A REVIEW: CIRCLE DETECTION USING MODIFIED CANNY EDGE DETECTION ALGORITHM

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Abstract:

In our routine life or day-to-day experiences, many objects that perceive are in circular form like coins, rings etc. The detection of their presence in an image reliably and efficiently is an important task in image processing. The Hough transform techniques for detection of shapes require a huge memory space for data processing, hence needs a lot of time in computing the location of the data space, writing to and searching through the memory space. In this paper, it is propose a efficient scheme for circle detection in grayscale digital images. First, it detect edges of the digital image using Canny Edge Detection Technique. Second, for contour tracing applies Freeman Chain Code. This algorithm can be applied to static images as well as vedio.

Keywords: Edge detection; Canny Edge Detection Algorithm; Chain Code; Circle Detection.

1. Introduction

A human being can find out a particular object like circle or rectangle from various objects by observing their shape, color, texture and feature and after that we can calculate properties of shapes like perimeter, area etc. To generate this intelligence into a system, we need to implement techniques to help the system in recognizing the shapes of object. For this, use modified canny edge detection algorithm. Edge detection is the first and very important step in shapes detection. In this paper we use canny edge detection technique for edge detection because canny edge detection technique is optimal algorithm for edge detection as compared to Sobel, Prewitt and Robert cross operators. The Canny edge detector is a very popular and effective edge feature detector that is used as a pre-processing step in many computer vision algorithms. It is a multi-step detector which performs smoothing and filtering, non-maxima suppression, followed by a connected-component analysis stage to detect "true" edges, while suppressing "false" non edge filter responses. After finding edges in image we apply Freeman chain code for contour detection. The flow-chat is shown in figure 2 to detect circle from images using Canny edge detection technique [3].

A. Canny Edge Detection Technique:

The Canny edge detector is a very popular and effective edge feature detector that is used as a pre-processing step in many computer vision algorithms. It is a multi-step detector which performs smoothing and filtering, non-maxima suppression, followed by a connected-component analysis stage to detect "true" edges, while suppressing "false" non edge filter responses. Steps of canny edge detection algorithm are shown in the form of flow-chat in figure no 1.

Canny defined a set of criteria that maximize the probability of detecting true edges while minimizing the probability of false edges [7].
There are many ways to perform edge detection. However, the majority of different methods may be grouped into two categories:

- **Gradient:** The gradient method detects the edges by looking for the maximum and minimum in the first derivative of the image.
- **Laplacian:** The Laplacian method searches for zero crossings in the second derivative of the image to find edges.

To smooth the image, the Canny edge detector uses Gaussian convolution as shown in figure no 1.

Next, the image is convolved with a 2D first derivative operator to determine gradient magnitude and direction at each pixel. Note that the maxima and minima of the first derivative gradient are the same as the zero-crossings of the second directional derivative. Only the maxima crossings are of interest because these pixels represent the areas of the sharpest intensity changes in the image. These zero-crossings are the pixels that represent the set of possible edges. All other pixels are subsequently suppressed. Finally, a two-threshold technique or hysteresis is

performed along the remaining pixels to determine the final set of edges.

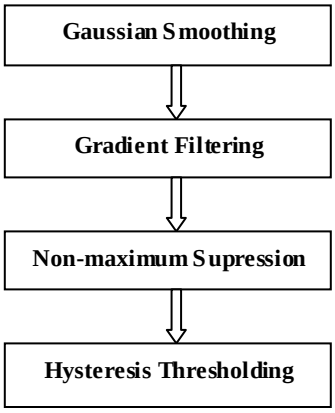


Figure 1: Flow diagram of Canny Edge Detector

If a single threshold, T1 is applied to an image, and an edge has an average strength equal to T1, then due to noise, there will be instances where the edge dips below the threshold. Equally it will also extend above the threshold making an edge look like a dashed line. To avoid this, hysteresis uses 2 thresholds, a high and a low. . Any pixel in the image that has a value greater than T1 is presumed to be an edge pixel, and is marked as such immediately. Then, any pixels that are connected to this edge pixel and that have a value greater than T2 are also selected as edge pixels. If you think of following an edge, you need a gradient of T2 to start but you don't stop till you hit a gradient below T1.

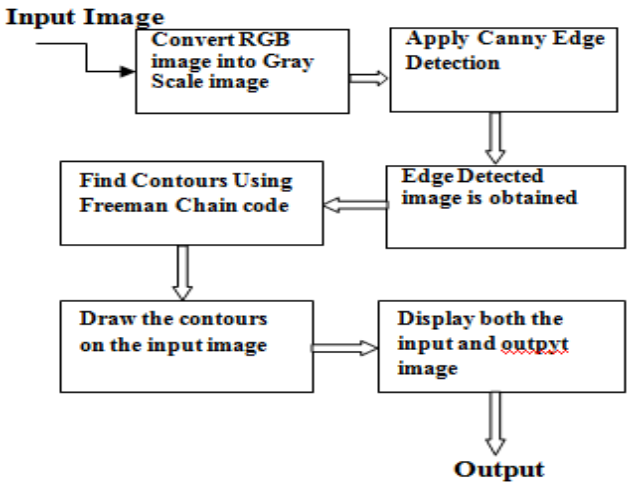


Figure2: Method for shapes detection in Gray Scale images.

B. *Freeman Chain Code for contour tracing:*

Chain code is a list of codes ranging from 0 to 7 in clockwise direction. These codes represent the direction of the next pixel connected in 3x3 window, as shown in table 1. The coordinates of the next pixel is calculated based on the addition and subtraction of columns and row by 1, depending on the value of chain code. Corresponding to the code in table 1, the next pixel position can be obtained by using table 2. For example, if a current pixel is located at coordinate (5,5), the coordinate of the next pixel based on chain code is given by table 2. The disadvantage is that we have to scan all the eight neighboring pixel while contour tracing.

There are two principles to track the edges which form the boundary of an object: one based on edge strength, and the other based on pixel direction [5].

Table 1. Chain code

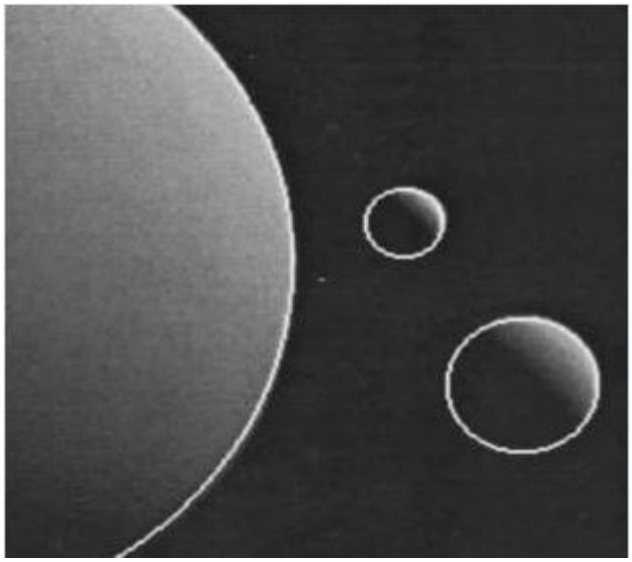
	Column-1	Column	Column+1
Row-1	5	6	7
Row	4	Current pixel	8
Row+1	3	2	1

Table 2. Pixel position

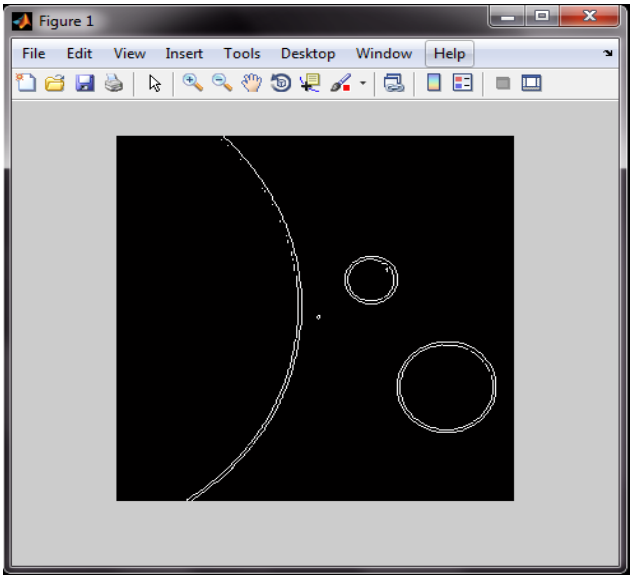
Current Pixel at coordinate (5,5)		
Code	Next Row	Next Column
0	5	5
1	6	6
2	6	5
3	6	4
4	5	4
5	4	4
6	4	5
7	4	6

At each pixel we determine the position of next pixel and so on the outline of the whole object can be obtained. Hence, given a binary image, the boundary of the shape can be determined efficiently.

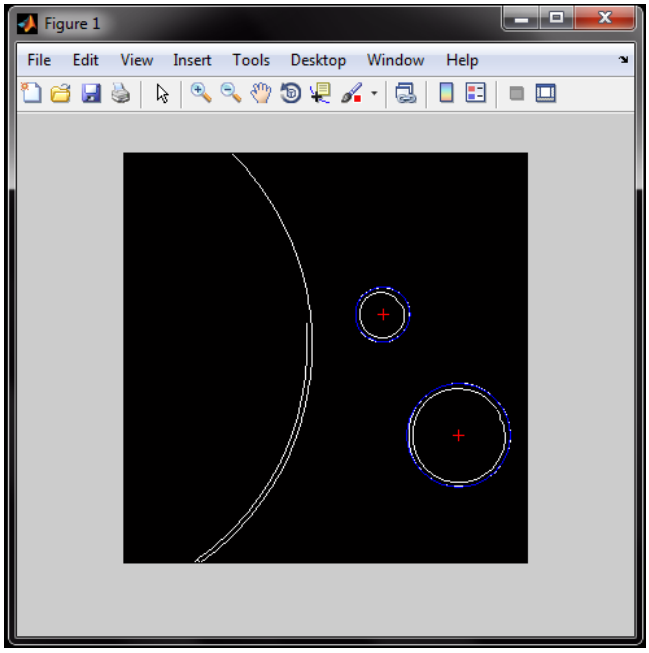
II. Results: Input Image:



Output Image: (1) After Edge Detection



(2) After Circle Detection



III. Conclusion and Future Scope:

We implement this algorithm to detect shapes in digital images. Chain code is the best method for boundary detection so we can use this method to detect numerical numbers and to recognize characters. Sometime its very difficult to recognize similar numbers like 5 and 6 , O and 0 etc. To recognize these characters correctly we can use Freeman chain code algorithm.

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