. INTODUCTION

Growth of information technology along with risks upon security, has increased the need of a robust as well as extremely accurate human recognition system. Authentication of any human can be carried out by means of password, biometrics or even smart cards. Keeping in mind password and handling smart card is tough, therefore biometrics dependent authentication system is extremely recommended. Biometrics means the scientific discipline which includes identifiers such as fingerprints, iris, face and also voice that are unique measurable features utilized to tag or explain a person's identity. The biometric traits are unique to a person because they are hereditary in nature thus turned out to be more accurate as compared to traditional human authentication schemes [12]. This system collects the biometric features of an individual, elicit-ate the characteristics with the gathered biometric traits and matches the elicited features together with the one saved in the database, in order to confirm the claimed identity. Iris is recognized as more stable as well as distinctive as the design and structure involving iris left constant in course of life. The possibility that two different individual possess similar iris is 1 in 1078 (Morimoto et al., 2005). There are multiple problems throughout entire procedure of Iris Recognition in the form of obtaining high quality picture, segmentation of the concentric boundaries, scalability, and appropriate characteristic representation as well as matching. John Dougman proposed first iris recognition system, afterwards various techniques had been proposed to enhance this biometric system. The procedure of iris recognition includes some pre-processing phases like localization, segmentation as well as normalization and also some filtering methods are employed to produce iris templates. The final binary template (iris code) can be generated by quantizing the phase details included in the filtered normalized image. The acquired binary template is then saved in the database. Bit-based metrics such as hamming distance is utilized for assessment of iris codes during iris recognition Inverse Biometrics refers to the procedure of reconstructing or maybe re-engineering the biometric template to acquire details regarding the identification related to the template [5].

In today's situation in which the biometric systems are taking over the traditional authentication techniques, inverse biometrics provides for a critical security threat. Since iris recognition is utilized in offering authentication or personal identification for extremely confidential as well as secure systems including airports, for forensic applications, etc. Within this paper, a different scheme for iris recognition have been explained using multiple classifiers. Performance of the every single employed selection technique is calculated using parameters like false real rate, false acceptance rate, etc.

II. LITERATURE SURVEY

COMPARISON OF DIFFERENT STATE OF ART

Authors	Year	Reference No	Parameters	Techniques	Strengths	Limitations
John Daugman	January 2004 (IEEE)	[1]	Pupillary and the outer (limbus) boundary of iris	Bandpass 2-D filter kernel, 2-D wavelet demodulation	1) For badly focused images of eye, Demodulation phase sequence bits are set 2) High speed performance	Not so accurate because of false matches
Leila Fallah Araghi	March 2010 (IMECS)	[2]	covariance matrix	Discrete wavelet transform by utilizing Competitive Neural Network (LVQ).	1) Simulation results are very promising 2) This method offers good class discriminacy	Less amount of data set used
Fadi N. Sibai	2010 (Elsevier)	[3]	RGB values extracted from the iris jpeg image	Feedforward artificial Neural network with the Backpropagation algorithm	High accuracy upto 93.33%	Only a single iris was processed instead of whole pair
V. Saishanmuga Raja	2013 (IJCA)	[4]	Accuracy rate, average time	Genetic Algorithm. Neural Network	High accuracy rate and reduced learning time is achieved.	In the starting stage, the network started mugging up rather than learning as well as predicting
Javier Galbally	2013 (Elsevier)	[5]	Motion blur, contrast, occlusion	Genetic Algorithm	High level of matching among real samples	Not much accurate
Himanshu Rai,	2013 (Elsevier)	[6]	Zigzag collarette area of iris	Support vector machine, hamming distance, parabola detection, trimmed median filter	Efficient for both identification as well as verification	Small dataset used
Maria De Marsico	2014 (Elsevier)	[7]	Mean, relative error	*Histogram, Hamming distance CSUM algorithm*	FIRME provides a solution for both face spoofing detection, and for optimal sample selection, by utilizing iterative entropy evaluation	Behave negatively because of bad acquisition, sensor problem, incorrect device orientation
KiranB.Raja	2014 (Elsevier)	[8]	Equal error rate(EER), contrast, diameter	Deep sparse filtering	1) Real life dataset used 2) Provide high degree of robust features	Not so much accurate since accuracy is 75%
Daniela Sanchez	2015 (Elsevier)	[9]	Percentage of complexity	Modular neural network, genetic algorithm	Optimizes the multiple modular neural networks which utilize different data points in the training phase, providing multiple results in the same evolution	Division of tasks cannot be done
Ashok K Bhateja	2015 (PATREC)	[10]	Sparse Concentration Index, Confidence index	*k*-nearest distance classifier, Cumulative Sparse Concentration Index based classifiers, Sector based classifier, Genetic Algorithm, Canny edge detection, Hough transform	1) Highly accurate and efficient method 2) Combines the strengths of three classifiers	Less amount of data set used
Ali Abdulhafidh Ibrahim1	2016 (JCC)	[11]	False Acceptance Rate, and Correct Recognition Rate, False Rejection Rate	Libor Masek and genetic algorithms, Principal Component Analysis (PCA**)**	Accuracy rate is higher	Error rate increases with the increase in number of samples and the recognition rate decreases when large samples are utilized
Rajwinder Kaur	2016 (IJCET)	[12]	false acceptance rate, false real rate	Genetic Algorithm	Provides high accuracy rate and low error	Small amount of data set used

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III. BASIC TECHNIQUES FOLLOWED

A. Iris Recognition Process

Iris Recognition process includes pre-processing measures such as Acquisition, Segmentation, as well as Normalization and the encoded normalized images are matched with the claimed identity. In iris recognition various steps involved are-

1. Image Acquisition: -An eye's picture is obtained by using a sensor or perhaps camera or some other image acquisition tool.

2. Image Segmentation/Localization: - Captured image of an eye is segmented to differentiate particular iris region from remaining section of the eye.

2.1. Canny **edge detector [13]**: This technique was adopted in order to identify edges of iris therefore three primary performance associated standards were recognized.

i. Superior recognition: The algorithm must identify all possible actual edges within image.

ii. Superior Segmentation: Within the actual picture the edges must be as near as it can be to the circled edges.

iii. Minimal multiplicity response to single edge as well as image must not produce fake edges.

2.2. Circular Hough Transform [14]:- It is extremely efficient algorithm therefore it is employed to discover the iris boundaries. Large calculations represents the three stage iteration problem within Hough transform, each (p, q) point edges in the image space votes for point (s, t, r') for every feasible circle moving from it within the parameter space, here s, t are the coordinates of the center of the circle and r' is its radius. Gray scale iris picture is employed with edge detector in order to produce edge map. Gaussian filter is utilized to choose the appropriate scale of edge analysis as well as smooth the image [15]. Accuracy depends relies on the number of accumulator cells, Amount of memory needed raise up due to increase of cells.

2.3. K-mean clustering Technique [16]:- It split the eyes picture within 3 different parts dependent on the values of intensity. 1st region includes iris along with pupil as well as eye lashes possessing little value of intensity. 2nd area contains bigger values with intensity composed of sclera region as well as luminance reflections. 3rd is the skin area in-between 2 areas. This technique is beneficial because primary dilemma is within the dark area. The benefit of employing this technique is that the useful regions in the iris region are not lost because of using arc.

3. Normalization: -The annular-like iris pictures of the eye is transformed into rectangular normalized images which are the representation of segmented iris picture from Cartesian into pseudo-polar coordinates.

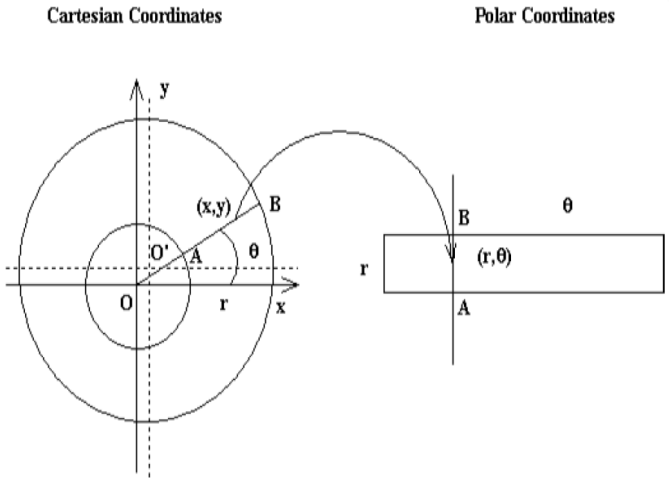

Fig. 2. Normalization of annular-like segmented iris image

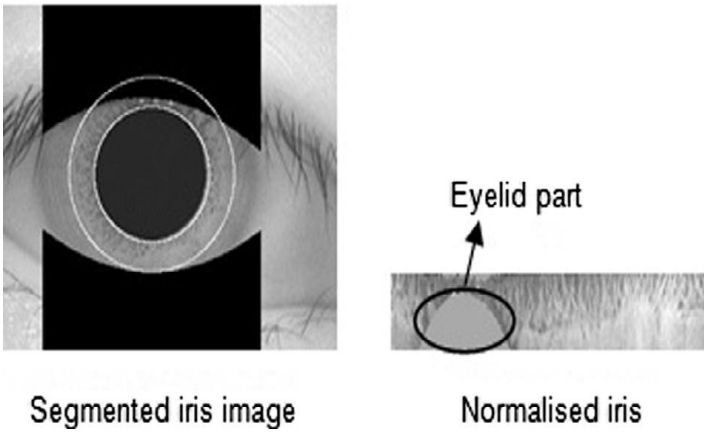

Fig. 3. Normalization process

4. Feature Extraction

It is the essential phase of recognition of iris utilized to find out iris representation.

4.1. Log- Gabor Filter [17]

Numerous modifications are included in the complicated texture of iris. Iris characteristic details are acquired through break down of the picture among complicated-valued phase coefficients of iris. One dimension filter is used to each and every portion of

normalized design of iris so as to achieve suitable characteristic details.

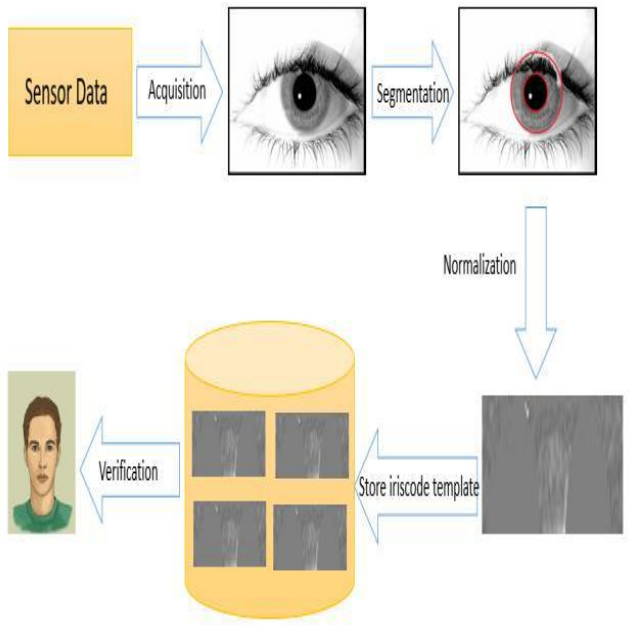

Fig. 4. Iris Recognition Process

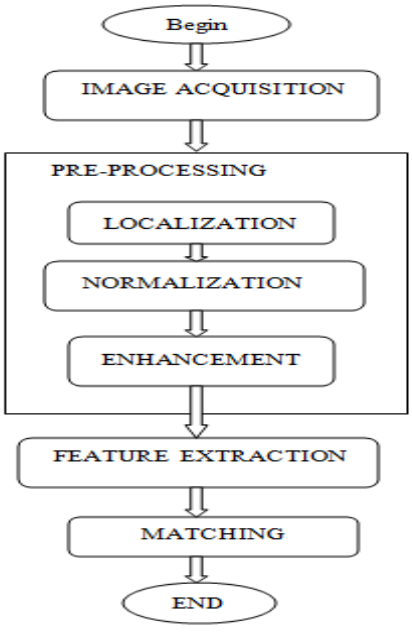

Fig. 5. Flowchart of Iris Recognition Process

The whole iris recognition process can be summarized using Fig. 4 and Fig. 5

4.2. Artificial neural network:

Artificial neural network (ANN) is a self-learning approach that imitates the properties of biological nervous systems. It is a system that changes its parameters based on external or internal information that flows through the network during the learning phase.

4.3. Genetic Algorithm

A fundamental genetic algorithm consists of three operators; Selection, Crossover, and Mutation. The algorithm begins by considering a set of chromosomes (usually the elements or units on which we want to apply genetic algorithms), called population. The chromosomes of the present population are employed to produce offspring which is forwarded to the next generation or population hoping that newly generated offspring chromosomes will be better in comparison to parent chromosomes [18].

1) Fitness Evaluation: - While producing offspring chromosomes, initially the fitness of all the chromosomes within consideration, is determined by means of predefined fitness function.

2) Selection: - The selection operator allows selecting a parent chromosomes based on their related fitness values. The chromosomes having the best fitness values are forwarded to the next generations. This sort of selection is referred as elitism. There are various selection operators available for usage among which three main selection operators utilized in this paper are:

2.1 Rank Selection: In this, the population is categorized based on the fitness values. The fitness allocated to every single chromosome relies upon its location among the individual's rank and not on the actual fitness value. The probability of every single chromosome getting selected for mating is actually their fitness normalized with the overall fitness of population.

2.2 Roulette wheel selection: The chromosomes tend to be mapped to contiguous sections of a line in a way that each's portion is equal in size to its fitness. Any arbitrary number is produced, and the chromosome whose section spans the random number is selected. Till the needed number of chromosomes is obtained (called mating population), the procedure is repeated another time. [21]

2.3 Stochastic Universal Sampling: The chromosomes are mapped to contiguous sections of a line, in a way that each chromosomes' portion of the segment is equal to its fitness value.

5. Encoding and Matching

5.1 Encoding: - Encoding procedure maps the normalized iris image to binary representation. Many encoding methods are available and most of them utilize filtering techniques (typically Log Gabor filtering technique) before quantizing the phasor response of the output that is filtered and representing the iris images in binary form. [19].

5.2 Matching: - In this process two iris codes i.e. the iris code of target iris image and that saved in the database are compared using bitwise operators like hamming distance. The encoding and matching process can be summarized in figure 6

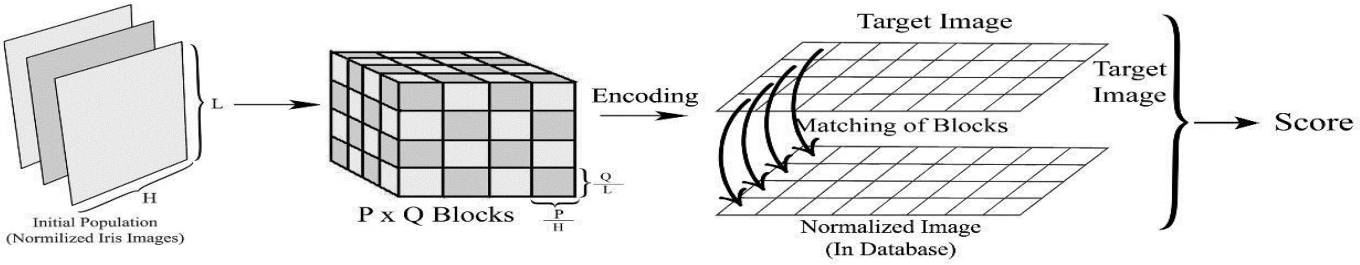

Fig. 6. Encoding and Matching Process

IV. CONCLUSION

The colored ring of eye is called iris which made by textured tissue that fills area of the pupil of the eye used for identify a person. No two single persons have same iris patterns .Iris of both the eyes are different. Iris based recognition system provides the accurate and authentic result. Its working speed is also high. Iris recognition system has similar working with retinal recognition system. The only difference between two is that retinal recognition system uses input acquisition subsystem. Iris recognition takes only few seconds to produce record and store the result in database so that it may work as cache. Before recognizing the new iris, we first match the entries in database. For future recognition and verification, database must be maintained. Contact lens and spectacles does not affect the quality of iris image. 256 bytes are used for storing the value of iris code.

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