Project for Iris Segmentation

SUBMITTED BY GROUP 04 of LAB GROUP - B2

Anis-Ul-Islam Rafid(150104083)
Zahid Al Mamun (150104087)
Amit Niloy (150104105)
Fabliha Fairooz(150104108)

CSE-4228- DIP Lab-Fall 18

1 Introduction & motivation

The iris is a thin circular diaphragm, which lies between the cornea and the lens of the human eye. A front-on view of the iris is shown in Figure 1. The iris is perforated close to its centre by a circular aperture known as the pupil. The function of the iris is to control the amount of light entering through the pupil, and this is done by the sphincter and the dilator muscles, which adjust the size of the pupil. The average diameter of the iris is 12 mm, and the pupil size can vary from 10 to 80 percents of the iris diameter

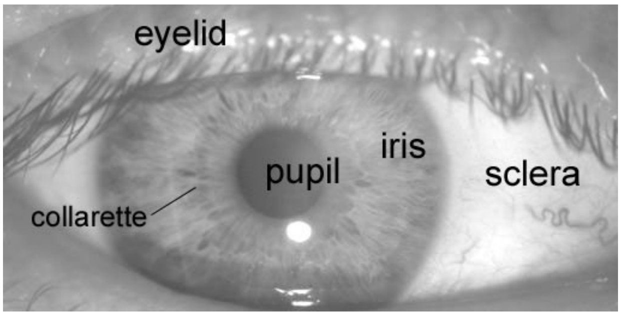


Figure 1: A front-on view of the human eye

Among various biometric technologies, such as finger-prints and face, iris recognition has a relatively short history of use. There are few large-scale experimental evaluations reported in the literature, and essentially none where the image dataset is available to other researchers. One constraint of current iris recognition systems, which is perhaps not widely appreciated, is that they require substantial user cooperation in order to acquire an image of sufficient quality for use. A number of groups have explored iris recognition algorithms and some systems have already been implemented and put into commercial practice by companies such as Iridian Technologies, Inc., whose system is based on the use of Daugman's algorithm. A typical iris recognition system generally consists of the following basic modules: I. image acquisition, iris location, and pre-processing,
II iris texture feature extraction and signature encoding, and
III iris signature matching for recognition or verification.
Iris recognition, a relatively new biometric technology, has great advantages, such as variability, stability and security, thus it is the most promising for high security environments. The proposed system here is a simple system design and implemented to find the iris from the image using Hough Transform Algorithm. Canny Edge detector has been used to get edge image to use it as an input to the Hough Transform. To get the general idea of Hough Transform, the Hough Transform for circle is also implemented. RGB value of 3-D accumulator array of peaks of inner circle and outer circle has been performed.
We have divided our work into two models . In the first model we segmented the iris and in the 2nd mode, we removed the backgroung of the image and just kept the iris and it's segments of the image.

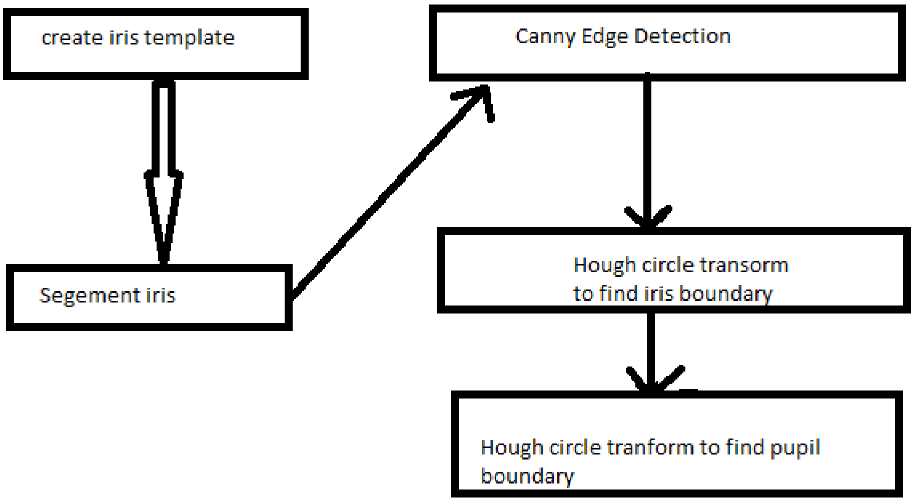
2 Dataset

We downloaded eye image and then applied segmentation. Most of the image is 330*360 dimension and few are 640*480 dimension.the type of the image files are .bmp and .jpg.

3 Work-flow and explanation of model 1

We have created iris template and then segmented the iris of an input image.We have segmented the iris by using canny edge detection and hough transformation technique[1].

1. **Canny Edge Detector**:
   Canny edge detection algorithm is known as the most popular algorithm for the edge detection. The main aim of the canny edge detection algorithm in this paper is that, the algorithm should not mark the edge which is not there and it should only mark the real edges.Hence the error rate is decreased. Another aim is to minimise the distance between the edge pixel detected and the original edge. To reduce the noises from the image it is necessary that the algorithm answer to single image.
   Canny is known to be most efficient method for edge detection. But Sobel is also one of the known methods. From the comparison of Sobel and Canny, findings are, both are gradient based edge detectors. However, Canny performs an additional processing, with non-maximum supervision which eliminates possible wide ridges that can result from the Sobel.
   Furthermore, where Sobel does a simple thresholding, Canny combines the thresholding with contour following to reduce the probability of false contours. And also, Canny was derived as a reasonable approximation



h

Figure 2: Work flow of model 1

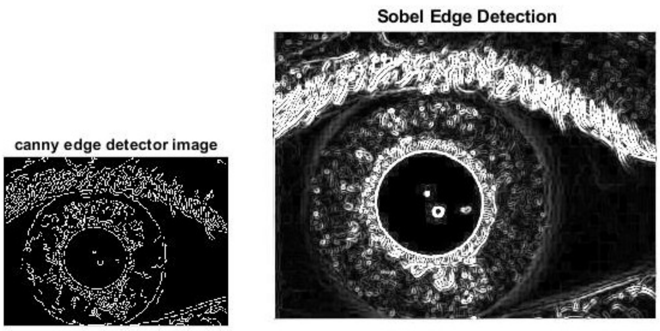


Figure 3: Sobel and Canny comparison

to an Optimal Edge Detection, while Sobel was empirically derived. The following figure shows the difference between Sobel method and Canny method practically.

1. **HOUGH TRANSFORM** :
Hough Transform is a technique to extract shapes from the image. The classical version of the Hough transform identifies straight lines from the images, but the extended version identifies regular or non-regular shapes from the image. The transform universally used today was invented by Richard Duda and Peter Hart in 1972, who called it a "generalized Hough transform" after the related 1962 patent of Paul Hough.In Hough Transform, input image is taken as binary image, the image to which edge detection has been applied. Thus the points which need to be transformed are those which likely to lie on an "edge" in the image. The transform itself is rounded into an arbitrary number of bins, each representing an approximate definition of a possible shape for which transformed is performed e.g. Line, Circle etc... Each feature point in the edge detected image is said to vote for a set of bins corresponding to the shapes that consist the feature point
By simply incrementing the value stored in each bin for every feature lying on that shape, an array is built up which shows which shapes fit most closely to the data in the image. By finding the bins with the highest value, the most likely shapes can be extracted. The simple way of finding these peaks is by applying some form of threshold, but different techniques may yield better results in different circumstances determining which shapes are found as well as how many.

   (a) **Hough Transform for Circles**:
   The extended version of Hough Transform can be used for finding circles from the image. To detect the circle from the image radius and center of the circle will be required. Hence r (radius), Xc(x-coordinate of center), Yc(y-coordinate of center). The equation of the circle is $= (\ ) + (\ )$

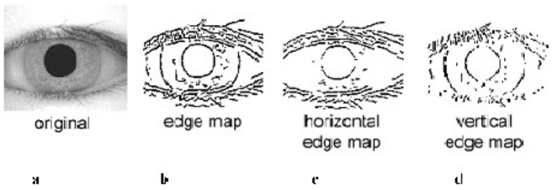


Figure 4: a) an eye image (from the CASIA database) b) corresponding edge map c) edge map with only horizontal gradients d) edge map with only vertical gradients

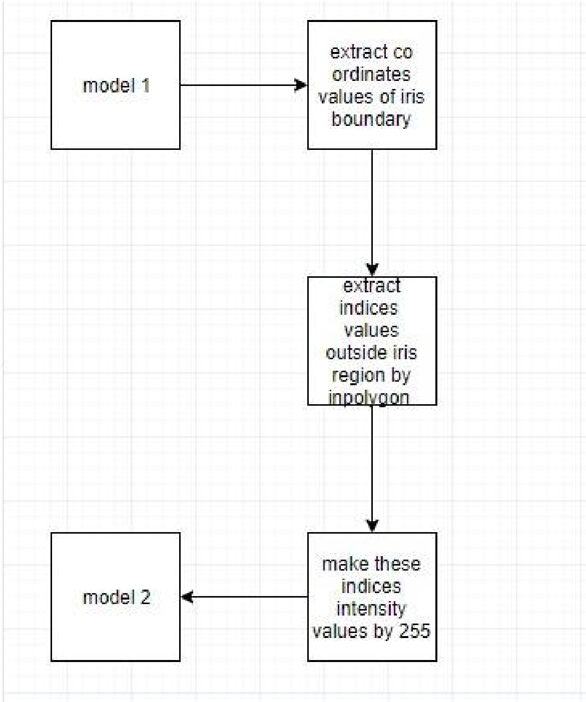
Figure 5: Circle in Hough Transform

Where r is radius of circle and (Xc,Yc) is center co-ordinates of the circle. Again in xy-space all featured pixels, obtained after applying the edge detection algorithm, will be processed. Each edge pixel, residing on the circle will be represented as a circle in the parameterized space. And in parameter space, if the circles coincide at say (Xci,Yci) point then, that point is center of the circle in the xy-plane.

(b) **Implementation of Hough Transform for circles** :
Hough Transform for circles works same as the Hough Transform for straight lines. But for lines the parametric space (Hough Space) is 2-Dimensional, whilst for circles the parametric space (Hough Space) is 3-Dimensinal. The dimensions of the 3-D parametric space will be radius of the circle, x-coordinate of the center circle and y-coordinate of the center of the circle.
Algorithm Explanation:
o Read image and perform image processing necessary.
o Apply canny edge detector.
o Initialize 3-D accumulator array.
o Find radius and Increment 3-D accumulator array.
o Finding Peaks.
This steps is perform in following steps:
Finding peak for center of the circle.
Finding peaks from array of radii.
o As the proposed system is to find iris from the image, the circles looked for are concentric circles. Hence if the center of the circles are found then from the accumulator array radii of that particular center co-ordinates are searched and stored. o From the stored radii, peaks are found using hill-climbing technique and from the peaks stored smallest peak is considered as a pupils radius. o Finding RGB values at different Radii o Comparing average RGB values for authorization.

4 Work-flow and explanation of model 2

In the 2nd model , we removed the backgroung of the image and just kept the iris and its' segments of the image . We got the segmented iris by applying canny edge detection and hough transform technique . After extracting the co- orinate values of iris boundary ,the indices values outside iris region is extracted by inpolygon function.
Inpolygon function has 4 parameters . Then indices values are converted to 255 . After that we go to model 2. When inpolygon function is called , the values except which are within (x,y), are saved in idx variable. Then if the idx is made white then background is removed .



h

Figure 6: Work flow of model 2

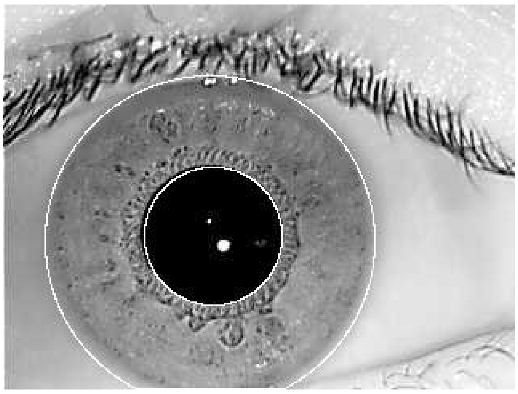


Figure 7: Result of model 1

Figure 8: Result of model 2

5 Comparison

In the first model there are noises in the image . But in the next model we just extracted iris, so better visualization is found and also it becomes easier in case of matching .

6 Discussion

In this project we segmented iris from the input image.We implemented two models.In the first model we used canny edge detection and Hough Transform to segment the iris.In the second model, we used inpolygoan function to remove the background.There are some complexities in this process.In future, we will try to reduce the complexities and try to improve the accuracy of the process.

7 Reference

[1] "Recognition of Human Iris Patterns for Biometric Identification, Libor Masek".2003