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Recognition of Human Iris Patterns for Biometric Identification

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Abstract: *Iris recognition is an efficient method for identification of persons. This paper provides a technique for the iris recognition. A biometric system provides automatic identification of individuals. Iris is an unique feature which is applicable for identification. Unlike face recognition or finger prints, iris recognition comes from randomly distributed features. It is most reliable and accurate method of identification. This paper proposes a personal identification using iris recognition system with the help of six major steps i.e. image acquisition,localization, Isolation, normalization, feature extraction and matching and also these six steps consists a numbers of minor steps to complete each step. The boundaries of the iris, as papillary and limbic boundary, are detected by using Canny Edge Detector. We can use masking technique to isolate the iris image form the given eye image, this isolated iris image is transformed from Cartesian to polar co-ordinate. Now finally extract the unique features (feature vector) of the iris after enhancing the iris image and then perform matching process on iris code using Hamming Distance for acceptance and rejectance process.*

Keywords: *Canny edge detection , Hamming distance , Hough transform, Masking, Histogram equalization, Haar wavelet.*

I. Introduction:

Iris Recognition is a biometrical based technology for personal identification and verification and it is to recognize a person from his/her iris prints. Iris patterns are characterized by high level of stability and distinctiveness. Each individual has a

Unique iris the difference even exists between identical twins and between the left and right eye of the same person. Thus, iris recognition is an efficient method of identifying persons.

II. Iris Recognition Systems:

The critical aspects for any biometrics are the number of degree-of-freedom of variation in the chosen index across the human population, since this determines uniqueness it's immutability over time and its protection to intervention and the computational prospects for efficiently encoding and reliably recognizing the identifying pattern. In the completely human population, no two irises are alike in their mathematical detail, even among identical twins.

Iris recognition is a method of biometric authentication, based on extraction features of the iris of an individual's eyes. Each individual has a unique iris, the variation even exists between identical twins and between the left and right eye of the same person.

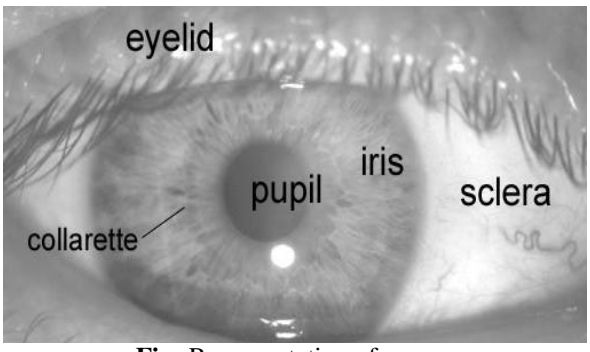

Fig: Representation of an eye

III. Characteristics Of Iris Making It Proper For Identification:

Unlike other biometrics such as fingerprints and face, the distinct aspect of iris comes from randomly distributed features. This leads to its high reliability for personal identification, and at the same time, the difficulty in effectively representing such details in an image.The iris has the great mathematical advantage that

its patterns are highly variable and the variability among different persons is huge and enormous. Another point which is highly favorable is that it is as internal (yet externally visible) organ of the eye, the iris is well protected from the environment and stable over time.

Algorithm:

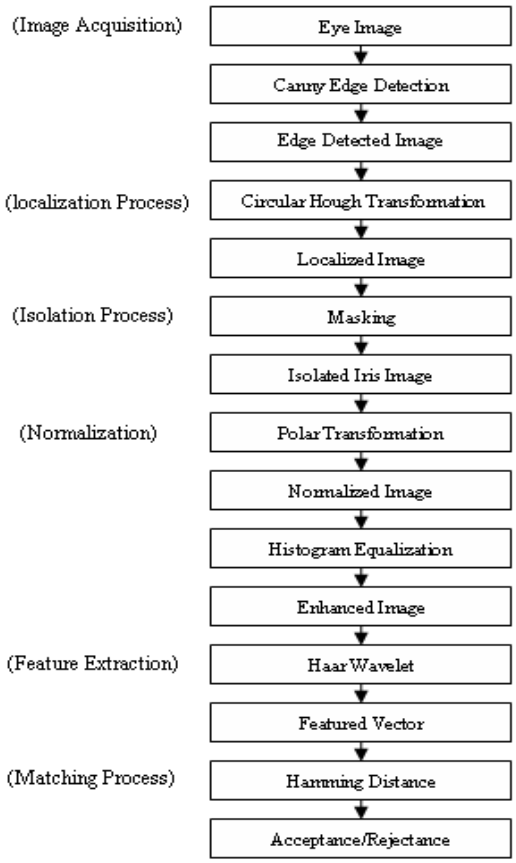

Image acquisition:

This is the first step for the entire process in the identification of iris. When a person desired to be identified by iris recognition system,first take the picture of eye. The camera can be located between three and a half inches and one meter to capture the image. In the manual procedure, the user needs to fine-tune the camera to get the iris in focus and needs to be within six to twelve inches of the of the camera. This process is much more manually concentrated and requires proper user training to be successful.

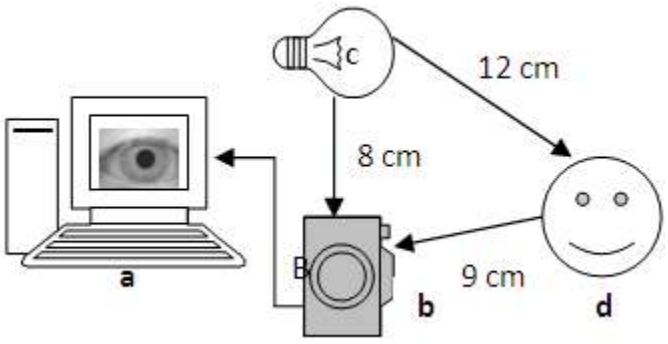

Fig: Image acquisition System (a) System with frame grabber (b) CCD Camera (c) Light Source (d) User.

Localization:

The obtained iris image has to be preprocessed to identify the iris, which is the portion between the pupil (inner boundary) and the sclera (outer boundary). The first step in iris localization is to detect pupil which is the black circular part encircled by iris tissues. The center of pupil can be used to detect the outer radius of iris patterns. The important steps involved in the iris localization are:

(i).Pupil detection
(ii). Outer iris localization

(i)Pupil Detection:

The iris image is converted into grayscale to remove the effect of illumination. As pupil is the largest black area in the intensity image, its edges can be identified easily from the binarized image by using suitable threshold on the intensity image. But the problem of binarization arises in case of persons having dark iris. Thus the localization of pupil fails in such cases. In order to overcome these problems Circular Hough Transformation for pupil detection can be used.

(ii)Outer iris localization:

External noise is removed by blurring the intensity image. But too much blurring may dilate the boundaries of the edge or may make it difficult to detect the outer iris boundary, sorting out the eyeball and sclera. Thus a unique smoothing filter such as the median filter is used on the original intensity image. This type of filtering eliminates bare noise while preserving image boundaries. After filtering, the contrast of image is enhanced to have sharp variation at image boundaries using histogram equalization.

Isolation:

Now the task is to segregate the iris. In the images used, there is some presence of the white of the eye. This was done by using a masking technique as here I am choosing best technique among other so I will use Gaussian Mask and then cropping the image to minimize the area that does not include any edge data. The mask is circular one which has the same radius as the iris. It thus passes all pixels that are contained in the circle which are all the pixels forming the iris.

Normalization:

For the purpose of accurate texture analysis, it is necessary to compensate this deformation. Since both the inner and outer boundaries of the iris have been detected so it is easy to map the iris ring to a rectangular block of texture of a fixed size.

Feature Extraction:

Both the Gabor Transform and the Haar Wavelet are considered as the Mother Wavelet. Laplacian of Gaussian (LoG) is also used in previous papers. In my paper, using Haar Wavelet, decomposing upto 4th level a feature vector with 87 dimensions is computed. Since each dimension has a real value ranging from -1.0 to +1.0, the feature vector is sign quantized so that any positive value is represented by 1 and negative value as 0. This results in a compact biometric template consisting of only 87 bits.

Matching:

Now this is our final phase for finishing our system. Here we will store the 87 bit iris code or template in our database for future matching and this matching is done with the help of an efficient matching algorithm here we are using Hamming Distance algorithm for the recognition of two samples that is reference template and enrollment template. It is basically uses an exclusive OR (XOR) function between two bit patterns. Hamming Distance is a measure, which delineate the differences, of iris codes.

Canny Edge Detection:

The Canny edge detection algorithm is known to many as the optimal edge detector. Canny's intentions were to enhance the many edge detectors already out at the time he started his work. He was very successful in achieving his goal and his ideas and methods can be found in his paper, "**A Computational Approach to Edge Detection**". In his paper, he followed a list of criteria to improve current methods of edge detection. The first and most obvious is low error rate. It is important that edges occuring in images should not be missed and that there be NO responses to non-edges. The second criterion is that the edge points be well localized. In other words, the distance between the edge pixels as found by the detector and the actual edge is to be at a minimum. A third criterion is to have only one response to a single edge. This was implemented because the first 2 were not substantial enough to completely eliminate the possibility of multiple responses to an edge.

Canny Edge Detection Algorithm:

The algorithm runs in 5 separate steps:
1. **Smoothing**: Blurring of the image to remove noise.
2. **Finding gradients**: The edges should be marked where the gradients of the image has Large magnitudes.

3**. Non-maximum suppression**: Only local maxima should be marked as edges.
4. **Double thresholding**: Potential edges are determined by thresholding.
5. **Edge tracking by hysteresis**: Final edges are determined by suppressing all edges that are not connected to a very certain (strong) edge.

Some Current And Future Applications Of Iris Recognition:

- national border controls: the iris as a living passport
- computer login: the iris as a living password
- cell phone and other wireless-device-based authentication
- secure access to bank accounts at cash machines
- ticketless travel; authentication of rights to services
- premises access control (home, office, laboratory, etc)
- driving licenses; other personal certificates
- entitlements and benefits authorization
- forensics; birth certificates; tracing missing or wanted persons
- credit-card authentication
- automobile ignition and unlocking; anti-theft devices
- anti-terrorism (e.g. security screening at airports)
- secure financial transactions (electronic commerce, banking)
- Internet security; control of access to privileged information
- "Biometric-Key Cryptography" (stable keys from unstable templates)

IV. Conclusion:

In this review paper, we show how a number of ways can identify a person but as a substitute of carrying bunk of keys or remembering things as passwords, we can use us as living password, which is called biometric recognition technology it uses physical characteristics or habits of any person for identification. In biometrics we have a number of characteristics which we are using in our recognition technology as fingerprint, palm print, signature, face, iris recognition, thumb impression and so on but among these irises recognition is best technology for identification of a person can say that this technology is not completely developed .Thus iris recognition is an efficient method for identifying persons.

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