Imperial Journal of Interdisciplinary Research (IJIR)
Vol-3, Issue-6, 2017
ISSN: 2454-1362, http://www.onlinejournal.in

IRIS Recognition System

Shyam Ji Verma[1], Deepti Saxena[2], Rahul Gautam[3] And Lalit Kaushal
[1,2,3,4] C.B.S. College of engineering & Managaement, Agra, Uttar pradesh, India

Abstract— *Iris recognition is the process of recognizing a person by analyzing the apparent pattern of his or her iris. There is a strong scientific demand for the proliferation of systems, concepts and algorithms for iris recognition and identification. This is mostly because of the comparatively short time that iris recognition systems have been around.*

In comparison to face, fingerprint and other biometric traits there is still a great need for substantial mathematical and computer-vision research and insight into iris recognition. One evidence for this is the total lack of publicly available adequate datasets of iris images.

The program converts a photo of an eye to an 'unrolled' depiction of the subject's iris and matches the eye to the agent's memory. If a match is found, it outputs a best match. The current functionality matches that proposed in the original requirements.

Keywords—*java swing, jdk, Iris RAM.*

I. INTRODUCTION

IRIS RECOGNITION IS THE MOST POWERFUL BIOMETRIC TECHNOLOGY THERE IS. NOTHING ELSE COMES CLOSE. NOTHING.

- Most accurate
- Scalable
- Opt-in
- Non-contact
- Interoperable cameras

The iris is the plainly visible, colored ring that surrounds the pupil. It is a muscular structure that controls the amount of light entering the eye, with intricate details that can be measured, such as striations, pits, and furrows. The iris is not to be confused with the retina, which lines the inside of the back of the eye.

No two irises are alike. There is no detailed correlation between the iris patterns of even identical twins, or the right and left eye of an individual. The amount of information that can be measured in a single iris is much greater than fingerprints, and the accuracy is greater than DNA.

In less than a few seconds, even on a database of millions of records, the Iris Code template generated from a live image is compared to previously enrolled ones to see if it matches any of them. The decision threshold is automatically adjusted for the size of the search database to ensure that no false matches occur even when huge numbers of Iris Code templates are being compared with the live one.

Some of the bits in an Iris Code template signify if some data is corrupted (for example by reflections, or contact lens boundaries), so that it does not influence the process, and only valid data is compared. Decision thresholds take account of the amount of visible iris data, and the matching operation compensates for any tilt of the iris.

II. SOFTWARE REQUIREMENTS SPECIFICATION

The first step in developing anything is to state the requirements. This applies just as much to leading edge research as to simple programs and to personal programs, as well as to large team efforts. Being vague about your objective only postpones decisions to a later stage where changes are much more costly.

The problem statement should state what is to be done and not how it is to be done. It should be a statement of needs, not a proposal for a solution. A user manual for the desired system is a good problem statement. The requestor should indicate which features are mandatory and which are optional, to avoid overly constraining design decisions. The requestor should avoid describing system internals, as this restricts implementation flexibility. Performance specifications and protocols for interaction with external systems are legitimate requirements. Software engineering standards, such as modular construction, design for testability, and provision for future extensions, are also proper.

The analyst must separate the true requirements from design and implementation decisions disguised as requirements. The analyst should challenge such pseudo requirements, as they restrict flexibility. There may be politics or organizational reasons for the pseudo requirements, but at least the analyst should recognize that these externally imposed design decisions are not essential features of the problem domain.

REQUIREMENTS**:**

Software Used : JDK 1.5 / Java Swing

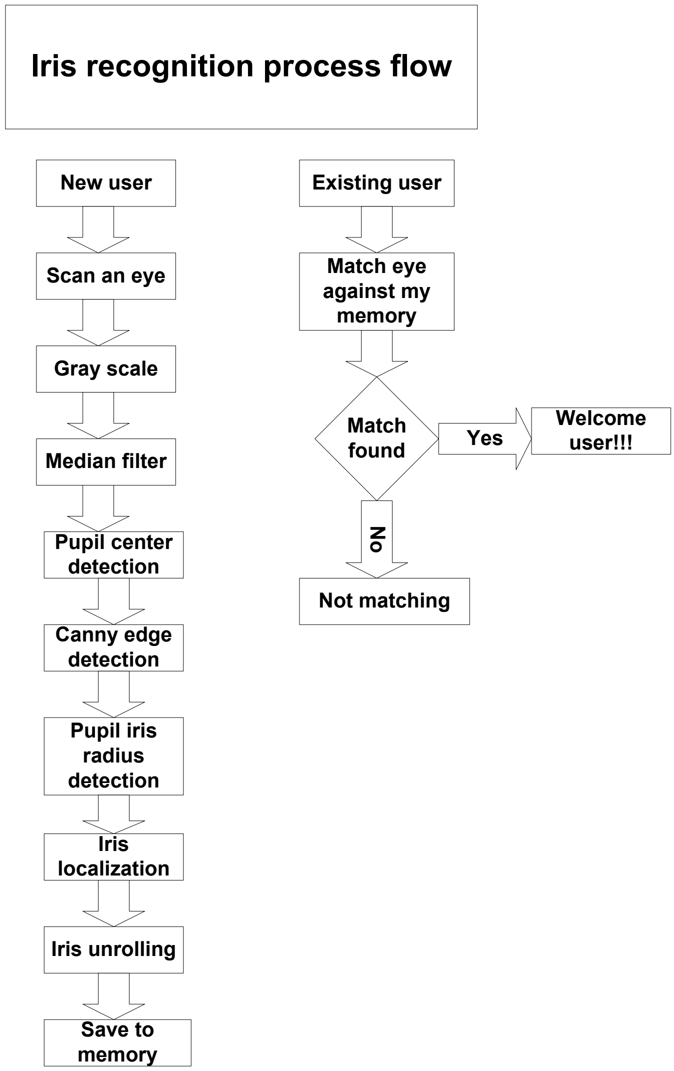
III. SYSTEM DESIGN

During analysis, the focus is on what needs to be done, independent of how it is done. During design, decisions are made about how the problem will be solved, first at high level, then at increasingly detailed levels.

System design is the first design stage in which the basic approach to solving the problem is selected. During system design, the overall structure and style are decided. The system architecture is the overall organization of the system into components called subsystems. The architecture provides the context in which more detailed decisions are made in later design stages. By making high level decisions that apply to the entire system, the system designer partitions the problem into subsystems so that further work can be done by several designers working independently on different subsystems.
The system designer must make the following decisions:

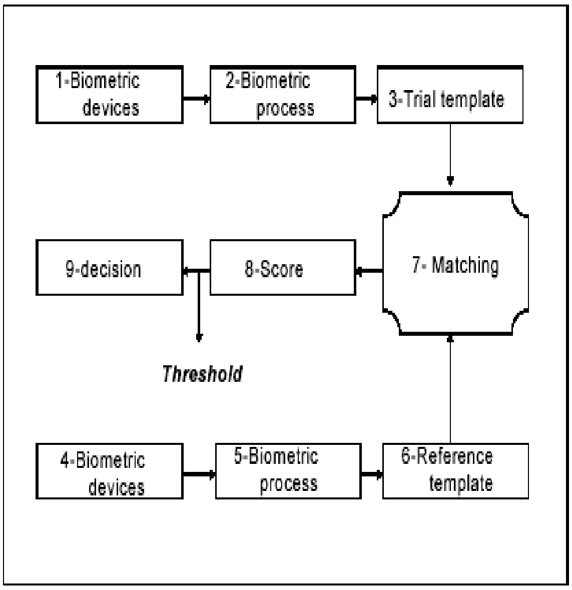
- Organize the system into subsystems.
- Identify the concurrency inherent in the problem.
- Allocate subsystems to processors and tasks.
- Choose an approach for management of data stores.
- Handle access to global resources.
- Choose the implementation of control in software.
- Handle boundary conditions.

PROCESS FLOW



- To design a iris recognition system based on an empirical analysis of the iris image and it is split in several steps using local image properties.
- The system steps are
- capturing iris patterns
- determine the location of the iris
- boundaries converting the iris boundary to the stretched polar coordinate system
- extracting the iris code based on texture analysis using wavelet transforms
- Classification of the iris code.

WORKING OF A BIOMETRIC SYSTEM



capture the chosen biometric process the biometricand extract and enroll the biometric template store the template in a local repository, a central repository, or a portable token such as a smart card live-scan the chosen biometric process the biometric and extract the biometric template store the reference template match the scanned biometric against stored templates provide a matching score to business applications with threshold value record a secure audit trail with respect to system.

IV. SYSTEM DEVELOPMENT

Following the logical design is physical design. The physical design may also be called as system development. This produces the working system by defining the design specifications that tell programmers exactly what the candidate system must do. In turn, the programmer writes the necessary programs or modifies the software package0 that accepts input from the user, performs necessary calculations through the existing file or database, produces the report on a hard copy or displays it on screen, and maintains an updated database at all times. In this phase we have done the following activities:

- Hardware & Software specifications.
- Cost estimations.
- Coding

HARDWARE AND SOFTWARE SPECIFICATIONS

A major element in building systems is selecting compatible hardware and software. The systems analyst has to determine what software package is best for the candidate system and, where software is not an issue, the kind of hardware and peripherals needed for the final conversion. Hardware and software selection begins with requirement analysis, followed by a request for proposal and vendor evaluation. The final system selection initiates contract negotiations.

We consider the following to select hardware and software for development environment:

- Reliability
- Functionality
- Capacity
- Flexibility
- Usability
- Security
- Performance
- Serviceability
- Ownership

Software

Operating System: Windows XP

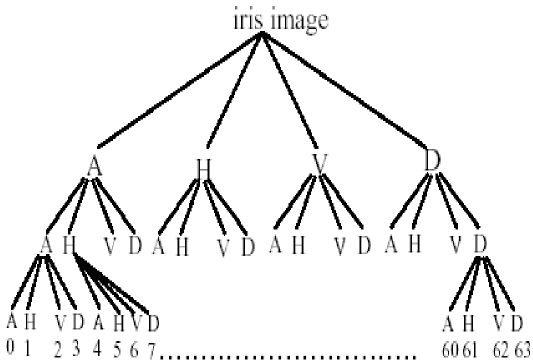
Application Programming: JDK 1.5 or higher

GUI Programming: Java Swing

Feature Code Generation

The majority of researchers have proposed wavelets approaches in order to capture local iris features at different scales. In our case, we have adopted the method introduced in [19].

After the iris image segmentation process is completed, the iris code is performed using Haarwavelet packets as well as the energy of the packets sub-images to extract texture phase structure information of the iris and to compute the iris 64-bits codes. Figure2. Wavelet packets decomposition for iris image The Iris code generation process can be summarized in the following steps:



Wavelet packets decomposition of iris image

Wavelet packets decomposition: We have used the Haar wavelet in a 3-level wavelet packet decomposition to extract the texture features of the unwrapped images [18]. This generates 64 wavelet packets (output iris sub images), numbered 0 to 63.The images contain approximation (A), horizontal detail (H), vertical detail (V) and diagonal detail (D) coefficients respectively as shown in Figure 2.

Wavelet packets energy computation: In order to obtain the most texture information in packet sub images, we have used an energy measure. The mean energy distribution allows evaluating which packets are used to compute the normalized adapted threshold for our iris code generation. The energy measure i E for a wavelet packet sub image i W can be computed as follows

$$E_i = \sum_{j,k} W_i (j,k)^2$$

Figure plots the mean energy distribution for the 64 wavelet packets subimages shown in Figure 1. This figure shows that energies of the wavelet packets 1 and 49 are the appropriate energies and the most suitable to compute the adapted threshold for iris code generation. However, in Figure, the energies of the wavelet packets 1 and 3 are the appropriate energies. On the other hand in [18], the authors have mentioned that the packet 2 and 10 are always used to compute their iriscode but, the most texture information are located in packets (subimages) 1 and 49. This shows that the author's assumption for the iris image

Signature computation using wavelet packets 2 and 10 is not always true because they have been using the mean energy distribution for the 149 unwrapped images of their iris database. This result has been confirmed by the authors of [21] who have mentioned that the *HD* distribution for the CASIA database has not been performed yet using the approach [19]. Moreover, Table 1 shows the first four maximal energy values for the 64 sub images for each iris specimen of the Image 088 of CASIA database. Clearly, we have not the same dominant energy for each specimen image iris. Figure 4 shows those packets 2, 49 and 7 holds much energy as well for the 756 CASIA iris images. It is therefore interesting to evaluate also the possibilities of using those packets as appropriate energies to generate iris codes as described in [19].

	CASIA iris specimen images 088						
	1	2	3	4	5	6	7
Packet number	49	49	2	7	3	35	7
	35	3	35	35	50	3	29
	2	11	49	49	46	49	3

CASIA iris specimen images

In our approach, we do not adopt the same strategy as that in [19].We use the appropriate wavelet packet energies of each iris image to compute the adapted threshold to encode the 64 sub images. Let E1…E be the appropriate wavelet packet energies of the packets 1… respectively. We define the normalized adapted threshold S as follows:

$$S = Coeff \cdot \frac{\mu(E_1, \cdots, E_\lambda)}{Max\,(E_1, \cdots, E_\lambda)}$$

where (Ei… E^λ) represents the mean wavelet peak energy value, Coeff as a constant and is the number of the appropriate energies. Therefore, the threshold S is not optimized experimentally (S=10) as defined in [19] for all iris images but each iris wavelet decomposition produces the adapted threshold S. For example, from Table 2, we have several adapted thresholds to encode the iris images. So, for iris 088_1_1, we choose S=1.341 to code the sub images using only the two aximal energies of the packets 1 and 49. But we choose S=1.320 using the three first maximal energies for the packets 1, 49 and 35. However, for another iris image we will not have the same adapted thresholds. In this paper, we have choose

Coeff = 1.4 as a constant.

C.IRIS FEATURE CODING

After determination the appropriate wavelet packets energies and the normalized adapted threshold, we can carry out the coding of the 64 wavelet packets energies to generate a compact iriscode by quantizing these energies into one bit according to each appropriate energy. Let *E* be the appropriate energy of the peak . Then the iriscode *C* computed according to *E* we define by the following:

$$C_\lambda(j) = \begin{cases} 1 & if \quad \frac{E_j}{E_\lambda} > S \\ 0 & otherwise \end{cases}$$

Where j = 0...63.

In our approach, we have used significant wavelet Coefficients of the iris sub image. Each used appropriate energy resulting in a total of 64 bits which correspond to the 64 sub images of the iris wavelet decomposition. Therefore, we obtain one iris code according to each energy. The iris code of the iris 088_1_1 of Fig 2, computed using the three first energy peaks (= 2...4) is illustrated in Figure 5. We note that our iris coding gives distinct iris codes for each appropriate energy E^λ.

iriscodes according to packet energies

D.IRISCODES MATCHING

The iris codes matching task is performed by pairing the iriscodes extracted from the input and the template iris images. The most common comparison method of iris signatures is the Hamming Distance (HD) [12]. This comparison is to be made with the user's iris template, which will be calculated depending on the binary matching algorithm which is implemented by the Boolean exclusive-OR operator

( ) applied to the 64 bit vectors that encode any two iris codes.

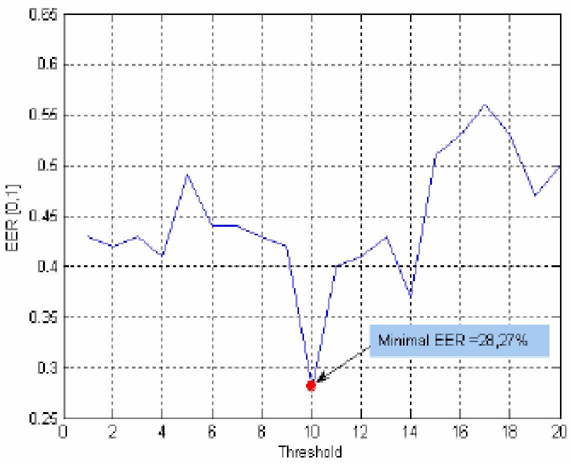
Let $T=\left\{C_i(j)\quad j=0\cdots N\right\}$ and $I=\left\{C'_k(j)\quad j=0\cdots N\right\}$

The preceding distance is computed according to the appropriate energy (maximal value) between two iris signatures in order to decide if both come from images of the same iris (authentic distance) or from images of different iris (impostoristance). Therefore, the combination of two or several packets is likely to hold more discriminating information than what each of them does separately as mentioned in. So, the preceding distance can be extended for two appropriate energies of each iris image as follow [18]:

$$HD_{i,k}=\frac{1}{2*N}\sum_{j=0}^{j=N}\left\|C_i(j)\oplus C_k(j)\right\|\cdot\left\|C_{i'}(j)\oplus C_{k'}(j)\right\|$$

E.Experimental results

In this section, we analyze the performance of the proposed iris verification algorithm. So, to evaluate the performance of our algorithm, different experiments on the Institute of Automation, Chinese Academy of Science, CASIA [20] databases have been carried out. As mentioned in [23,24], automatic detection of the pupils is easier because CASIA database images have a black circle in the pupil and some of these black circles cover the part of iris and also the specular reflection. First, we report the experimental results obtained running our algorithm using several wavelets categories. Thereafter, we present some result to study the effect of the wavelet packet combination. Finally, we compare our performance with the algorithms reported in [18,19] which use the fixed threshold. For the first experiment, we have uses the first wavelet packet feature that has the maximal energy value to generate the iris signature (to encode 64 bits of the wavelet packets). This experiment was motivated by an iris code computation using only two appropriate energies according to the equation (2 and 3) to compute the adapted threshold and one iris code according to the maximal energy. The energy corresponding to sub image 0 has not been used because this sub image contains offset information.
The discrimination results using wavelet packets categories are shown in Table 2. Clearly, using the first appropriate energy, the Haar wavelets are most suitable for iris recognition. The Receiver Operating Curve (ROC) for results is shown in Figure6 (FAR: False Acceptance Rate and FRR: False Reject Rate).
Thus, our matching algorithm is slower with the error rate EER=2,38%, 4.67%, 4.68%, 5.28% and 6.28% for Biothogonal, Daubechies, Symlet, Coiflet and Haar wavelets, respectively.
However, the appropriate energies of the packets combination have independently proved to achieve positive separation only for the Haar wavelets compared to the choices of these appropriate energies. Figure 7 gives the performance results using the dominant energies combination. Obviously, we can see consistent performance improvement of our matching using the first and the third energies of each iris image decomposition. Hence, using the combination of these appropriate energies for iris code generation, our matching algorithm is slower with the error rate EER=1.41% using Haar wavelets. The drawn significant result starting from these experiments is that the combination of the wavelet packets for the other wavelets types does not give a better performance for our iris recognition system.



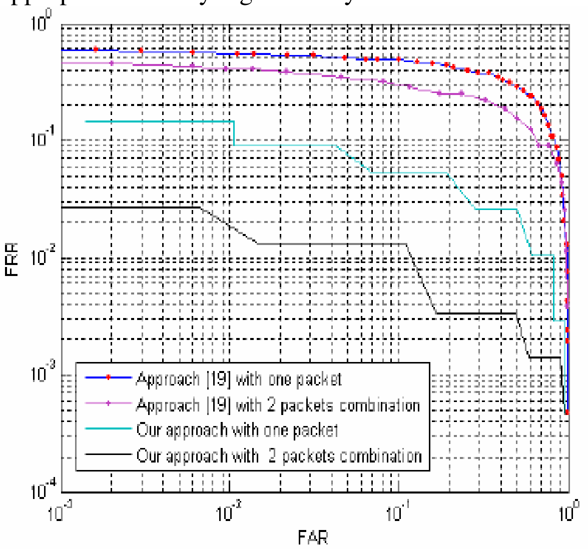
The threshold optimized experimental results

Before comparing our approach with those of [18,19], we illustrate in Figure 8, the minimal ERR curve by varying the threshold S from 1 to 20. With the threshold S=10, we obtain the minimal EER for the CASIA database. Clearly, the matching algorithm [19] achieves better performance for the threshold S=10 using the packets 2 and 49 with EER=28.27%. This confirms the choice of the authors.

	Number of Packets	EER (%)	Iriscode size
Our approach	1	6.28	64
	2	1.41	128
	3	0.33	196
Approach [19]	1	32.45	512
	2	28.27	1024
	3	28.89	1536

THE COMPARATIVE RESULTS ON CASIA DATABASE

Compared with these approaches, our iris matching achieves better performance using one appropriate energy or the combination of several ones. The comparative results are shown in Table 3 in terms of iris code size and ERR in respect to the database CASIA. Obviously, the experiments conducted over a sample of all CASIA iris image database indicate that the improving matching accuracy is not directly proportional to the combination of the iriscodes generated from the appropriate energies as in the approach [19]. As illustrated in Figure9, we have obtained the error rate EER=1.41%, 3.71% and 4.76% using a single appropriate energy and EER= 3.03%, 1.41% and 5.0% for the combination of the first three appropriate energies, respectively. Figure 9 shows the ROC curves comparison of our approach with the ones proposed in [19] in both these situations. It can be seen that, in all cases, the Equal Error Rate, is always below 5%, achieving 1.05% for the first energy. More importantly a FAR=0.06% has been obtained for very low rates of False Rejection FRR=1.2%, which means that our system is more appropriate for very high security environments.



CASIA iris image database

V. CONCLUSION

The primary focus of this work is a personal authentication system based on human iris verification using wavelet packets decomposition. The proposed technique uses only appropriate packets with dominant energies to encode iris texture according the adapted thresholds. The usefulness of this approach was confirmed in the experiments conducted here, which reveals that the verification results with an EER=0.3% has been obtained for packets combination, which means that our system is appropriate for very high security environments.

VI. REFERENCES

[1] Ales Muron and Jaroslav Pospisil, "The human iris structure and its usages," *Acta Univ. Palacki. Olomuc. Fac.Rerum Nat. Phys.*, vol. 39, 2000, pp. 87–95.

[2] J.G. Daugman, "High confidence visual recognition of persons by a test of statistical independence," *IEEE Trans. on Pattern Analysis and Machine Intelligence*, vol. 15, no. 11, Nov 1993, pp. 1148–1160.

[3] J.G. Daugman, "Demodulation by Complex-Valued Wavelets for Stochastic Pattern Recognition," *Int'l J.Wavelets, Multiresolution and Information Processing*, vol. 1, no. 1, 2003, pp. 1-17.

[4] R. Wildes, J. Asmuth, G. Green, S. Hsu, R. Kolczynski,J. Matey, and S. McBride, "A Machine-Vision System for Iris Recognition," *Machine Vision and Applications*, vol. 9, 1996, pp. 1-8.

[5] H. Proenc and L. A. Alexandre, "Toward Noncooperative Iris Recognition: A Classification Approach Using Multiple Signatures", IEEE Trans. on Pattern Analysis and Machine Intelligence, vol. 29, no. 4, Nov 2007, pp.

[6] Kwanghyuk Bae, Seungin Noh, and Jaihei Kim, "Iris feature extraction using independent component analysis," Proc. 4th Intl. Conf. on Audio and Video Based Biometric Person Authentication LNCS, vol. 2688, 2003, pp.

[7] C. Sanchez-Avilaa, R. Sanchez-Reillob, "Two different approaches for iris recognition using Gabor filters and multiscale zero-crossing representation," Pattern Recognition, vol. 38, 2005, pp. 231 – 240.