IRIS RECOGNITION USING DISCRETE COSINE TRANSFORM AND WAVELET PACKET DECOMPOSITION

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ABSTRACT

Iris recognition is basic technology for personal identification and verification and is most reliable and accurate for biometric identification system. Iris recognition system gives security to the organization and Institutes from the unauthorized access . Digital templates encoded from iris pattern using mathematical and statistical algorithms allow the identification of an individual. In this paper for iris recognition, 2-D discrete cosine transformation is used for the compression of the image and wavelet packet decomposition is done, to obtain distinctive feature from an iris image and will give more effective results.

Keywords: Biometrics, Discrete Cosine Transformation, Iris Recognition, Wavelet, Iris Segmentation, Iris Normalization.

I INTRODUCTION

Iris Recognition is regarded as one of the most promising biometric identification technologies with high uniqueness an noninvasiveness, anti-falsification many other advanced qualities. The identification performance is greatly affected by robustness and accuracy of iris segmentation. The random pattern which are visible from some distance are identify with the help of mathematical analysis, this is the same purpose of iris recognition. Iris is the colored section between the pupil and sclera of the eye. The primary purpose is to control the size of the pupil. The unique feature of iris includes the tissue that gives iris radial. The two basic modes of a biometric system: First, is verification (or Authentication) mode the system performs a one-to-one comparison of a captured biometric with a specific template stored in a biometric database in order to verify the individual is the person they claim to be. Basically 3 steps are there in the verification of a person. First step, reference models for all the users are generated and stored in the database. In the second step, some templates are matched with reference models to generate the original and impostor scores and calculate the threshold. In third step is the authentication step. In this process may use a smart card, ID number ,username to indicate which template should be used for comparison 'matched recognition' is a common use of the verification mode, to prevent multiple people from using same identity. Second the system performs a 1: M (one-to-many) comparison against a biometric stored database in attempt to identify the identity of person is called identification mode. The system will succeed in identifying the person if the comparison of the biometric template to a template in the stored database falls within a previously set threshold. Identification mode can be used so that the user does not have to provide any information about the template to be used or for 'unmatched recognition' of the person. Whether the person is who she (implicitly or explicitly) denies to be" The latter function can only be achieved through biometrics since other methods of personal recognition such as password, PINs or keys are not very much effective.

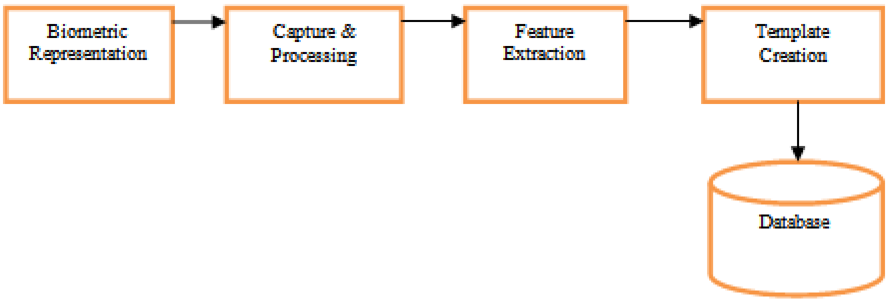


Fig: 1 Process of recognition through the Biometric Repersentation

II TECHNIQUES USED

2.1 New normalization method for iris recognition, which is different from the conventional one in which the annular iris region is unwrapped to a rectangular block under polar coordinate. In this method, we investigate the effect of interpolation and decimation in conventional normalization method to recognition rate for the first time. We used the original texture to fill the pupil area, then a novel normalized image can be obtained with the geometric structure and directional information of original iris image well preserved, which enables us to choose simpler features than before. Subsequently, we extracted the multi-direction and multi-scale information feature of normalized iris image by contour let transform, and adopt SVM to classify the features. Experimental results validate the improvement of recognition rate. [6]

2.2 A biometric system provides automatic identification of an individual based on a unique feature or characteristic possessed by the individual. Iris recognition is regarded as the most reliable and accurate biometric identification system available. In this paper, we describe the novel techniques we developed to create an Iris Recognition System, in addition to an analysis of our results. We used a fusion mechanism that amalgamates both, a Canny Edge Detection scheme and a Circular Hough Transform, to detect the iris boundaries in the eye's digital image. We then applied the Haar wavelet in order to extract the deterministic patterns in a person's iris in the form of a feature vector. By comparing the quantized vectors using the Hamming Distance operator, we determine finally whether two irises are similar. Our results show that our system is quite effective [5].

2.3 Iris recognition system using wavelet packet is presented. Computational complexity of Daubechies wavelet is less as compared to Gabor wavelets. As Gabor wavelet based iris recognition system is patented this limits the further development. In this paper, we propose a novel multi-resolution approach based on Wavelet Packet Transform (WPT) for iris texture analysis and recognition. The development of this approach is motivated by the observation that dominant frequencies of iris texture are located in the low and middle frequency channels.

The features of the new iris pattern are compared against the stored pattern after computing the signature of new iris pattern and identification is performed. It specifically uses the multiresolution decomposition of 2-D discrete wavelet packet transform for extracting the unique features from the acquired iris image. [2]

2.4 A biometric system for iris recognition. The system is based on using the two dimensional (2-D) Discrete Cosine Transform (DCT) to obtain distinctive features from an iris image. Classification of the iris image is then achieved by applying a Wavelet Packet Transform (WPT) to the coefficients (features) extracted from the DCT (frequency) matrix. The iris images used in this system were obtained from the CASIA database. [1]

2.5 A novel multi-resolution approach based on Wavelet Packet Transform (WPT) for iris texture analysis and recognition. The development of this approach is motivated by the observation that dominant frequencies of iris texture are located in the low and middle frequency channels. With an adaptive threshold, WPT sub images coefficients are quantized into 1, 0 or -1 as iris signature. This signature presents the local information of different irises. The signature of the new iris pattern is compared against the stored pattern after computing the signature of new iris pattern and identification is performed.[3]

2.6 A new eyelash detection algorithm based on directional filters, which achieves a low rate of eyelash misclassification. Second, a multi-scale and multidirectional data fusion method is introduced to reduce the edge effect of wavelet transformation produced by complex segmentation algorithms. Finally, an iris indexing method on the basis of corner detection is presented to accelerate exhausted the 1: N search in a huge iris database. The performance evaluations are carried out on two popular iris databases, and the test results are experimentally more robust and accurate with less elapsed time compared with most existing methods.[4]

III THE TECHNIQUES THOSE ARE USED IN PROPOSED METHOD

3.1 Discrete Cosine Transformation

The DCT has been used in many practical applications, especially in signal compression. For example, the compression achieved in the famous JPEG image format is based on the DCT. The strong capability of the DCT to compress energy makes the DCT a good candidate for pattern recognition applications . The DCT can constitute an integral part of a successful pattern recognition system For example; the DCT was successfully used in face recognition application. 2D - DCT compress all the energy /information of the image and concentrate it in a few coefficient located in the upper left corner of the resulting revalue M×N DCT/ frequency matrix .

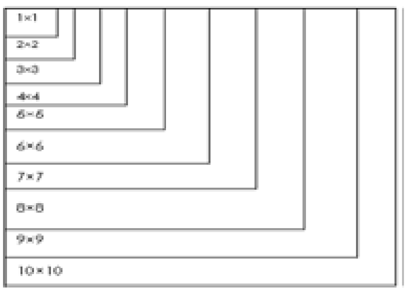


Fig 3.1.1 Frequency matrix

The method is a square-windowing method that extracts the L ´* L = L2 lowest-frequency coefficients in the upper left corner of the DCT matrix.we divide the input image into the set of 4-by-4 blocks and afterwards the two dimensional DCT is computed for each blocks to obtained the DCT coefficients. The obtained DCT coefficients are than binaries. The element of frequency of component can be de composed by the DCT. If the network is still forced to train on more epochs, over-learning occurs and the error rate starts increasing with increasing number of epochs. The level off and error rate decrease when epochs goes lower to 74. The more use of epochs , to make template of image then the size of template is reduced , most discriminated coefficient ,DCT matrix are extracted and binaries.[8]

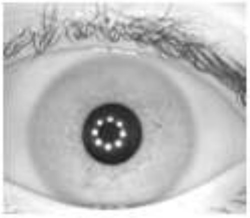
3.2 Wavelet Packet Decomposition

Wavelet transforms have been one of the important signal processing developments in the past years especially for the applications such as vision, data compression, segmentation and time division frequency. During the past decade several efficient implementations of wavelet transforms have been derived. The theory of wavelets has fundamentally work on quantum mechanics and the functions theory though a unifying framework is a recent occurrence for the Wavelet analysis is done using a prototype function called a wavelet. Wavelets are functions of finite interval and which has average value of zero .we are using Haar wavelet decomposition to extract the iris features, and Hamming distance to measure the dissimilarity between the binary iris codes. the general structure of the iris recognition system In the first module, an unrolled iris image contrast is enhanced using histogram to enable a better extraction of pattern by modeling the values in associate degree intensity image, or the values within the color map of associate degree indexed image, so the bar chart of the output image , so that the histogram of the output image approximately matches a specified histogram. The effect of performing histogram equalization on an iris image. Histogram equaliz ed iris region is then decomposed using Haar decomposition up to four levels of decomposition (Figure 3). Since decomposing the iris region of 512 X 64 pixels will produce a very large number of coefficients, in our method, we only choose to take the fourth level of Haar decomposition to reduce the code length. Taking the fourth level decomposition will produce 348 coefficients. These numbers are then converted to binary iris code simply by converting positive coefficients to 1 and negative coefficients to 0.[18]

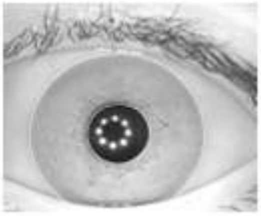
IV BASIC STEPS USED FOR IRIS RECOGNITION PROCESS

4.1 Segmentation

The proper segmentation is the very important part the iris recognition system. The segmented eye we first generated the edge map of the eye using the canny edge detector and on the generated edge map we perform the circular Hough transform as suggested by Wildes et al., which is used to detect the iris and sclera boundaries first and iris and pupil boundaries later. We manually set the radius range for iris and pupil boundaries by detecting their pixel value variation. The radius range for pupil boundaries were present between 30 to 80 pixel and iris boundaries will present between 90 to150 pixel during the very next step to canny edge detection of segmentation is localization of iris Figure 1 shows the template of input eye image, and Figure 2 shows the template of segmented eye image . In this stage we use DCT for the compression of the image. Database of 10 iris images from the wide range data of casia database is taken and in this research one of the iris image from the casia database is taken.



4.1.1 Input Image.



4.1.2 Segmentation

4.2 Normalization

The iris has unique pattern as you know, so for the different person, the iris has different size and for the one person size may be change due to entering the light in the eye. To achieving the accurateness in the system, it is necessary to compensate for such deformation. Constant dimension in iris region will be produced by normalization .By subsequent processing, we reduce the distortion of iris due to pupil movement at some point of extent. It was all done by the Daughman Further reducing the processing time and enhances the feature extraction process as well as matching performance. we define the region of interest of the iris for where we perform the feature extraction process, because the part of the iris near to the pupil contain most of the information and region near to the sclera contain few texture characteristics and are easy to occluded by eyelids and eyelashes therefore for performing feature extraction process we only take 67% of iris image a region close to the pupil and we discarded rest of the part of iris by defining region of inter through Matlab image processing tool. the obtained normalized iris has low contrast and may have non uniform brightness, all these things may affect the feature extraction and matching. To achieve well distributed texture image, image intensity values can be adjusted first, then we employ histogram equalization and finally contrast and sharpness improving.

Fig: 4.2.1 Normalized Image

Fig: 4.2.2 Enhanced Normalized Image

4.3 Feature Extraction

An unrolled iris image contrast is enhanced using histogram to enable a better extraction of pattern by transforming the values in an intensity image, or the values in the colour map of an indexed image, so that the histogram of the output image approximately matches a specified histogram. Histogram equalized iris region is then decomposed using Haar decomposition up to four levels of decomposition .Since decomposing the iris region of 512 X 64 pixels will produce a very large number of coefficients, in our method, we only choose to take the fourth level of Haar decomposition to reduce the code length. Taking only the fourth level decomposition will produce 348 coefficients. These numbers are then converted to binary iris code simply by converting positive coefficients to 1 and negative coefficients to 0. Histogram equalization . Unrolled iris image before contrast equalized and after equalized .An iris pair with Hamming distance above a threshold of 0.32 is matched against each other, whereas the rest are rejected. The main reason a perfect accuracy cannot be obtained is due to the quality of the test data and the iris regions are not segmented accurately due to noises like eye lashes and lighting effect.

4.4Iris Code Matching

Two iris codes are compared by apply the hamming distance algorithm for the matching technique and calculation of the Hamming distance is taken only with bits that are generated from the actual iris region. High degree of freedom ,each iris produce a bit pattern which is independent to that produce by another bit pattern .Measure hamming distance between two pattern 0.5 .All the work had been done with the help of bits, which helps to generate from the actual iris region .The hamming distance will be as follow XOR is used for the hamming distance between two template is fall below.32.If the HD comes out more than 0.32 ,it signifies that the both iris are from different eyes.

V RESULTS

Haar wavelet at level 4.

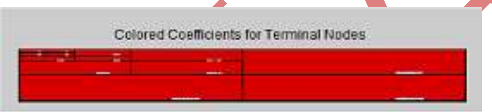


fig 5.1 coefficients for the terminal node

Graph representation of Hamming distancce

fig 5.2 Inner class hamming distance

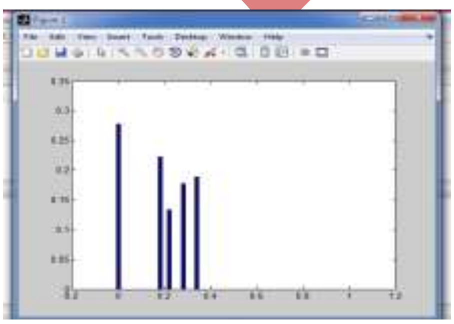
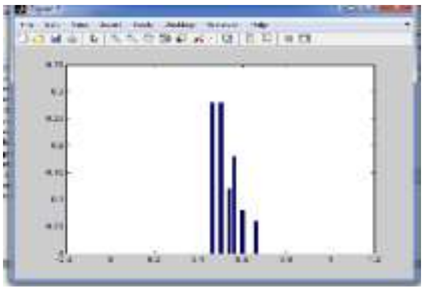


fig5.3Inter class hamming distance



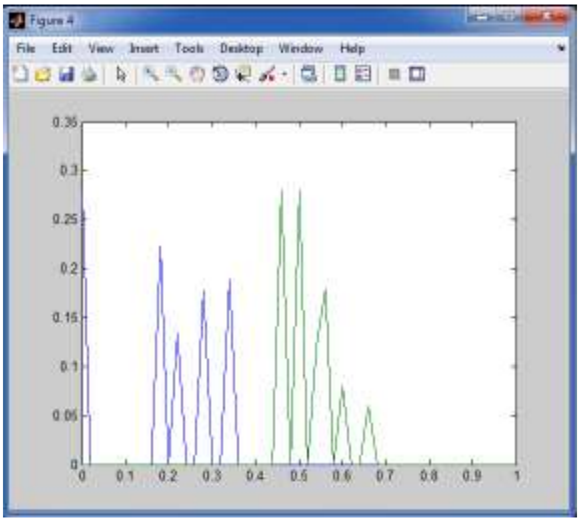


fig 5.4 Comparison between inner class and inter class hamming distance

Difference between inner and inter class hamming distance. after the comparison between these two ,no overlapping is present .

FALSE ACCEPTANCE RATE- FALSE REJECTION RATE = 6.3%

Equal Error RATE = 0.1%
Correct Recognition Rate = 99.9%
Comparison with existing methods(CRR) Comparison with existing (time)

Methods	CRR(%)	ERR(%)
Daughman	100	0.08
Boles	92.64	8.13
proposed	99.9	0.1

Methods	Feature Extraction(ms)	Matching time
Daughman	200ms	430ųsec
Proposed	52ms	45ų sec

VI CONCLUSION

Earlier studies shows less efficiency and algorithm was taking more time ,but by the using both the techniques DCT for the compression and WPT for the feature extraction , the efficiency of the system is increased with less error rate as compare to other method, Also it will take less time as compare to the earlier used algorithms. DCT matrix gives quality to the image, so our system will achieve its robustness. This system gives more correction rate than the other method due to this ,the efficiency of the system will increased at higher rate.

REFERENCES

1. Sunita lokhande, Vikram .N.Bapat,"iris recognition for biometric identification uing wavelet packet decomposition",vol.1 issue4,june2012.
2. Ahmad.M. Sahran ,"Iris recognition using discrete cosine transform and artificial neural network", journal science5(5):369-373.
3. S.Hariprasad, V.Mohan, "Biometric personal identification based on iris pattern recognition using wavelet packet recognition".2010
4. Yulin Si,jiang yanMei,and Huiyun Gao ,"Novel approaches to improves robustness,accuracy and rapidity of iris recognition system", IEEE

5. Naveen Singh, Dilip Gandhi, Krishanpal singh, "Iris recognition system using a canny edge detection and a circularhaugh transform",may 2011

6. Min Han, Weifengsun,MingyanLI, "Iris recognition based on a novel normalization method and contourlet transform",IEEE, 2009.

7. Daugman. How iris recognition works Proceedings of 2002 International Conference on Image Processing, Vol.1, 2002.

8. D. M. Monro, S. Rakshit and D Zhang, “DCT-based iris recognition,” IEEE Trans. Pattern Anal. Mach. Intell., vol. 29, no. 4, pp. 586 596, Apr. 2007.

9. J. Daugman, “New methods in iris recognition,” *IEEE Trans. Syst., Man, Cybern. B, Cybern.*, vol. 37, no. 5, .

10. Ma, T. Tan, Y. Wang, and D. Zhang, “Personal identification based on iris texture analysis,” *IEEE Trans. Pattern Anal. Mach. Intell.*, vol. 25, no. 12, pp. 1519–1533, Dec. 2003.

11. W. Boles, B. Boashash. A human identification technique using images of the iris and wavelet transform. *IEEE Transactions on Signal Processing*, Vol. 46, No. 4, 1998.

12. L. Ma, T. Tan, D. Zhang, and Y. Wang, “Local Intensity Variation Analysis for Iris Recognition,” Pattern Recognition, vol. 37, no. 6, pp. 1287-1298, 2004.

13. V. Dorairaj, N. Schmid, and G. Fahmy, “Performance evaluation of non ideal iris based recognition system implementing global ICA encoding,” in *Proc. IEEE ICIP*, 2005, vol. 3, pp. 285–288.

14. N. Ahmed, T. Natarajan, and K. Rao, “Discrete Cosine Transform,”IEEE Trans. Computers, vol. 23, pp. 90-93, 1974.

15. D. Marr and E. Hildreth, “Theory of edge detection,” in Proc. R. Soc.Lond., vol. 207, pp. 187–284, 1980.

16. C. Sanchez-Avila and R. Sanchez-Reillo, “Two different approaches for iris recognition using Gabor filters and multiscale zero-crossing representation,” *Pattern Recognition.*, vol. 38, no. 2, pp. 231–240, Feb. 2005.

17. M. Vatsa, R. Singh, and A. Noore, “Reducing the false rejection rate of iris recognition using texturaland topological features,” *Int. J. SignalProcess.*, vol. 2, no. 1, pp. 66–72, 2005.

18 Tz. Weng. ng,Thein lang Tay, Siak wang khor "Iris recognition using haar wavelet.978-1-4244-6893 - 5,IEEE,2010.