NOVEL ALGORITHM FOR IRIS RECOGNITION AND IDENTIFICATION

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ABSTRACT

Iris recognition is the process of identifying a person by collecting the relevant patterns of his or her iris. Now a day's there is a lot of demand for the novel algorithms for iris recognition and identification, because of its short time to recognize and identify the object. In general, there are many types of authentication systems available like face authentication, fingerprint authentication, and other biometric traits for authentication, there is still having some limitations in all these current authentication systems. This laid an idea for implementing a strong authentication to overcome all the pitfalls of previous methods and to increase more security to get accurate results. For designing the iris recognition algorithm, there is a great need for mathematical and computer-vision research to look into deeper areas. In this proposed application we try to take some sample IRIS images and then convert a photo of an eye to an 'unrolled' depiction of the subject's iris and try to compare this unrolled subject with an agent's memory I.e. test images. If a match is found, it will generate the result as objected matched and it will also display the object or person name. If the match is not found, this will show an error message to check with alternate images.

Key Words:

Iris Recognition, Relevant Patterns, Authentication, Computer-Vision, Unrolled Depiction, Fingerprint Authentication, Face Authentication, Biometric Traits.

1. INTRODUCTION

Iris is defined as the pigmented region of the eye. It is a circular sinewy diaphragm which separates the two interior regions of the eye. It is mainly formed from ciliary muscle across the eyeball and reached in front of the lens. It is having a very small circle sharped aperture in the middle through which the light enters the eye, which is called pupil. The main functionality of iris is to control the excess amount of light rays not to pass directly enter into the eye by giving some contractions and relaxing the eye muscles. In the initial state of iris formation, a particular pattern is formed and this will be become stronger during pigmentation which occurs in a couple of years. The formation of particular pattern is not depend or relate with any genetic factors of that person, but only depends on ancestral genes is the pigmentation of the iris, giving eye its color. In a deep analysis or survey, we found that no two identical twins acquire non-germane iris patterns[1].

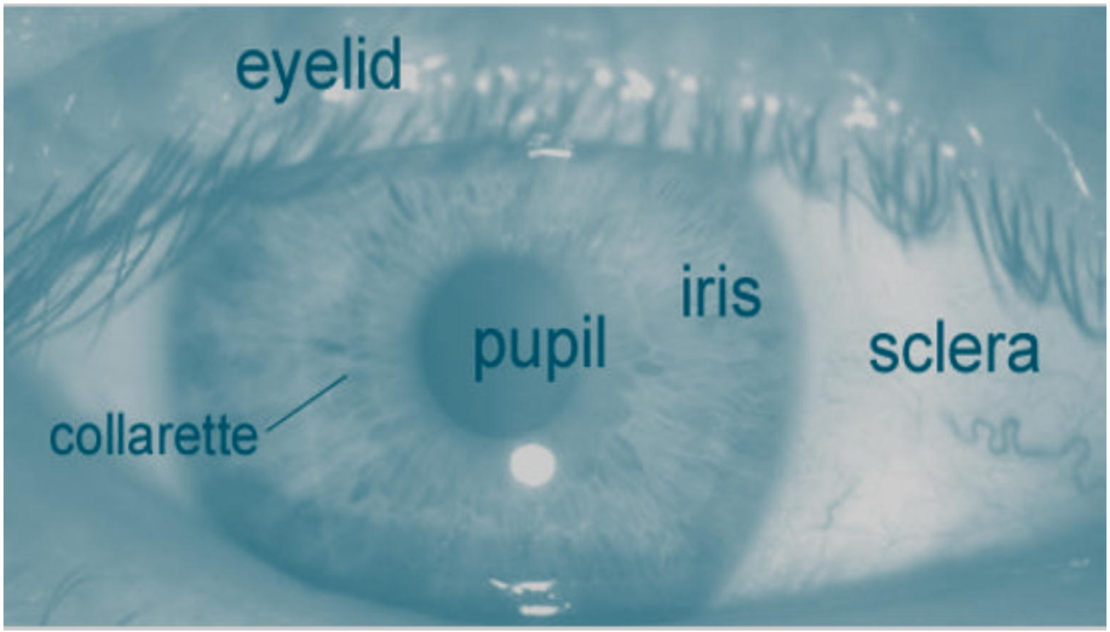


Figure 1.Denotes the Sample View of IRIS

From the above figure 1, we can clearly identify the IRIS image, with all its parameters surrounded around the iris of an eye. In recent days most of the users try to use iris as the main source for providing authentication from the un-authorized or restricted access. The iris is a well-protected part of the eye, though it is clearly viewed from the external look, it is having some unique self-generated pattern[2]. This pattern remains always stable throughout human life without any change of its parameters. Some of the key factors which strongly support the justification of IRIS as best suited method for identifying an individual than other primitive methods are as follows:

In order to tell the importance of iris, we need to first discuss about the importance of **image processing** framework because of its unique feature and ability to identify the pattern by extracting the data from input image of the eye. Initially the digital image of the eye is converted into biometric patter and then tries to store those values into the database tables. This data may sometime contain a physical-mathematical representation of the unique information about the iris image and this will be used to identify or match the parameters with the test database[3]. Now let us see the step wise procedure for iris recognition and comparison with other primitive authentication methods.

1. Initially the input should be a valid eye image which should be captured or acquired properly. This phase is also termed as Image acquisition phase.
2. Now the input image is converted into a template manner for eyes' iris region. This is mainly converted in order to match or compare the input images with test images and this will be act as biometric identification phase[4].
3. This phase is almost known as matching phase in which the template is studied in regard with the other templates stored in a database for comparison until either a matching model is found or no match is detected.
4. If a match is recognized, the resultant output will be displayed as client is identified and the same will be sending as an acknowledgement for the client.
5. If no match is recognized, the client remains unidentified and tries to acknowledge as anonymous user[5].

II. LITERATURE WORK

In this section we mainly discuss about the background work that was carried out in finding the work that is related to iris recognition.

MOTIVATION

A well-known author like the Hough transform considers a set of edge points and finds the circle that best fits the most edge points. In matching two iris images, a well know approach like Daugman's approach involves computation of the normalized Hamming distance between iris codes, whereas Wildes applies a Laplacian of Gaussian filter at multiple scales to produce a template. Matching is achieved via an application of normalized correlation and Fisher's linear discriminant as a similarity measure. Wildes briefly describes [6] the results of two experimental evaluations of the approach, involving images from several hundreds of irises.

A well-known author like Wildes' [7] proposed an approach to compute a binary edge map followed by a Hough transform to detect circles.

A well-known author like Tan et.al. [8] proposed an approach to invent several innovations, and try to compare all primitive methods with these new methods to know the efficiency of iris recognition. He proposed a main concept like an iris is localized in several steps which first find a good approximation for the pupil center and radius, and then apply the Canny operator and the Hough transform to locate the iris boundaries more precisely.

A well-known author like M. Vatsa et. al. [9] proposed an novel approach to iris verification which uses textural and topological features of the iris image. The proposed 1D log Gabor wavelet is used to extract the textural information and Euler numbers are used to extract the topological information from the iris image. They used Hamming distance algorithm and proposed difference matching algorithm to match the textural and topological information.

Two well-known authors like Boles and Boashash [10] proposed an novel approach locate the pupil center using an edge detection method, records grey level values on virtual concentric circles, and then constructs the zero-crossing representation on these virtual circles based on a one-dimensional dyadic wavelet transform.

III. THE PROPOSED IRIS RECOGNTION METHODOLOGY

In this section we mainly discuss about the proposed method used for iris recognition and verification of an individual. In the proposed system we try to design Iris recognition and authentication as main source for recognizing a person by analyzing the apparent pattern of his or her iris. 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. The project 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.The proposed IRIS recognition holds 8 stages to detect or match the image.

8 STAGES OF IRIS DETECTION

The following are the 9 stages of iris recognition, now let us discuss about each stage in detail:

STAGE 1: SCAN EYE

The eye scanning will be simulated in this system as we have no method of taking real-time images of subjects. Therefore, all eye images are to be jpeg image files at least 1000 x 1000 pixels in dimension. The eye is scanned by manually selecting the file and instructing the agent to scan it. The agent begins scanning an eye by turning the jpeg file into an image object in full color (24 bit RGB).

STAGE 2: EYE GRAY SCALING ALGORITHM

The agent next converts the full-color image to an 8-bit representation. This reduces space complexity, making further computations faster without losing reliability.

Gray = (Red + Green + Blue) / 3

PSEUDO CODE FOR CONVERTING IMAGE INTO GRAY SCALE

```
For Each Pixel in Image {

  Red = Pixel.Red
  Green = Pixel.Green
  Blue = Pixel.Blue

  Gray = (Red + Green + Blue) / 3

  Pixel.Red = Gray
  Pixel.Green = Gray
  Pixel.Blue = Gray

}
```

STAGE 3: MEDIAN FILTER

Applies a median filter to the gray scaled image to reduce the amount of noise and artifacts before the pupil center detection.

$$median[A(x) + B(x) \neq median[A(x) + B(x)]$$

These filters smoothes the data while keeping the small and sharp details. The median is just the middle value of all the values of the pixels in the neighborhood. Note that this is not the same as the average (or mean); instead, the median has half the values in the neighborhood larger and half smaller. The median is a stronger "central indicator" than the average [7].

STAGE 4: PUPIL CENTER DETECTION

To perform the fifth step, the agent must now find the center of the pupil to orient the coordinate system at the center of the eye. The accuracy of pupil positioning is mostly decided by the edge of pupil. It is generally reckoned that the point of which the pixel has the large gray gradient is the edge point of the pupil. One of the edge detection operators is **Canny** operator that applies two thresholds to the gradient: a high threshold for low edge sensitivity and a low threshold for high edge sensitivity. After detecting edges, it is time to use circular Hough transform to find the pupil exactly. Fig.2 (a) shows the result of executing CHT and show executing CHT directly on image produces a lot of circles that all of them is wrong except one circle that fit on pupil. One solution for this problem is to limit the area of image that CHT implemented on it. We limit area using the result boundary box in section A and Fig.2 (b) shows the result.

Figure. 2: (a) Implementing original CHT and (b) Implementing CHT in boundary box of pupil area (c) Approximate and final pupil center (white and red cross) and (d) Final circle fitted to pupil.

Euclidean distance can be used to calculate distance between the center of circles and approximate center of pupil that can be expressed as

$$dist(ac,cc) = \sqrt{(x_{ac} - x_{cc})^2 + (y_{ac} - y_{cc})^2}$$

Where ac(xac ,yac) is coordinate of the approximate pupil center and cc(xcc ,ycc) is coordinate of the circle center.

After calculate distance, nearest circle found by CHT is fitted to pupil and Fig.1 (d) show the results.

STAGE 5: CANNY EDGE DETECTION

Step 5 also requires that the edges of the iris and pupil be marked so an edge detection process needs to be completed by the agent. We decided to have the agent use the 'Canny Edge Detection' algorithm.

STAGE 6: PUPIL AND IRIS RADIUS DETECTION ALGORITHM

In this stage the agent attempts to find the radius of both the pupil and iris using the center found in stage 3 and the edges found in stage 4. The radii will be used by the agent in both step 6 and 7.Here we try to use **Daugman's algorithm for** performing the pupil and iris radius detection.

STAGE 7: IRIS LOCALIZATION

This process is mostly for visual purposes and refers to removing erroneous information from the original image outside of the iris radius, whereby leaving only the image within the bounds of the iris radius intact.

STAGE 8: IRIS UNROLLING ALGORITHM

The agent must now use the radii found in stage 5 as well as the pupil center found in stage 3 to perform the unrolling of the iris. Traversing the eye in a polar coordinate, circular fashion, the agent maps information from the original image to the output (unwrapped) image.

STAGE 9: IRIS MATCHING

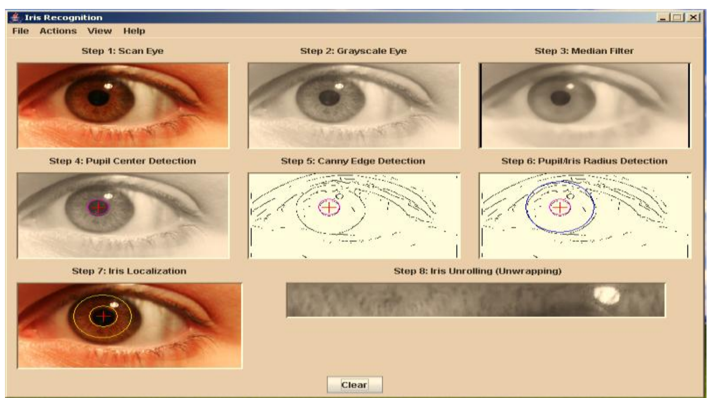
This is the last stage in which we try to match the input image with the database images.

1. Performs a mean filer on the unrolled image stored in memory
2. Subtracts the mean filtered image from the unwrapped image of the eye being matched to
3. Computes a percentage difference between the eye being matched and the identity
4. Selects the identity that has the highest percentage match and displays the result to the user in a dialog box

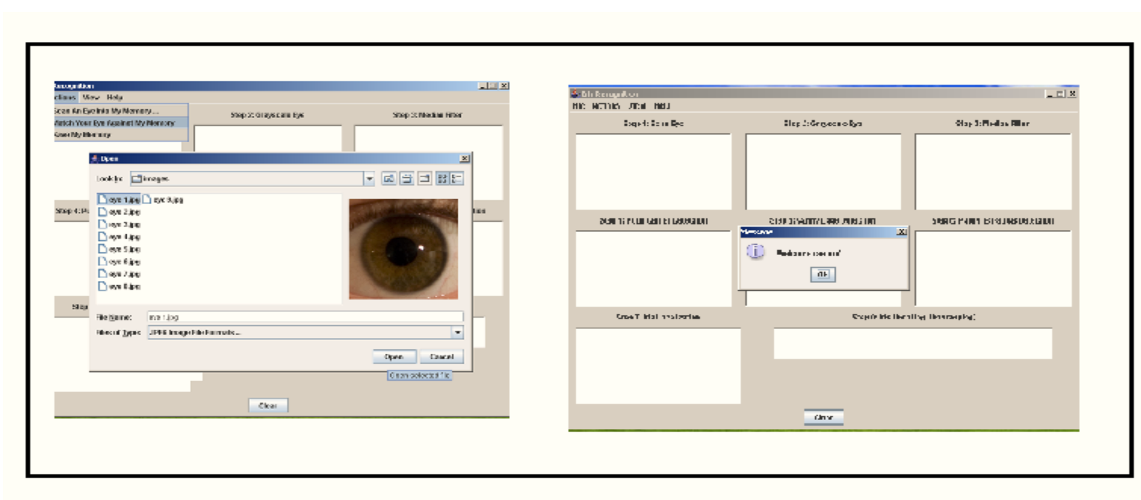
IV.EXPERIMENTAL EVALUATION

We have conducted experiment on several IRIS images collected form google database and try to test the efficiency of our proposed application with all those pre-defined images. Here we use JAVA as the programming language with front end as Java Swings ,AWT and back end we use Sample images.Finally we developed an application which can able to show the performance of our proposed application by taking a sample data set with more than 20 distinct iris images and try to map those sample images with the agents memory and check the efficiency of the proposed application.

AGENT IMAGE INSERTION



From the above figure we can see an agent will try to load iris images into the database by undergoing all the 8 layers present inside the application. Once it undergo all the intermediate stages ,then it will be passed into a unrolling state. This unrolling image is used as a input to identify the user images which are input during train phase.



From the above image we can see the client choose one sample iris image as input and then try to match that image with corresponding unrolling images which are present in the database. Once if there is any image matched with those values, it will show the resultant output as matched and if not it will show as not found.

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. Experimental results based on these 9 stages demonstrated that the proposed method achieved high detection rates and takes less time complexity. In future we want to extend some more stages in iris recognition to give some more best security and also reduce the time complexity.

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