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Iris Detection Using Segmentation Techniques

Neeti Taneja[1*], Mohammad Shabaz [2], Vinayak Khajuria [3]

[1]Dept. of Computer Science and Engineering, Apex Institute of Technology, Chandigarh University, Punjab, India
[2] Dept. of Computer Science and Engineering, Apex Institute of Technology, Chandigarh University, Punjab, India
[3] Dept. of Computer Science and Engineering, Apex Institute of Technology, Chandigarh University, Punjab, India

[*]*Corresponding Author: neeti.ibmcse@cumail.in, Tel.: 0172-2632944*

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Abstract— This paper introduces an approach to be adopted for the detection of iris from the medical image of human eye. The microscopic image of human eye is taken which consists of number of features such as pupil, retina, iris etc. Firstly image pre-processing is done on the input image so as to remove unwanted noise from it and then various image segmentation techniques such as edge detection, Hough transform etc. are applied for the efficient identification of the inner and outer boundary of iris. To efficiently detect iris boundary, accurate evaluation of circumference of iris in the human eye is required.

Keywords—Segmentation,Edgedetection,Houghtransform,etc

I. INTRODUCTION

In the field of image processing, medical imagery occupies a significant place.For the efficient analysis of medical images, Segmentation techniques play a key role. The process of segmentation extracts out the portion of iris from the image of human eye. The main problem arises when improper segmentation [1] happens because it will lead to ambiguous results. This requires adequate effort to properly segment the microscopic image of human eye. To achieve this there arises a need to follow a step-step approach for the accurate detection of iris. Section I contains the introduction, Section II contains the proposed approach along with results, Section III includes conclusion with future directions.

II. METHODOLOGY

For correct diagnosis of iris in different medical images, proper segmentation is required. One of the proposed approach is as follows:

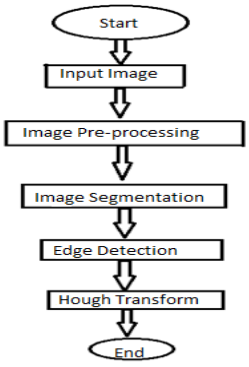

Figure. 1 Step-by-step approach

1. **Image Pre-processing**

The microscopic image of human eye may be noisy due to speculation [2]. So for correct analysis of the image, unwanted noise needs to be removed so as to smoothen the image. For obtaining a smoothened image, it needs to be pre-processed. Pre-processing involves the use of different filters such as Gaussian filter, mean filter, median filter etc. for shunting out the unwanted noise.

2. **Image Segmentation**

The main aim of segmentation technique is to make the image meaningful by easily analyzing the requisite features from the image. Here in this case we will take the microscopic image of an eye and segment the image so as to detect iris portion [3] from the human eye. Iris segmentation is one of the important classical image processing problem. It refers to the process of automatically detecting the inner and outer boundaries of an iris in a given image. This process helps in extracting features from the discriminative texture of the iris, while excluding the surrounding regions.

3. Edge Detection

This segmentation technique is very useful for obtaining sharp boundaries or edges from the image. It highlights the important features of the image by removing unwanted information.

Edge detection technique involves two main methods:

a) Gradient edge detection
b) Laplacian edge detection

Gradient edge detection computes the first derivative of the image and then looks for maximum and minimum values in it. On the other hand, Laplacian edge detection computes the second derivative of the image and finds zero crossings in it.

There are various edge detection operators available :

i) Sobel operator
ii) Prewitt operator
iii) Robert cross operator
iv) LoG operator
v) Canny operator

Sobel operator uses a pair of 3×3 kernels .One kernel is the rotation of other by 90°.These kernels are designed to respond maximally to edges running vertically and horizontally relative to the pixel grid, one kernel for each of the two perpendicular orientations. The kernels can be applied separately to the input image, to produce separate measurements of the gradient component in each orientation that is Gx and Gy.

The magnitude of gradient is given by:
$|G|=\sqrt{Gx2+Gy2}$
The Sobel operator is slower to compute but its larger [4] convolution kernel smoothes the input image to a greater extent and makes the operator less sensitive to noise.

Canny operator is the optimum edge detector due to
a) Easy Localization
b) No multiple responses
c) Low error rate

4. Hough Transform

The Hough transform is a standard image analysis tool [5] for finding curves to determine the parameters of simple geometric objects, such as lines and circles, present in an image. The circular Hough transform [6] can be employed to deduce the radius and centre coordinates of the iris regions. Firstly, the first derivatives of intensity values in an eye image are calculated to generate an edge map and then the result is thresholded. From the edge map, votes are cast in Hough space for the parameters of circles passing throughеach edge point.

Algorithm for Hough transform:
Step 1: Initializing the iris radius.
Step 2: Scaling the image.
Step 3: Gaussian filtering.
Step 4: Creating edge map using canny edge detection.
Step 5: Detecting inner boundary using Circular Hough transform.
Step 6: Detecting outer boundary inside located iris using Circular Hough transform.
Step 7: Detecting eyelid using Linear Hough transform.
Step 8: Displaying the segmented image.

III. RESULTS AND DISCUSSION

The original image of human eye as shown in figure 2 (a) is pre-processed using Gaussian filter as shown in figure 2 (b) below. Pre-processing removes unnecessary noise from the image. The results of Sobel edge detector is shown below in figure 2(c).Sobel edge detector identifies sharp boundaries in the input image of human eye. The Gaussian filtered image obtained in figure 2(b) is binarized as shown in figure 2(d) and the result of Sobel edge detection is shown in figure 2(e).

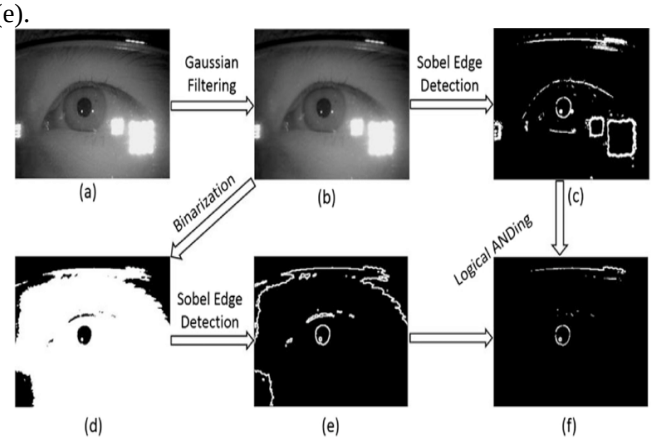

Figure. 2 Results of image pre-processing and Sobel edge detection

Finally Logical AND operation is performed on both the figure 2(c) and figure 2(e) and the result is shown in figure 2(f).
The figure 3(a) is showing an original image of a human eye. The technique of edge detection is applied and the resulting image is shown in figure 3(b).Finally the result of Circular Hough transform is shown in figure 3(d) as it is applied in the original human eye image shown in figure3(c).Circular Hough transform identifies the circumference and radius of the iris inner and outer boundary.

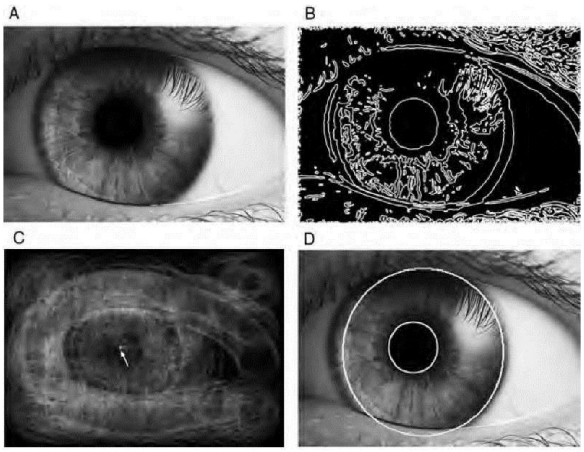

Figure. 3 Results of Circular Hough Transform

CONCLUSION and Future Scope

The ultimate task is to identify the inner and outer boundary of iris from the sample eye image of human. This requires the calculation of circumference of iris in the eye image which in turn needs the radius of iris and that can be obtained through the implementation of various segmentation techniques such as edge detection, Hough transform, etc. These techniques can be applied in the detection of micro-organisms from water and red blood cells from the human body.

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Authors Profile

Ms. Neeti Taneja had completed Masters of Engineering from Chitkara University, Punjab in the year 2015 and Bachelors of Engineering from Kurukshetra University in the year 2011. She is currently working as Assistant Professor in Department of Computer Science & Engineering, ApexInstitute of Technology, Chandigarh University, Punjab since July, 2016. Her main areas of interest includes Digital image processing, Network Security, Operating system,etc.

Mr. Mohammad Shabaz has done M.Tech from Department of Computer Science & Engineering, ApexInstitute of Technology, Chandigarh University, Punjab in the year 2018 and B.Tech fromBaba Ghulam Shah Badshah University, Rajouri in the year 2016. He is currently working as Assistant Professor in Department of Computer Science & Engineering, ApexInstitute ofTechnology, Chandigarh University, Punjab. His areas of interest includes Machine Learning,Algorithm Designing and Computational Analysis.

Mr. Vinayak Khajuria has done M.Tech from Department of ComputerScience&Engineering,ApexInstituteofTechnology, ChandigarhUniversity,Punjab in the year 2018 and B.Tech fromBaba Ghulam Shah Badshah University,Rajouri in the year 2013. He is currently working as Assistant Professor in Department of Computer Science & Engineering, ApexInstitute of Technology, Chandigarh University, Punjab. His areas of interest includes Machine Learning,Algorithm Designing and Computational Analysis.

