IRIS Detection Based Person's Identification

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Abstract—This paper presented an iris recognition system in order to verify both the uniqueness of the human iris and also its performance as a biometric identification. 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. The iris recognition system consists of an automatic segmentation system that is based on the Hough transform, and is able to localize the circular iris and pupil region, occluding eyelids and eyelashes, and reflections. The extracted iris region is then further goes for quad tree decomposition method for another segmentation of iris. After that the segmented iris further goes for the matching in the database. The database contains the features that are need to be stored and then the extracted features are compared with these already stored features and then the identification of a person is done.

Keywords: - *Iris Recognition, Biometric Identification,* Automatic Segmentation and Matching

I. INTRODUCTION

A biometric system provides automatic recognition of an individual based on some sort of unique feature or characteristic possessed by the individual. Biometric systems have been developed based on fingerprints, facial features, voice, hand geometry, handwriting, the retina, and the one presented in this paper, the iris. The iris is a thin circular diaphragm, which lies between the cornea and the lens of the human eye [7]. A front-on view of the iris is shown in Figure 1. Formation of the unique patterns of the iris is random and not related to any genetic factors. The average diameter of the iris is 12 mm, and the pupil size can vary from 10% to 80% of the iris diameter [5]. The iris consists of a number of layers the lowest is the epithelium layer, which contains dense pigmentation cells. The stromal layer lies above the epithelium layer, and contains blood vessels, pigment cells and the two iris muscles [3]. The density of stromal pigmentation determines the color of the iris [3]. The externally visible surface of the multi-layered iris contains two zones, which often differ in color. An outer colliery zone and an inner papillary zone, and these two zones are divided by the collarets – which appears as a zigzag pattern. Fig.1 shows the front view of the human eye. Although prototype systems had been proposed earlier, it was not until the early nineties that Cambridge researcher, John Daugman, implemented a working automated iris recognition system [5]. The Daugman system is patented and the rights are now owned by the company Iridian Technologies [5]. Even though the Daugman system is the most successful and most well known, many other systems have been developed [5]. The Daugman system is claimed to be able to perfectly identify an individual, given millions of possibilities. The system is to be composed of a number of sub-systems, which correspond to each stage of iris recognition. These stages are segmentation – locating the iris region in an eye image, normalization – creating a dimensionally consistent representation of the iris region, and feature encoding – creating a template containing only the most discriminating features of the iris. The input to the system will be an eye image, and the output will be an iris template, which will provide a mathematical representation of the iris region.

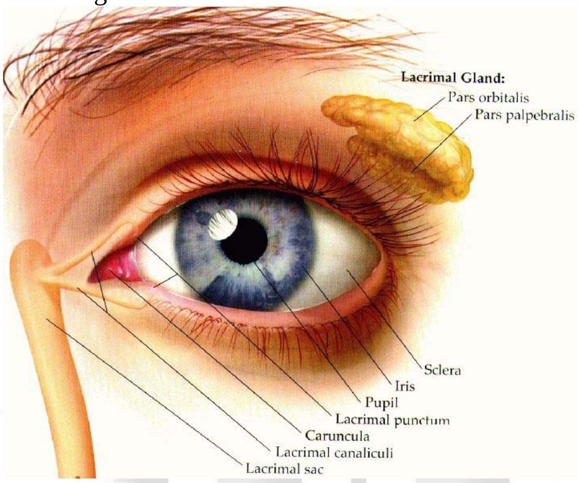

Fig. 1: The Front Part of Eye Image

II. PROPOSED ALGORITHM

The Proposed algorithm defines the following steps

- Image acquisition
- Iris detection using boundary box analysis
- Iris segmentation
- Feature extraction using intensity value mapping for RGB
- Database matching

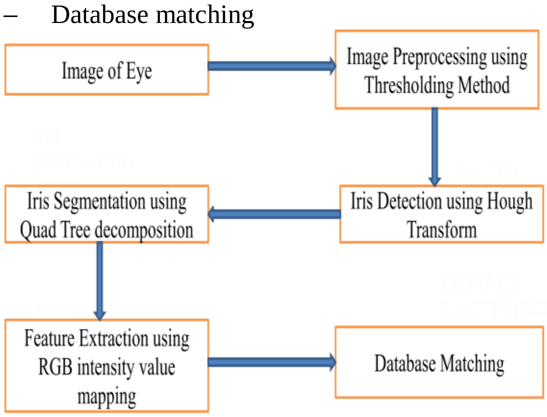

Fig. 2: Proposed Flowchart

A. *Image Acquisition*

The image is acquisition is the first step in iris recognition process. In this process the image of an eye is captured from the sensor. Then this analog image is digitized for further image processing.

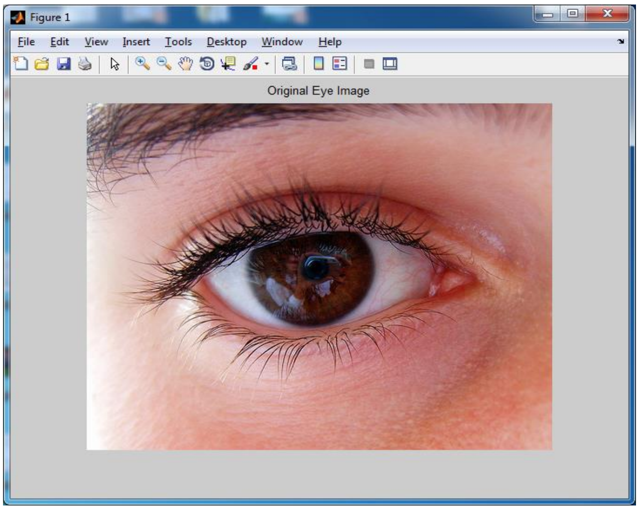

Fig. 2: The Original Eye Image

B. Image Preprocessing

The digitized eye is then converted into the black and white image for iris detection. The image of an eye becomes the binary image by converting it into the black and white image. Binary 0 is taken for black and binary 1 is taken for white color.

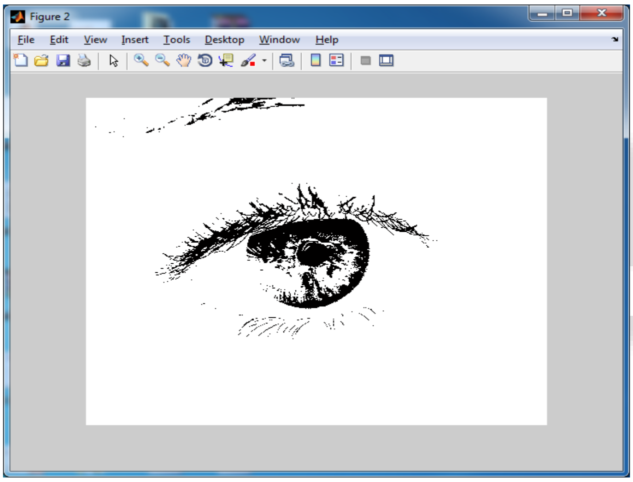

Fig. 3: The Binary Image

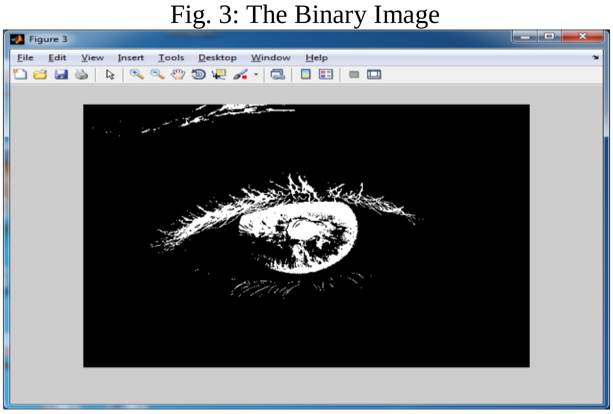

Fig. 4: The Inverted Binary Image

C. Iris Detection using Hough Transform

The process of identifying possible circular objects in Hough space is relatively simple, first we create our accumulator space which is made up of a cell for each pixel, initially each of these will be set to 0. For each (edge point in image (i, j)): Increment all cells which according to the equation of a circle

$$(i-a)^2 + (j-b)^2 = r^2$$

could be the center of a circle, these cells are represented by the letter 'a' in the equation. For all possible value of a found in the previous step, find all possible values of b which satisfy the equation. Search for the local maxima cells, these are any cells whose value is greater than every other cell in its neighborhood. These cells are the one with the highest probability of being the location of the circle(s) we are trying to locate. Note that in most problems we will know the radius of the circle we are trying to locate beforehand, however if this is not the case we can use a three-dimensional accumulator space, this is much more computationally expensive. This method can also detect circles that are partially outside of the accumulator space if enough of its area is still present within it.

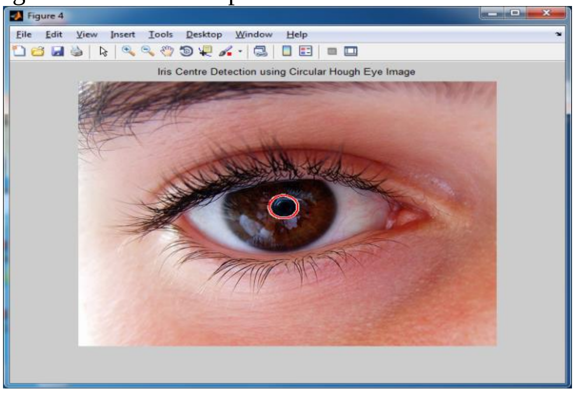

Fig. 5: Pupil Detection using Circular Hough Transform

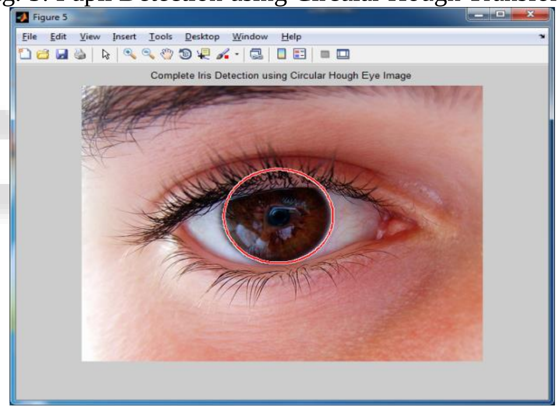

Fig -6: Iris Detection using Circular Hough Transform

D. Iris Segmentation

The iris segmentation is the process to divide an image into different parts. The image is divided into the parts for future feature extraction. Here we have used tree decomposition method for segmentation.

E. Quad-tree Decomposition

The region quad-tree represents a partition of space in two dimensions by decomposing the region into four equal quadrants, sub quadrants, and so on with each leaf node containing data corresponding to a specific sub region. Each node in the tree either has exactly four children, or has no children (a leaf node). The region quad-tree is a type of trie. A region quad-tree with a depth of n may be used to represent an image consisting of $2^n \times 2^n$ pixels, where each pixel value is 0 or 1. The root node represents the entire image region. If the pixels in any region are not entirely 0s or 1s, it is subdivided. In this application, each leaf node represents a block of pixels that are all 0s or all 1s. A region quad-tree may also be used as a variable resolution representation of a data field. For example, the temperatures in an area may be stored as a quad tree, with each leaf node storing the average temperature over the sub region it represents. If a region quad-tree is used to represent a set of point data (such as the latitude and longitude of a set of cities), regions are subdivided until each leaf contains at most a single point. The tree decomposition method is used for segmentation. In which instead of dividing the whole iris into a uniform grid, quad tree partitions the iris by means of detecting the centre and the measurement of radius.

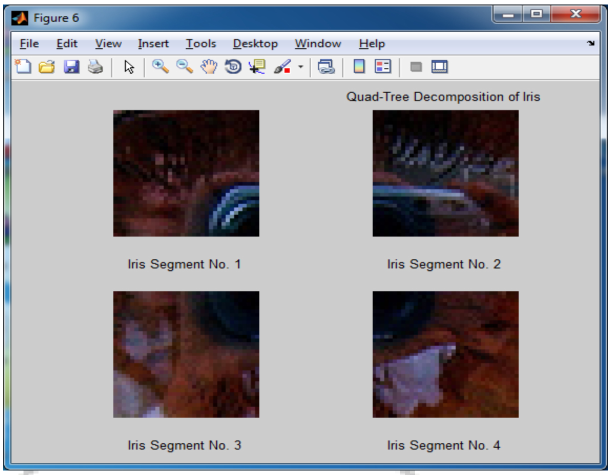

Fig. 7: Iris Segmentation using Quad-tree Decomposition

F. *Feature Extraction*

The segmented iris is then taken for feature extraction. In this process small pixels are taken by segmenting the image. The features are matched using the hamming distance method.

G. *Database Matching*

After taking the values from the feature extraction process the corresponding values are matched with the values which are previously stored in the database. Thus the identification is done. The matching will be done by using correlating the pixels values. After the matching the identification of the person will be done and the database of the person will be generated. The database is generated of a person using the Graphic User Interface.

Fig. 8: Person's Identification Database

III. Conclusions

From this work we can conclude that Hough transform is very simple method for iris and pupil detection. It is also very fast and less time consuming method. The Quad-tree decomposition method that is used for the iris segmentation provides accurate result and then features are extracted and matched with the database. The database contains values of features. These features are taken in the features extraction are compared with the features stored in the database. Thus, person's identification is done.

IV. References

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