Visual Recognition Assignment 1

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February 13, 2022

Lines and Circles Detection using Hough Transform

1 Line Detection using Hough Transform

1.1 Introduction

Any line can be represented in many ways. The common way of representing a line is by the equation $y = mx + c$. We can also represent a line using the normal form which is $\rho = x\cos\theta + y\sin\theta$ where θ is the angle made by the perpendicular at the origin and ρ is the perpendicular distance from the origin as show in the below figure. We use this representation of the line in the algorithm.
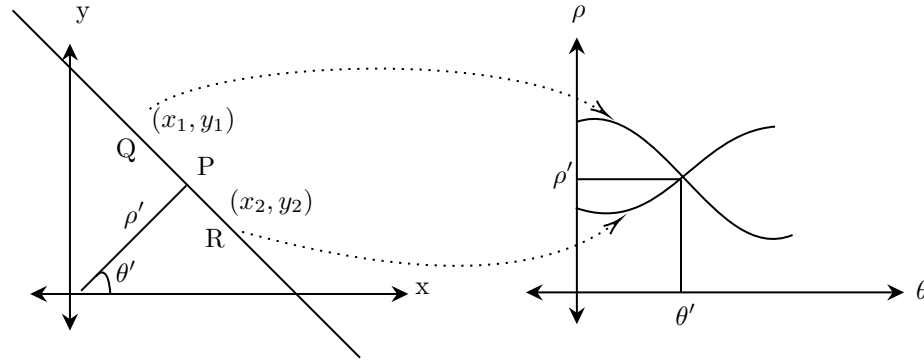
1.2 Algorithm

We create an edge image of the given image.
Then for every non zero point on the image we generate the ρ and θ values using the equation $\rho = x\cos\theta + y\sin\theta$. In the above image we generated parameters for point Q and R. We store these values in accumulator and perform voting.
Finally, we select the parameters with highest number of votes and use them to plot the line in image space.

1.3   Implementation

- Firstly, I have taken an image of a road for which the white lines should be detected.

- Rescaled the image to a smaller size. Converted the image into grayscale.

- Blurred the image.

- Used Canny Edge detection to get edge image.

- Finally applied Hough transform which was implemented based on above algorithm to detect the lines.

1.4   Results

The lines are detected properly after adjusting the threshold value. The results can be seen in the below image.
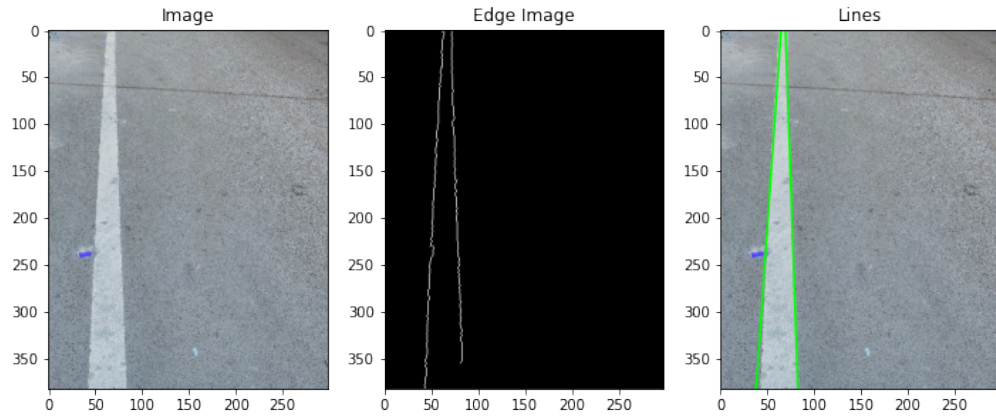
2   Circle Detection using Hough Transform

2.1   Introduction

Circles are represented by the equation $(x - a)^2 + (y - b)^2 = r^2$, where (a,b) is the center of circle and r is the radius of circle. The parametric equations of circle are $x = a \pm r cos\theta$ and $y = a \pm r sin\theta$. We use these equations in the hough transformation algorithm.
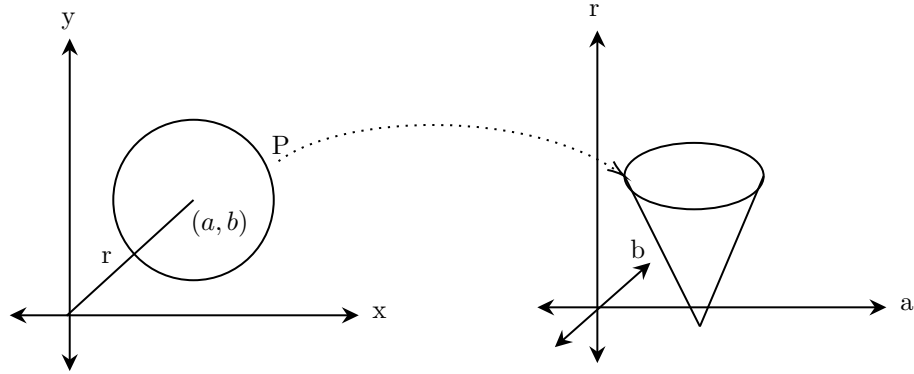
2.2   Algorithm

We create an edge image of the given image.

Then for every non zero point on the image and a particular r value we generate the a,b using the equation $x = a \pm r cos\theta$ and $y = a \pm r sin\theta$. In the above image we generated parameters for point P. We store these values in accumulator and perform voting.

Finally, we select the parameters with highest number of votes and use them to plot the circle in the image space.

2.3   Implementation

- Firstly, I have taken an image of a road for which the white lines should be detected.

- Rescaled the image to a smaller size. Converted the image into grayscale.

- Blurred the image.

- Used Canny Edge detection to get edge image.

- Finally applied Hough transform which was implemented based on above algorithm to detect the circles.

2.4   Results

The circles are detected properly after adjusting the threshold value. There were many concentric circles coming up. So I have selected only one of them by removing the others. The results can be seen in the below image.

Image | Edge Image | Circles