2 Part II: Road Lane Detection Using Hough Transform

The objective of this part of the assignment is the detection of road lanes in an image using Hough Transform.

Figure 8: Final output after lane detection

(a) Original image

(b) Image after lane detection

2.1 Hough Transform

The Hough transform can be used to determine the parameters of a line when a number of points that fall on it are known. The normal form of a line can be described with the following equation: $x\cos\theta + y\sin\theta = \rho$ where ρ is the length of a line that starts from the origin and perpendicular to the required line, and θ is its inclination. The true parameters ρ and θ will get maximum votes from the line points, and can be found with a Hough accumulation array.

2.2 Implementation Details

2.2.1 Smoothing the image

Smoothing the image is accomplished using a 2-dimensional median smoothing filter.

2.2.2 Edge Detection

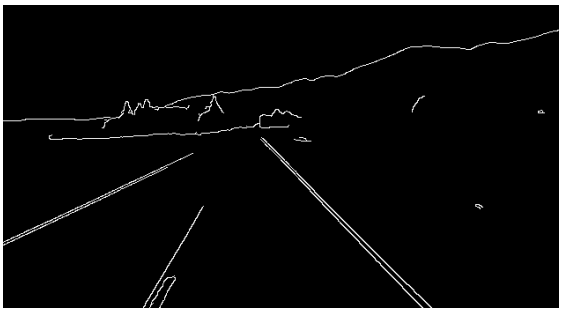
After smoothing the image, Canny's algorithm has to be used for edge detection. We will use relatively high values for thresholding to remove most of the noise.

2.3 Region Of Interest

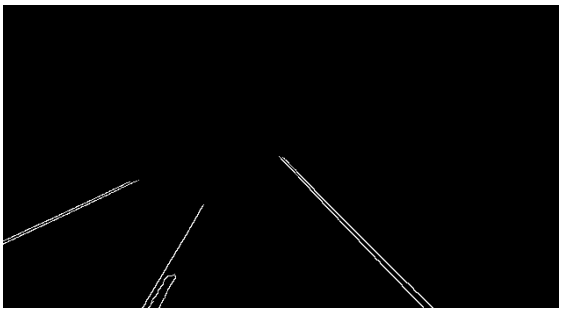
The output of the edge detection will contain unnecessary edges that belongs to objects outside the road. Therefore, to eliminate this noise, define a polygon (region) of the image to mask the

noise edges producing only an edge image, as shown in the figure, that contains the region of interest that focus on the road.

Figure 9: Region Of Interest Extraction



(a) Edge Detection Output



(b) ROI Output

2.3.1 Accumulation into (ρ, θ)-space using Hough transform

```
For each edge point (x,y) in the image
    For θ = 0 to 180
       ρ = x cos θ + y sin θ
       H(θ, ρ) = H(θ, ρ) + 1
    end
end
```

2.3.2 Refining Coordinates and HT Post-Processing

During the whole process of finding the parameters, some inaccuracies could occur. This could be due to choosing a large bin size for HT or due to noise in the detected edges. Therefore, after finding the parameters, a search in the (ρ, θ)-space is executed. We look for the highest peaks of the accumulator function and perform non-maximum suppression for lower values.

3 Notes

You are required to deliver the following:

- Your code.
- Output for some test images.

- Report including explanation of your code and representative results on sample test images.

You should work in groups of 3.