Improved the Performance of Iris Recognition Using Genetic Algorithm

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Abstract - In this paper proposed a feature selection cum feature optimization process using wavelet transform function and GA algorithm. The wavelet transform function well knows texture feature extraction technique. The extracted feature not contains noised texture data. For the process of optimization used population based GA algorithm. In this proposed method used dual fitness function for selection of feature and optimization of feature. The dual fitness function work in terms of average length of template code for recognition process. For the estimation of recognition rate used hamming distance formula for count bit difference of genuine iris and imposter iris template. The recognition rate of feature based technique achieved 99.9 %

Keyword: - Iris Recognition, Image, FAR, FRR.

I. INTRODUCTION

The current stress on security and surveillance has led to a rapid development of automatic personal identification systems based on biometrics. Recently, iris recognition has been in the limelight for security biometrics applications. As it is well-known, biometrics deals with identification of individuals based on their biological and/or behavioral features. Technologies that exploit biometrics have the potential application of identifying individuals in order to control access to secured areas or materials. Nowadays a lot of biometric techniques are being developed based on different features and algorithms [1]. In fact, there are many biometric techniques that are either widely used or under investigation, including voice, face, iris, fingerprint, ear, retinal scan, signature. Each technique has its strengths and limitations, not being possible to determine which the best is. No single biometrics is expected to effectively meet the needs of all the applications. Nevertheless, it is known that, from all of these techniques, iris recognition is the most promising for high security environments. Iris recognition is in many ways a very good research topic in computer science. It combines many aspects of information technology research, such as computer vision, pattern recognition, statistics and human-machine interface. The purpose of iris recognition is real-time, high confidence recognition of a person's identity by mathematical analysis of the random patterns that are visible within the iris of an eye from some distance. Iris recognition has many practical uses; it can be used to authenticate person's identity or to identify a certain person from a large set of data. The iris is a protected internal organ of the eye, located behind the cornea and the aqueous humor, but in front of the lens[2]. The iris has many features that can be used to distinguish one iris from another. One of the primary visible characteristic is the trabecular meshwork, a tissue which gives the appearance of dividing the iris in a radial fashion that is permanently formed by the eighth month of gestation. During the development of the iris, there is no genetic nuance on it, a process known as chaotic morphogenesis that occurs during the seventh month of gestation, which means that even identical twins have uncorrelated minutiae, i.e. dieting irises. In fact, even persons own eyes are uncorrelated [4].

Fingerprint identification is also known as dactyloskopy or also hand identification is the process of comparing two examples of friction ridge skin impression from human fingers, palm or toes.

Figure 1: Example of finger print.

Method of fingerprinting helps police to investigate crimes during long period of time. The most amazing fact how many details about person can be known using only his/her fingerprints. Human skin has two layers: epidermis and dermis. Dermis has also two layers: papillary и reticulated layer. In papillary layer find themselves in pairs pyramidal formations that are called papillary. Each pair of papillary is divided by channels of sweat glands. Such pairs make a row and covered by the layer of epidermis build comb of papillary lines. Papillary lines are situated chaotically but as streams. When three streams are near each other they build triangle which is called delta. Papillary pattern is flexible. It means that there are no two similar papillary patterns in the world [8]. Each person has its own unique papillary pattern. Each papillary pattern has its own unique details of structure: beginning and end of lines, merging and separation of lines, bends and breaks, ridges, eyes and hooks, breaks of papillary lines and oncoming places of their beginnings and ends.

II. IRIS RECOGNITION

Iris is a unique characteristic of a person. The primary visible characteristic of iris is the trabecular meshwork that makes possible to divide the iris in a radial fashion. It is formed in the eighth month of gestation. Iris is stable and does not change during the whole life. Iris recognition is considered to be one of the exact methods of biometrics. Iris is protected by eyelid, cornea and aqueous humour that make the likelihood damage minimal unlike fingerprinting.

Some sources divide the process of iris recognition into two steps, some into three:

1. Capturing the image: The image can be captured by a standard camera using both visible and infrared light. The procedure can be manual or automated. In the manual procedure the iris should be in focus and the length between the camera and iris should be within six and twelve inches , while in automated procedure the length is between three and a half inches and one meter. In automated procedure the camera automatically locates the face and iris into the focus and makes the process rather easy and friendly.
2. Define the location of the iris and optimizing the image: when the iris is in focus , the iris recognition system just identifies the image with the best focus and clarity. The image is analyzed. The purpose of the analysis is to identify the outer boundary of the iris where it meets with white clear of the eye, the papillary boundary and the centre of pupil. The result of the analysis is the precise location of the circular iris.
3. Store and compare the image: the process of division, filtering and mapping segments of the iris into hundreds of vectors(phasors) takes place. The process is also known as 2-D Gabor. 2-D Gabor phasor can be easily understand as “what” and “where” of the image. Even after this procedure there are still 173 degrees of freedom to identify the iris. 2-D Gabor takes into consideration the changes that may occur with an iris.

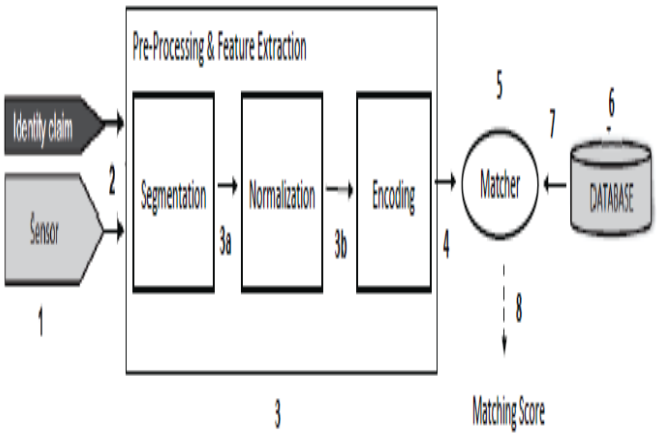

Figure 2: Architecture of an automated iris verification system.

III. FEATURE OF IRIS

Feature extraction process play important role in iris recognition and pattern recognition system based authentication mechanism. Among the pigment related features belong the crypts and the pigment spots and naturally the color of the iris. Crypts are noticeable thin lines that extend from the pupil to the edges of the iris. Pigment spots are random concentrations of pigment cells in the visible surface of the iris. They are known as moles and freckles with nearly black color. Features that control the actual size of the pupil are called radial and concentric furrows. Together they are called contraction furrows and they control the size of the pupil, which in turn controls how much light gets into the eye. [14] Typical radial furrows usually begin near the pupil and extend through the collarets. The radial furrows are creased in the anterior layer of the iris, from which loose tissue may bulge outward and this is what permits the iris to change the size of the pupil. The concentric furrows are generally circular and concentric with the pupil. They typically appear in the ciliary area, near the periphery of the iris and permit to bulge the loose tissue outward in different direction than the radial furrows. It is a sinuous line as can be seen from figure 2, which forms an elevated ridge running parallel with the margin of the pupil. The collarets is the thickest part of the human iris. [14] The most striking part of the iris if of course the pupil, black round dot in the middle of the iris as can be seen in figures 1 and 2. Pupil may at rest glance seem round in shape, but in actuality it may not be exactly circular in shape and its deviation from the circle is a visible characteristics. Centers of the iris and the pupil are different and they can dire from each other of about 20%. Further properties of the iris that enhance its suitability for use in high confidence identification systems include its inherent isolation and protection from the external environment. Humans protect their eyes instinct since they are the most valuable of human senses.

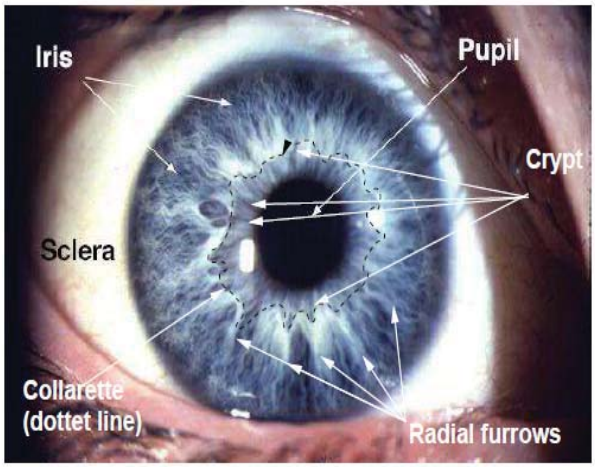

Figure 3: Visible features of the eye.

IV. PROPOSED WORK

In this section discuss the proposed algorithm of iris recognition based on feature selection and feature optimization process. Initially used iris image data base and passes through Gabor transform function and these transform function gives a texture feature of iris image. The extracted Gabor textures passes through multi-objective genetic algorithm and selects the proper feature and optimized the feature and finally passes through the creation of random template generation. The process of algorithm discuss step by step in below section.

1. Select data set for feature extraction
2. apply Gabor transform function for feature extraction
3. Start generation of feature matrix in terms of texture feature
4. convert feature matrix as row wise and make vector of these feature
5. Initialized a population set (t=1)
6. Compare the value of distance vector with population set
7. If value of feature greater than vector value
8. Processed for encoded of data
9. Encoding format is binary
10. After encoding offspring are performed
11. Set the value of probability for mutation and the value of probability is 0.006.
12. Set of optimal feature.
13. If template is not generated go to selection process
14. Else optimized template generated.
15. the template goes through the recognition process
16. hamming distance measure the bit difference of binary bit
17. finally recognized the iris template
18. calculate the recognition rate and error rate
19. exit

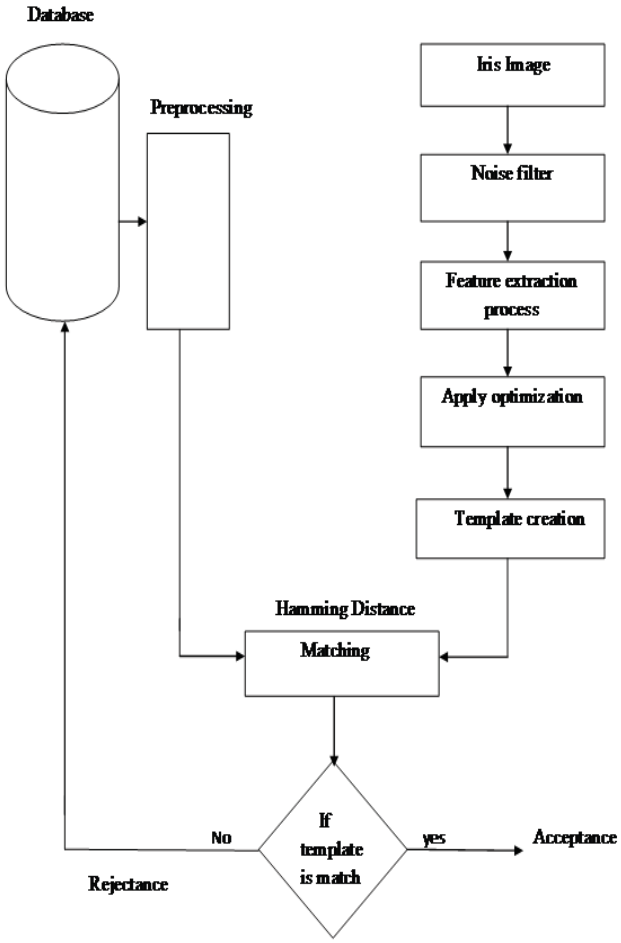

Figure 4: Block diagram of proposed model.

V. EXPERIMENTAL RESULT AND ANALYSIS

Iris recognition has been an active research topic in recent years because of its high accuracy. There is not any public iris database while there are many face and fingerprint databases. Firstly we get the values of FAR and FRR through Hough transform Wavelet transform and then genetic algorithm after run the program code. Finally we get the better result of Genetic algorithm with compare as wavelet transform and Hough transform. To investigate the effectiveness of the proposed method for Iris Recognition System. We perform some experimental task, all these tasks perform in MATLAB7.5 software and well famous CASIA Iris Image Database.

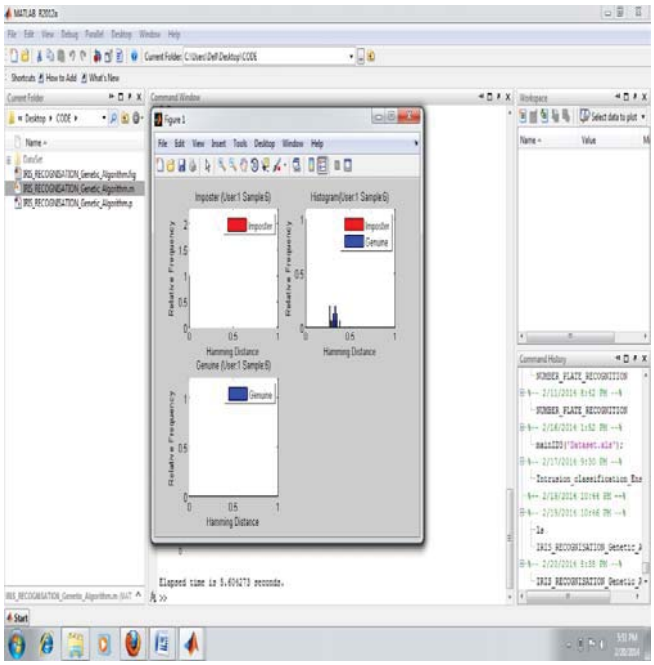

Figure 5: Shows that the comparative information of hamming distance between imposter users and genuine users of histogram in compassion of relative frequency and hamming distance, for Wavelet transform and the No. of user is 1.

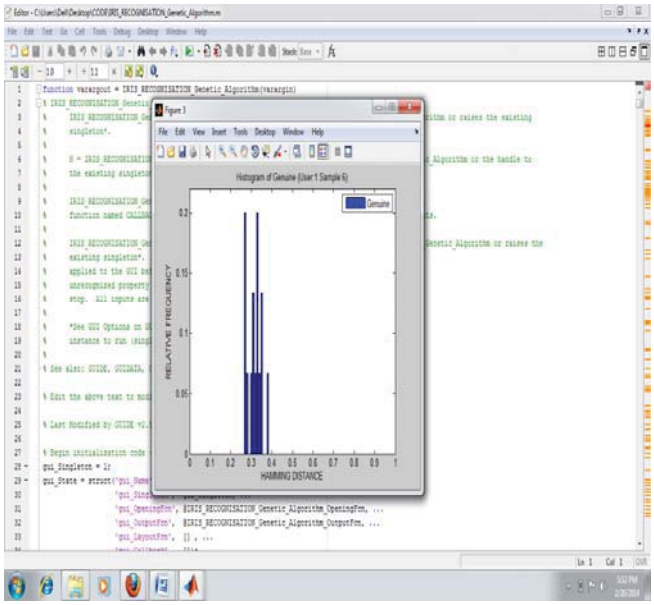

Figure 6: Shows that the comparative information of hamming distance between imposter users and genuine users of histogram in compassion of relative frequency and hamming distance, for Wavelet transform and the No. of user is 1.

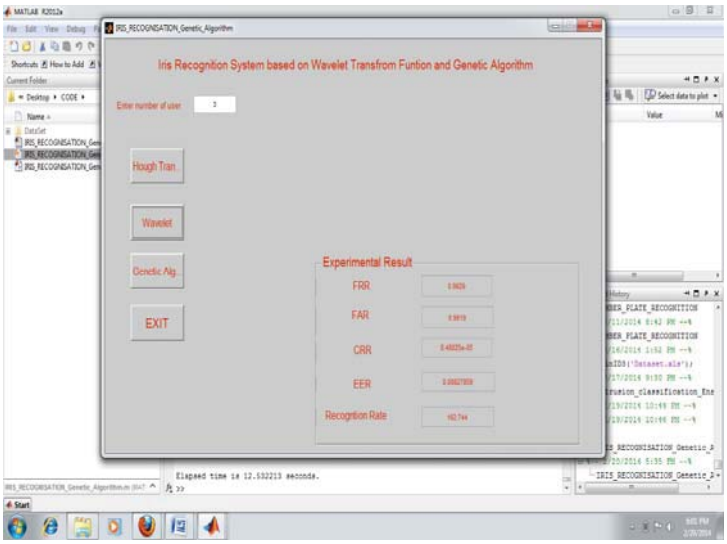

Figure 7: Shows that the result window for Wavelet transform and the No. of user is 3.

No. of user	FRR	FAR	CRR	EER	RECOGINITION RATE
1	1.0000	1.0000	6.548	0.0010	80.37
3	0.9777	0.9900	8.322	0.0022	93.13
5	0.9866	0.9972	7.527	0.0025	96.45
7	0.9904	0.9986	8.342	0.0021	92.44
10	0.9933	0.9997	9.173	0.0018	89.51

Table 1: Simulation results based on Hough transform on different users.

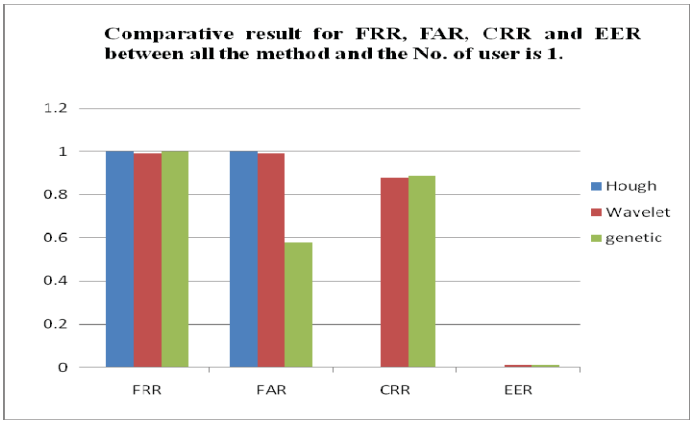

Figure 8: Shows that the Comparative result of FRR, FAR, CRR and FER using Hough, Wavelet transform and Genetic transform, and the No. of user is 1.

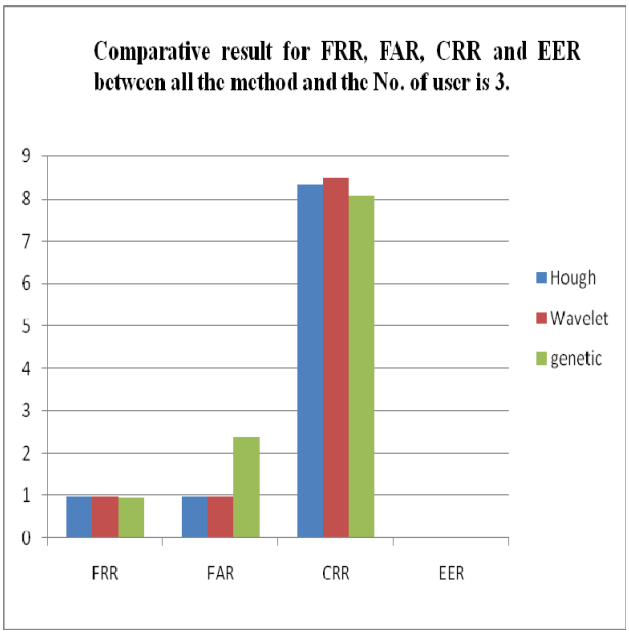

Figure 9: Shows that the Comparative result of FRR, FAR, CRR and FER using Hough, Wavelet transform and Genetic transform, and the No. of user is 3.

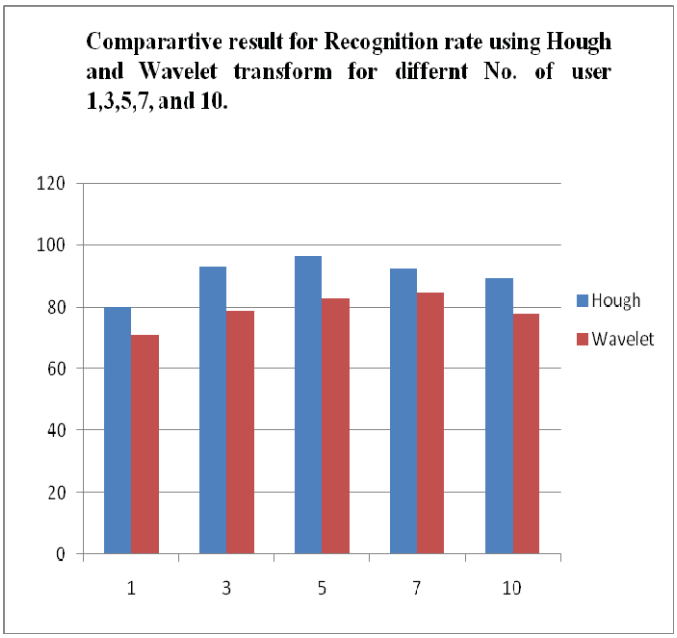

Figure 10: Shows that the Comparative result of Recognition rate using Hough, and Wavelet transform and the No. of user is 1,3,5,7 and 10.

VI. Conclusion and Future Work

In this paper proposed a feature selection cum feature optimization iris recognition system. Feature based iris recognition system improved the recognition rate of system and reduces the template creation error. The feature extraction process is done by wavelet transform function. Wavelet transform function well knows texture feature extractor. The extracted feature passes through optimization and selection process, for the optimization and selection process used genetic algorithm. Genetic algorithm is population based searching technique. The optimized feature selection process improved the iris recognition system. The feature selection and feature optimization process used two different fitness functions for satisfying the condition for optimal selection. the dual fitness condition function

take more computational time for template generation in future reduce the dual fitness function in single objective function and increase the execution speed of iris recognition system.

REFERENCES

[1] Karen P. Hollingsworth, Kevin W. Bowyer, Patrick J. Flynn "Improved Iris Recognition through Fusion of Hamming Distance and Fragile Bit Distance" IEEE TRANSACTIONS ON PATTERN ANALYSIS AND MACHINE INTELLIGENCE, VOL. 33, 2011. Pp.2465-2477.

[2] Zaheera Zainal Abidin, Mazani Manafand Abdul Samad Shibghatullah "ant-CBIR: A New Method for Radial Furrow Extraction in Iris Biometric" Proceedings of the International Conference on Information Security and Cyber Forensics, 2014.Pp.20-25.

[3] Sonali Sharma, Dr. Kamal Sharma, Surjeet Dalal "Recognition and identification schemes for the development of Eigen feature extraction based iris recognition system" Sonali Sharma al. International Journal of Recent Research Aspects ISSN: 2349-7688, Vol. 1, 2014, Pp.70-74.

[4] Sonali Sharma, Dr. Kamal Sharma, Dr. Surjeet Dalal "Feature Recognition from Histogram and Eigen Algorithm in Digital Image Processing" Sonali Sharma al. International Journal of Recent Research Aspects ISSN: 2349-7688, Vol. 1, Issue 2, 2014, Pp. 111-119.

[5] Nitin K. Mahadeo, Andrew P. Papli´nski, Sid Ray "Optimization of Iris Codes for Improved Recognition" Pp.48-55.

[6] 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, Pp.1-19.

[7] Chun-Wei Tan, Ajay Kumar "Accurate Iris Recognition at a Distance Using Stabilized Iris Encoding and Zernike Moments Phase Features" IEEE Trans. Image Processing, 2014, Pp.1-28.

[8] Jing Liu1, Zhenan Sun, Tieniu Tan "Code-level Information Fusion of Low-Resolution Iris Image Sequences for Personal Identification at a Distance", Pp1-6

[9] Maryam Soltanali Khalili and Hamed Sadjedi "A ROBUST IRIS RECOGNITION METHOD ONADVERSE CONDITIONS" International Journal of Computer Science, Engineering and Information Technology (IJCSEIT), Vol.3, No.5, 2013, Pp.33-48.

[10] Priyam Ghosh, M Rajashekharababu "Authentication using Iris Recognition with Parallel Approach" IJCSNS International Journal of Computer Science and Network Security, VOL.13 No.5, May 2013,Pp.87-93.

[11] Chun-Wei Tan, Ajay Kumar "Adaptive and Localized Iris Weight Map for Accurate Iris Recognition under Less Constrained Environments" Pp.1-7.

[12] Inmaculada Tomeo-Reyes Vinod Chandran "Effect of Pupil Dilation and Constriction on the Distribution of Bit Errors within the Iris" Pp4321-4328

[13] Kevin W. Bowyer, Karen P. Hollingsworth and Patrick J. Flynn "A Survey of Iris Biometrics Research: 2008-2010" 2012.

[14] J. Daugman "Probing the Uniqueness and Randomness of Iriscodes: Results from 200 Billion Iris Pair Comparisons" Proc. IEEE, 2006 vol. 94, no. 11, Pp. 1927-1935.

[15] K.W. Bowyer, K.P. Hollingsworth, and P.J. Flynn "Image Understanding for Iris Biometrics: A Survey" Computer Vision and Image Understanding, 2008, vol. 110, no. 2, Pp. 281-307.

[16] R.M. Bolle, S. Pankanti, J.H. Connell, and N. Ratha "Iris Individuality: A Partial Iris Model" Proc. Int'l Conf., 2004, Pattern Recognition, Pp 927-930.

[17] K.P. Hollingsworth, K.W. Bowyer, and P.J. Flynn"All Iris Code Bits Are Not Created Equal" Proc. IEEE Int Conf. Biometrics: Theory, Applications, and Systems, 2007 Pp 1-6.

[18] K.P. Hollingsworth, K.W. Bowyer, and P.J. Flynn "The Best Bits in an Iris Code" IEEE Trans. Pattern Analysis and Machine Intelligence,jvol., 2009 31, no. 6, Pp 964-973.

[19] N. Barzegar and M.S. Moin "A New User Dependent Iris Recognition System Based on an Area Preserving Pointwise Level Set Segmentation Approach" EURASIP J. Advances in signalprocessing,2009, vol. 2009, Pp 1-13.

[20] G. Dozier, D. Bell, L. Barnes, and K. Bryant"Refining Iris Templates via Weighted Bit Consistency" Proc. Midwest Artificial Intelligence and Cognitive Science Conf.,2009, Pp 1-5.