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RESEARCH ARTICLE

Iris Recognition using Wavelet Transformation Techniques

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Abstract-In this paper, we propose the novel techniques that we have developed to create Iris Recognition. With the help of a fusion mechanism that amalgamates both, a Canny Edge Detection scheme and a Circular Hough Transform, which is used to detect the iris' boundaries in the eye's digital image. For extracting the deterministic patterns in a person's iris in the form of a feature vector we have applied the wavelet transformation technique. By comparing the quantized vectors using the Hamming Distance operator, we determine whether two irises are similar.

1. Introduction

Nowadays with the growing of emerging technologies, Security of computer and financial systems plays crucial role. These systems require remembering many passwords that may be forgotten or even stolen. Most organizations are concerned with protecting sensitive data from external malicious attacks, relying on technical controls that include perimeter security, network/wireless surveillance and monitoring, application and point security management, and user awareness and education In the second case results are usually disastrous for the user. Thus biometrical systems, based on physiological characteristics of a person, are taken into consideration for growing number of application.

Iris recognition is an automated method of biometric authentication that uses the mathematical pattern-recognition techniques on images of the irises of an individual's eyes, whose complex random patterns are unique and can be seen from some distance.

A good biometric is characterized by the use of a feature that is; highly unique – so that the chance of any two people having the same characteristic will be minimal, stable – so that the feature does not change over time, and be easily captured – in order to provide convenience to the user, and prevent misrepresentation of the feature.

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The proposed technique involves two mechanisms i.e. terminal and token part or prepositioning and matching. We implemented 'Iris Recognition' using mat lab for its ease in image manipulation and wavelet applications. The step involved in the proposed system is represented in Fig1.The first step of our project consists of images acquisition. Then, the pictures' size and type are manipulated in order to be able to subsequently process them. Once the preprocessing step is achieved, it is necessary to localize the iris and unwrap it. At this stage, we can extract the texture of the iris using adaptive Wavelets. Finally, we compare the coded image with the already coded iris in order to find a match.

2. Acquisition and Segmentation of image

We consider Image acquisition is the most critical step, since all subsequent stages depend highly on the image quality, we used a CCD camera for getting image. We set the resolution as 640x480, the type of the image as jpeg, and the mode to white and black for greater details. Furthermore, we took the eye pictures while trying to maintain appropriate settings such as lighting and distance to camera. The result is highly resolute image which is given as the input to our simulation.

The first stage of iris recognition is to isolate the actual iris region in a digital eye image. The iris region, present in the eyes can be approximated by two circles, one for the iris/sclera boundary and another, interior to the first, for the iris/pupil boundary. The eyelids and eyelashes normally occlude the upper and lower parts of the iris region. Also, specula's reflections can occur within the iris region corrupting the iris pattern. A technique is required to isolate and exclude these artifacts' as well as locating the circular iris region. The output of the segmentation is iris signature.

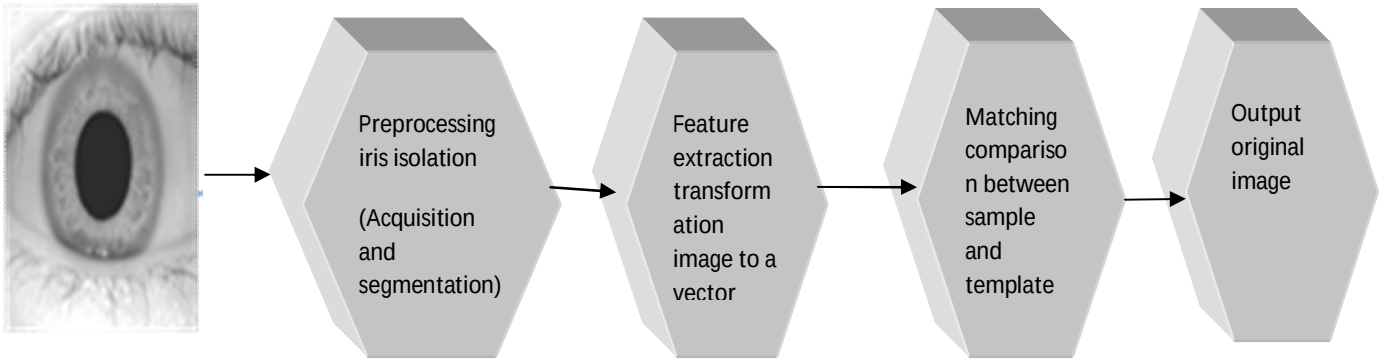

Fig.1.Steps involved in iris recognition

3. Process of detecting Eyelash and Noise by 1D Gabor filters

Kong and Zhang presented a method for eyelash detection, where eyelashes are treated as belonging to two types, separable eyelashes, which are isolated in the image, and multiple eyelashes, which are bunched together and overlap in the eye image. Separable eyelashes are detected using 1D Gabor filters, since the convolution of a separable eyelash with the Gaussian smoothing function results in a low output value. Thus, if a resultant point is smaller than a threshold, it is noted that this point belongs to an eyelash. Multiple eyelashes are detected using the variance of intensity. If the variance of intensity values in a small window is lower than a threshold, the centre of the window is considered as a point in an eyelash.

The Kong and Zhang model also makes use of connective criterion, so that each point in an eyelash should connect to another point in an eyelash or to an eyelid. Specula reflections along the eye image are detected using thresholding, since the intensity values at these regions will be higher than at any other regions in the image. This method is not necessary if image is perfect. The steps are represented by the following flowchart fig 2.

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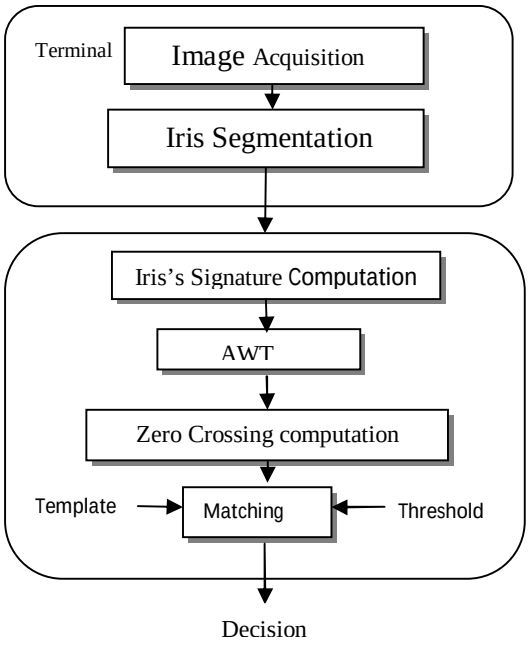

Fig .2. Flowchart for iris recognition

4. Minimizing the radius and centre coordinates of the pupil and iris regions by Hough Transform

The Hough transform is a standard computer vision algorithm that can be used to determine the parameters of simple geometric objects, such as lines and circles, present in an image. The circular Hough transform can be employed to deduce the radius and centre coordinates of the pupil and iris regions. An automatic segmentation algorithm based on the circular Hough transform is employed by Wildes et al, Kong and Zhang, Tisse et al. Firstly, an edge map is generated by calculating the first derivatives of intensity values in an eye image and then thresholding the result. From the edge map, votes are cast in Hough space for the parameters of circles passing through each edge point. These parameters are the centre coordinates x_c and y_c, and the radius r, which are able to define any circle according to the equation

$$x^2+y^2+c=0 \longrightarrow (1)$$

A maximum point in the Hough space will correspond to the radius and centre coordinates of the circle best defined by the edge points. Wildes et al. and Kong and Zhang also make use of the parabolic Hough transform to detect the eyelids, approximating the upper and lower eyelids with parabolic arcs, which are represented

$$(-(x-h_j)\sin\theta_j+(y-k_j)\cos\theta_j)^2 = a((x-h_j)\cos\theta_j+(y-k_j)\sin\theta_j) \rightarrow (2)$$

Where a_j controls the curvature, (h_j, k_j) is the peak of the parabola and θ is the angle of rotation relative to the x-axis.

In performing the preceding edge detection step, Wildes et al. bias the derivatives in the horizontal direction for detecting the eyelids, and in the vertical direction for detecting the outer circular boundary of the iris, this is illustrated in Fig. 3. below. Taking only the vertical gradients for locating the iris boundary will reduce influence of the eyelids when performing circular Hough transform, and not all of the edge pixels defining the circle are required for successful localization. Not only does this make circle localization more accurate, it also makes it more efficient, since there are less edge points to cast votes in the Hough space.

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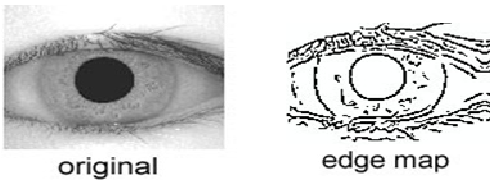

Fig.3.Circular boundary of the iris

4.1. Localizations.

It includes feature extraction, that's extraction of information from iris.

A. Histogram

The first step in the localization process is pupil segmentation based on analysis of the histogram. We assumed that a pupil is the darkest area in the image and standard deviation of luminance in this area is relatively low. It has to be emphasized that unwanted elements (reflections, eyelashes, etc) may appear in the threshold image. Nevertheless pupil can be segmented by relatively simple method, based on image thresholding using the histogram analysis. It is possible, because in general, histogram function of all eye images have a local maximum placed in the area of small luminance values (Pupil). In the sense it will detect the pixel difference between two images in the form of gray level.

B. Wavelet Encoding

Wavelets can be used to decompose the data in the iris region into components that appear at different resolutions. Wavelets have the advantage over traditional Fourier transform in that the frequency data is localized, allowing features which occur at the same position and resolution to be matched up. A number of wavelet filters, also called a bank of wavelets, is applied to the 2D iris region, one for each resolution with each wavelet a scaled version of some basis function. The output of applying the wavelets is then encoded in order to provide a compact and discriminating representation of the iris pattern. It is one of the mechanisms of feature extraction.

4.2. Matching

For matching, the Hamming distance was chosen as a metric for recognition, since bit-wise comparisons were necessary. The Hamming distance algorithm employed also incorporates noise masking, so that only significant bits are used in calculating the Hamming distance between two iris templates. Now when taking the Hamming distance, only those bits in the iris pattern that corresponds to '0' bits in noise masks of both iris patterns will be used in the calculation. The Hamming distance will be calculated using only the bits generated from the true iris region.

Hamming distance

The Hamming distance gives a measure of how many bits are the same between two bit patterns. Using the Hamming distance of two bit patterns, a decision can be made to whether the two patterns were generated from different irises or from the same one.

In comparing the bit patterns *X* and *Y*, the Hamming distance, *HD*, is defined as the sum of disagreeing bits (sum of the exclusive-OR between *X* and *Y*) over *N*, the total number of bits in the bit pattern.

$$HD = \left(\frac{1}{N}\right) \sum_{j=1}^{N} X(XOR)Y_j \longrightarrow (3)$$

Since an individual iris region contains features with high degrees of freedom, each iris region will produce a bit-pattern which is independent to that produced by another iris, on the other hand, two iris codes produced from the same iris will be highly correlated.

If two bits patterns are completely independent, such as iris templates generated from different irises, the Hamming distance between the two patterns should equal 0.5. This occurs because independence implies the two bit patterns will be totally random, so there is 0.5 chance of setting any bit to 1, and vice versa. Therefore, half of the

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bits will agree and half will disagree between the two patterns. If two patterns are derived from the same iris, the Hamming distance between them will be close to 0.0, since they are highly correlated and the bits should agree between the two iris codes.

5. IMPLEMENTATION

- Ability to split the full national database of Iris Codes into an unlimited number of parallel search engines ('Iris Engines'). Each search engine can perform more than 500,000 complete iris comparisons per second.
- Support of a diverse communications network, including very slow links. Even links as slow as 33.6 Kbytes/sec are compatible with real-time performance on iris recognition requests
- Automatic synchronization of Iris Code data from detached enrollment locations.
- Uninterrupted search capability during synchronization.
- Use of separate hardware components for enrollment, central database maintenance, and recognition functions. This maintains predictable performance and allows load sharing, distributing the computing workload to match demand with available resources and providing resilience against faults.
- Adaptive modularity, allowing hardware to be added to support any requirements for response speed or database size.
- Automatic backup procedures, together with 'hot standby' capability to switch the entire form to a second emergency location in mission-critical applications.

6. RESULT

In this paper, we have presented the design and test results of a QRS complex detector .The detection algorithm is based on the Discrete Wavelet Transform and implements an adaptive weighting scheme of the selected transform coefficients in the time domain.

Simulation results (Fig6.1-6.11) shows that the proposed filter effectively removes the additive noise by preserving fine details in the image.

A primary concern was to examine the effect of feature set size on text categorization effectiveness. All potential features were ranked for each category by expected mutual information between assignment of that feature and assignment of that category.

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Fig.4.1. Input Image

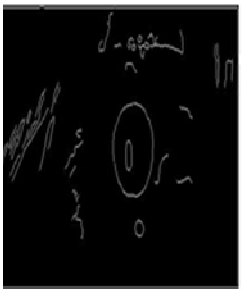

Fig.4.2. Edge Detection

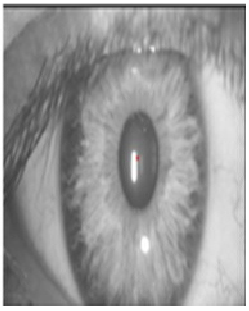

Fig.4.3. Hough Circle

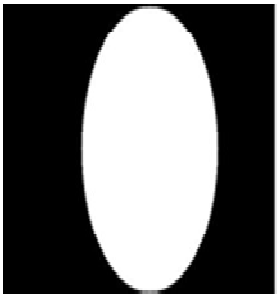

Fig.4.4.Background Removal

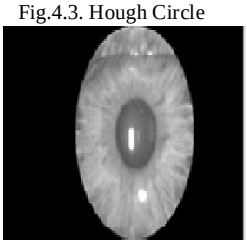

Fig.4.5.Iris Detection

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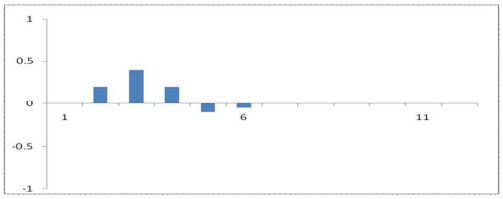

Fig.4.6.Original Scaling Filter

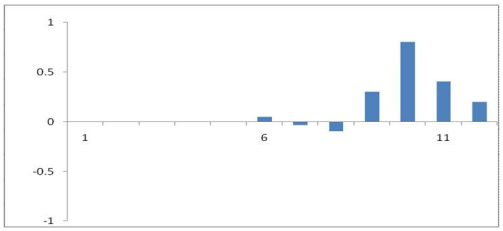

Fig.4.7.Decomposition Low-pass Filter

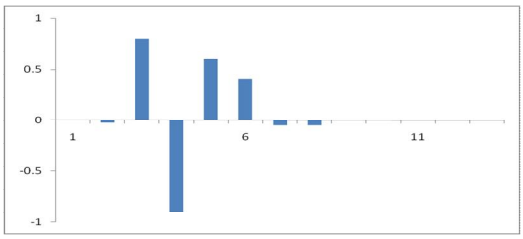

Fig.4.8.Decomposition High-pass Filter

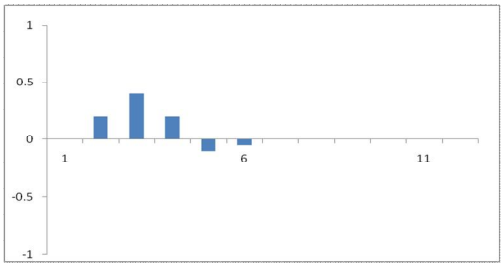

Fig.4.9.Reconstruction Low-pass Filter

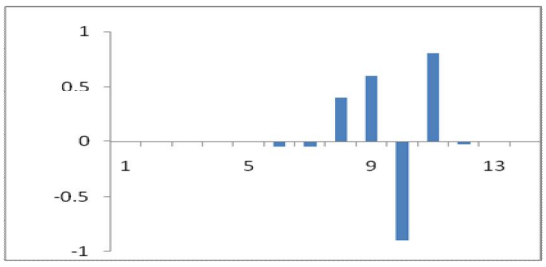

Fig.4.10.Reconstruction High-pass Filter

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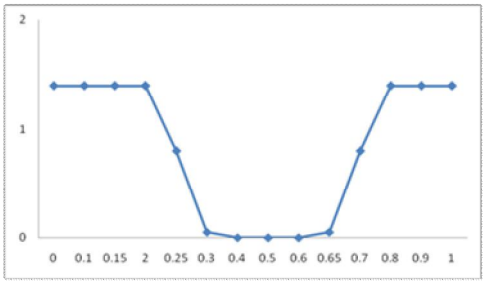

Fig.4.11.Transfer Modulus Low-pass Filter

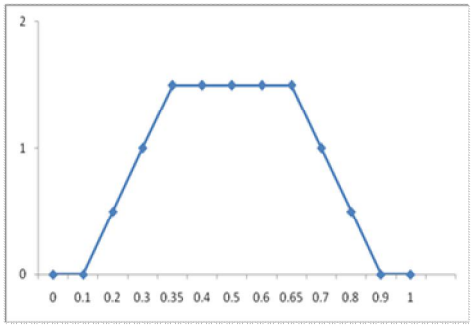

Fig.4.12.Transfer Modulus High-pass Filter

7. CONCLUSION

We have successfully developed a new Iris Recognition system that is capable of comparing two digital eye-images. This identification system is quite simple requiring few components and is effective enough to be integrated within security systems that require an identity check. The errors that occurred can be easily overcome by the use of stable equipment. Judging by the clear distinctiveness of the iris patterns we can expect iris recognition systems to become the leading technology in identity verification.

REFERENCES

[1] L. Ma, T. Tan, Y.Wang, and D. Zhang, "Efficient iris recognition based characterizing key local variations," *IEEE Trans. Image Process.*, vol.13, no. 16, pp. 739–750, Jun. 2004.

[2] R. P. Wildes, "Iris recognition: An emerging biometric technology," *Proc. IEEE*, vol. 85, no. 9, pp. 1348–1363, Sep. 1997.

[3] C. Tisse, L. Martin, L. Torres, and M. Robert, "Personal identification on technique using human iris recognition," in *Proc. Vision Interface*,2002, pp. 294–299.Masek, "Recognition of human iris patterns for biometric identification," Master's thesis, Sch. Comput. Sci. Softw. Eng., Univ.WesternAustralia, Perth, 2003.

[4] J. Daugman, "Probing the uniqueness and randomness of iris codes: Results from 200 billion iris pair comparison," *Proc. IEEE*, vol. 94, no. 11, pp. 1927–1935, Nov. 2006.

[5] J. Daugman, "New methods in iris recognition," *IEEE Trans. Syst., Man Cybern. B, Cybern.*, vol. 37, no. 5, pp. 1167–1175, Oct. 2007.

[6] N. Ritter, R. Owens, J. Cooper, and P. P. Van Saarloos, "Location of the pupil-iris boder in slit-lamp images of the cornea," in *Proc. Int. Conf. Image Anal. Process.*, Sep. 1999, pp. 740–745.

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[7] W. W. Boles and B. Boashash, "A human identification technique using images of the iris and wavelet transform," *IEEE Trans. Signal Process.*, vol. 46, no. 4, pp. 1185–1188, Apr. 1998.

[8] B. Fernandez-Saavedra, J. Liu-Jimenez, and C. Sanchez-Avila, "Quality measurements for iris images for biometrics," in *Proc. IEEE EUROCON Int. Conf. "Computer as a Tool"*, Sep. 2007, pp. 759–764.

[9] S. Mallat, "Zero-crossing of wavelet transform," *IEEE Trans. Inf. Theory*, vol. 37, no. 4, pp. 1019–1033, Jul. 1991.

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