AN AUTOMATED SEGMENTATION OF HUMAN IRIS FOR BIOMETRIC IDENTIFICATION

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Abstract - Biometric system is used to identify, verify and analyze an individual with respect to their physiological and behavioral characteristics. Many applications like authentication endorse biometric systems. These processes are exerted through the unique attributes of an individual such as finger prints, iris of eyes, speech, and voice and so on. Our proposed work is focused on segmenting iris from the human eye images. In this method, we have used canny edge detection method along with gradient magnitudes to refine the edges on those images. This strategy enhanced our algorithm crucially and gives more accurate and efficient segmentation of iris. Moreover, our proposed method is quantitatively and qualitatively evaluated by the Jaccard (J) and Dice (D) similarity using the expert segmented result with segmented iris image of the proposed method.

***Keywords*: Biometric Identification; Iris Segmentation; Canny Edge Detecton; Gradient Method.**

1. Introduction

In the era of developments in the computer applications field, the biometric systems are very essential for many purposes for authentication with individual identification. With unique physiological and behavioral characteristics of humans, we can produce several applications for individual identification, authentication and security based processes. In traditional authentication systems, a PIN or a secret password like attributes are used. As a need to enriched authentication systems, there are number of enhancement are added to those systems such as finger print identification, iris identification and GAIT analysis. The National Science and Technology Council addresses the five integrated components in the Biometric system that are (i) a sensor used as a input device (ii) the signal processing algorithm which forms a biometric template (iii) a data storage component (iv) the matching algorithms and (v) the automated or human assisted matching algorithms [1]. The iris biometric system is a popular and widely used biometric system which used in many domains for those systems runs to be in restricted way. The basic concepts of iris recognanization model and the intensity based iris segmentation can be found in [2] [3]. Some of the iris segmentation techniques are presented with a comparision in [4] and frequency based techniques is also proposed in [5]. The segmentation of iris using different active contour variants is proposed in [6-8]. In this paper, we concentrated in recognizing the iris through constructing an algorithm for segmenting the iris from eye. Moreover, it is an automated algorithm that finds gradients after using canny edge detection algorithm.

The concept of edge detection on an image is introduced in [9] and the zero-crossing of the Laplacian of Gaussian of an image is used for detecting the edges. The sudden changes in the pixel intensities or discontinuty are known as edges. An edge detector proposed by canny [10] known as a canny edge detection method that works under the follwing sequence of steps.

Step 1: Smoothing the image using Gaussian filter

Step 2: Finding the gradient magnitude and the direction of maximum intensity change

Step 3: The pixels larger than the gradient magnitude at the neighbouring two pixels in the gradient direction are marked as an edge

Step 4: Thresholding for removing the weak edges

The proposed methodlogy of our iris segmentation method is explained in section 2, the results and disscussion included in section 3 and in the section 3 we concluded our paper.

2. Proposed Method

The flowchart of our proposed method is depicted in Fig. 1.

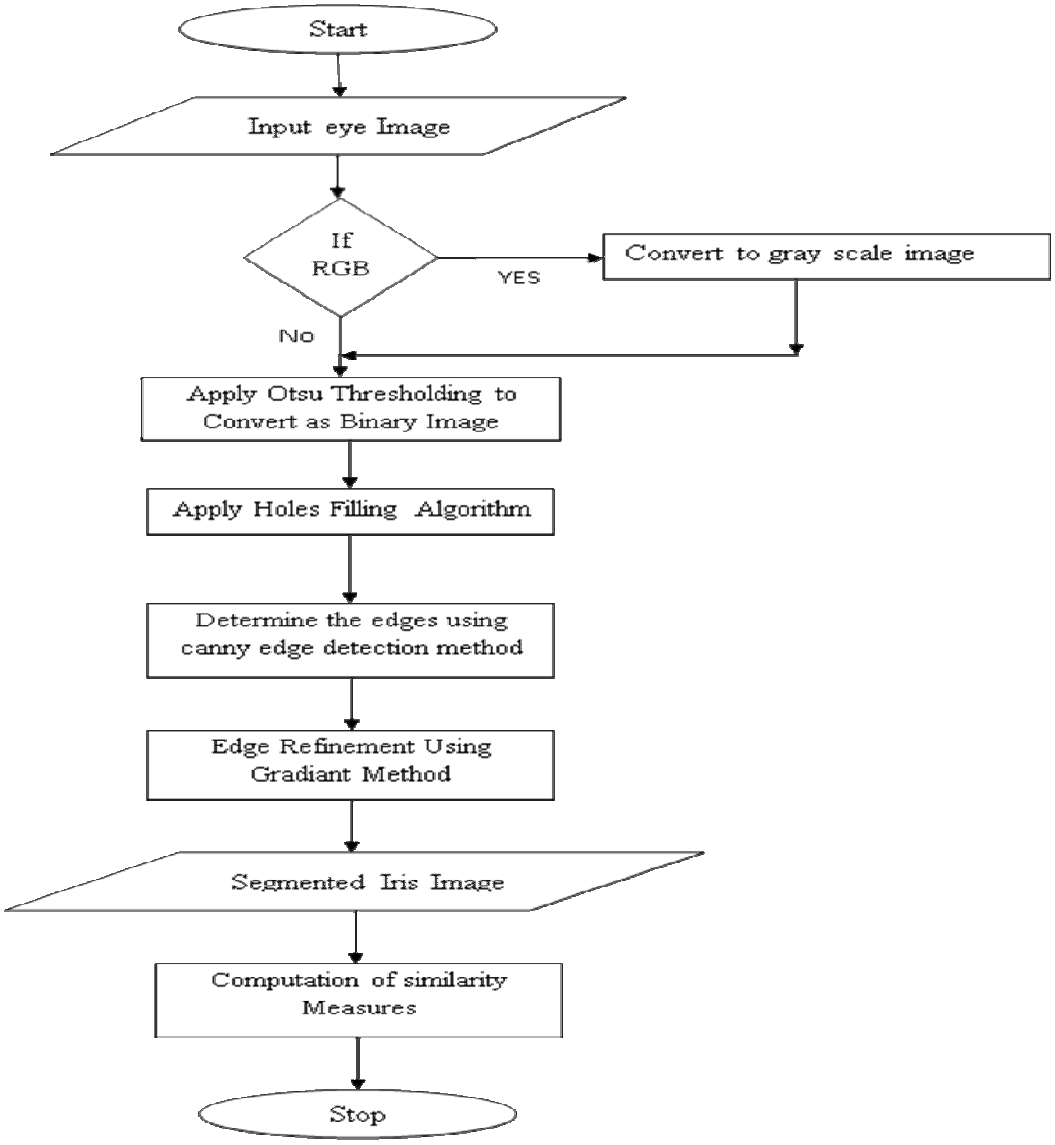

Fig. 1. Flowchart of our proposed method

The sequential steps of our proposed method are implemented as follows.

Step 1. Input of Eye Image

The eye images that are collected from various internet sources are selected for implementing our proposed method. As we proposed this method for gray-scale images, the images are converted into a gray scale images in case of RGB image.

Step 2. Binary Image Conversion

For implementing our algorithm, we need to convert the image into a binary image. The Otsu thresholding method is used to convert the gray-scale images into binary image. After getting the binary image, the holes filling algorithm is applied to fill the holes in the binary image as shown in Fig. 2 (c).

Step 3. Detection of Edges using Canny Edge Detection Method

In the eye images, the edges of the iris are subject to detect followed by segmenting through the detected pixel information. In our method, we used canny edge detection method to detect the edges. By applying canny edge detection method by the steps mentioned in previous sections, we can get edges of the iris from the whole eye image. The extraced edges are shown in Fig. 2 (d).

Step 4. Refinment of Edges using Gradient method

The edges of iris which are detected from the previous step has some unclear and fake edges. We used gradient method to enhance the edges and to get accurate edges of iris with this strategy. Finally, we can get the segmented iris image with these edges. The resultant images of the final detected edges and segmented iris image are shown in Fig. 2 (e) and Fig. 2 (f) respectively.

Step 5. Computation of similarity measures

Our proposed method is evaluated through computing the similarity measures such as Jaccard (J) and Dice (D) by using the Eqn. (1) and Eqn. (2) respectivly.

Step 6. Similarity Measures

To evaluate the performance of segmented images, the similarity measures Jaccard (J) and Dice (D) are used. It compares the expert segmented result with our proposed segemented result.

The Jaccard similarity is taken by the intersection divided by the union of the two finite sets and the formula is given as follows.

$$\mathrm{J}(\mathrm{s1},\mathrm{s2}) = \frac{|S1 \cap S2|}{|S1 \cup S2|} \tag{1}$$

The Dice is calculated by the following formula

$$\mathrm{D}(\mathrm{s1},\mathrm{s2}) = \frac{2\,|S1 \cap S2|}{|S1|+|S2|} \tag{2}$$

where, S1 represents the total pixels of the Expert segmented image and S2 represents the segmented iris image by the proposed method.

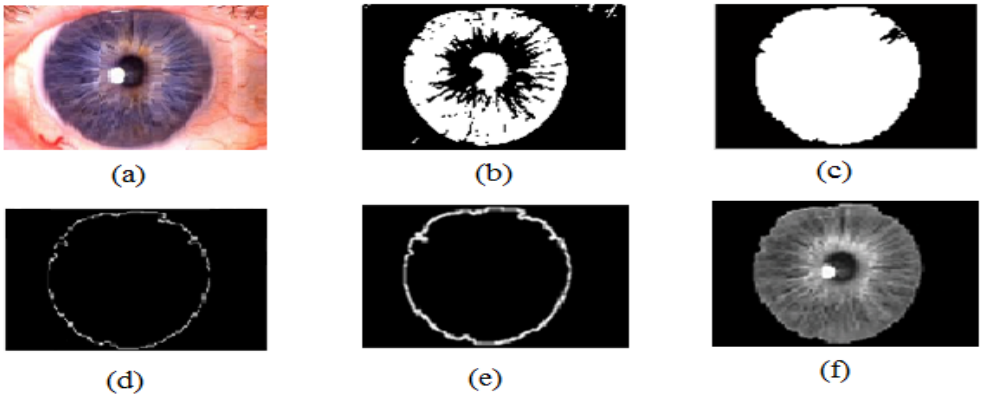

Fig. 2. (a) Original Image (b) Converted Binary Image (c) Holes filled image (d) Extraction of edges using Canny Method (e) Refined Edges Using Gradient Method (f) Segmented Iris Image

3. Results and Disscussions

Our proposed method is implemented through MATLAB. The selected sample images from our dataset and their corresponding segmentation results are depicted in Fig. 3. In Fig. 3, coumn 1 contains the original images, column 2 contains the extracted edges using canny method, the refined edges by applying gradiant method is included in column 3 and the segmented iris images are shown in coulmn 4.

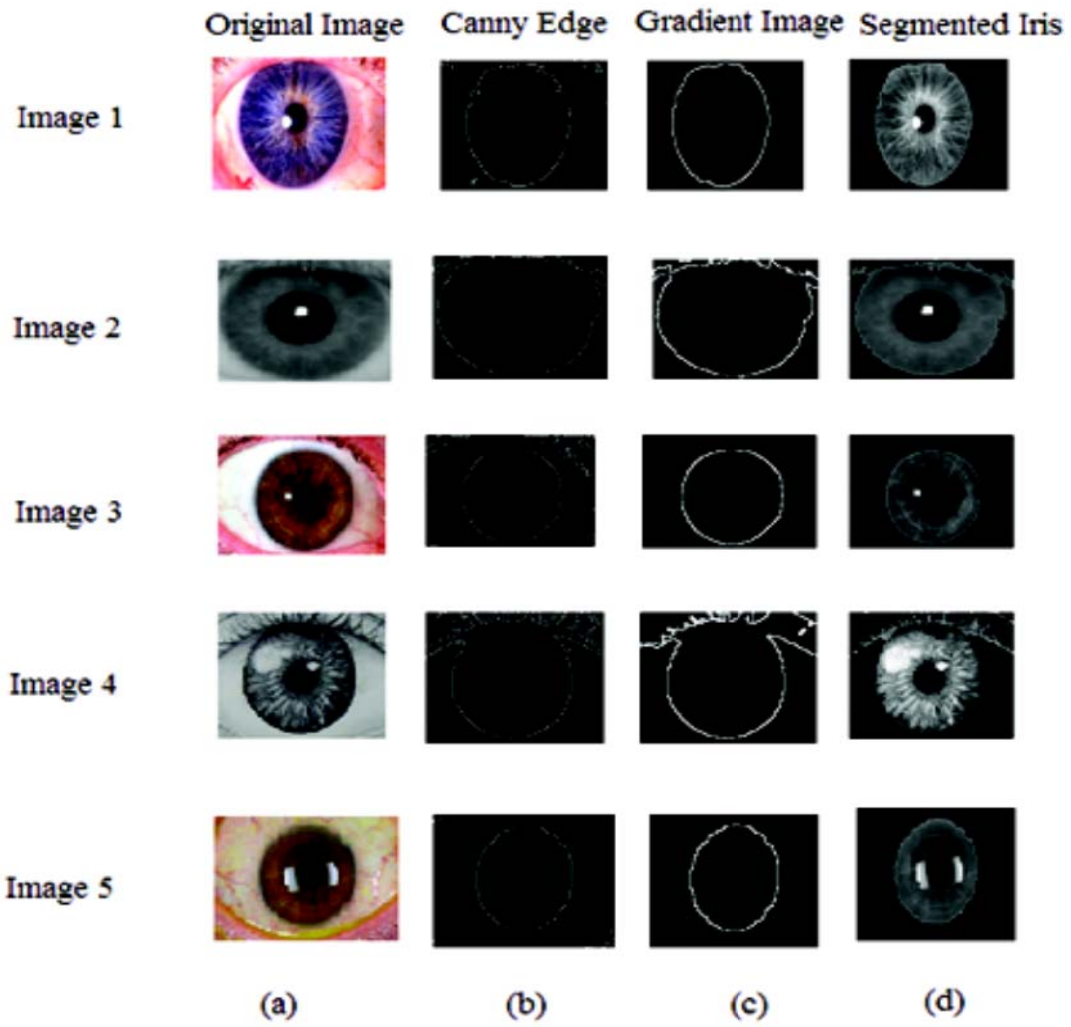

Fig. 3. Resultant images of our Proposed Method

Our proposed method is assessed using Jaccard and Dice coefficients. The Jaccard and Dice values for the tested images are shown in Table. 1. It is evident from Table.1 that our proposed algorithm gives better segmented results in terms of Jaccard and Dice similarity mesures.

Table 1. Jaccard and Dice values

Image	Jaccard	Dice
Image 1	0.8220	0.9023
Image 2	0.7419	0.8519
Image 3	0.8589	0.9241
Image 4	0.8312	0.9078
Image 5	0.8712	0.9311

4. Conclusions

In this paper, we have proposed an automated algorithm for segmentation of iris from the eye images. We have used canny edge detection method to extract the edges and the gradient method is used to refine the edges from the unclear and fake edges. Moreover, it is an automated algorithm so that it can be used as an efficiant identification method in biometric systems.

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