Road lane detection

Mohd Zahid Faiz
MT2019514

Road lane detection using Canny edge

This report consists of two sections. First section deals with the approaches used and the second section gives a brief review of results. The data set used in this is CALTECH roads video.

Abstract

The approach used to detect the road lane is Canny edge detection, with proper masking the image to get the desired location of lanes. The edges detected are then plotted using Hough lines.

Section 1: Approaches used

Detection of roads in real time is one the important applications on self-driving cars. To detect the lanes and keeping the vehicle in those lanes are one of the important tasks. But the problems like type of camera used to record the video, camera orientation, road variations (turn, breaker, bumps, light, shadow) still is one the major concerns.

I used four approaches and tested which one was easier to compute and giving better results.

First approach was to simply detect the edges in the whole image. But the image was giving too many edges since it was noisy. Apart from that the surroundings were also being detected in the edges which was not a good way to start.

Second approach I did was to try to segment the image into roads and surroundings. Here segmentation is done using two methods and then compared:

A) Using HSV color model and masking out only the road part.

B) Using K means to segment out the image into road and surroundings.

This second approach used was also not good because the segmentation done using HSV color model was only working for some images with similar illumination. If the shadow comes then the HSV mask must be changed. The k means segmentation was also having same problem. It had another problem that the number of layers to be segmented must be changed with the change in illumination.

But this second approach gave insights about how the images with different illumination can be tackled.

Form the above two approaches the problems were clear:

1) Use Edge detection only on the desired areas.

2) Segments are used only to de-noise the road area, not good for edge detection.

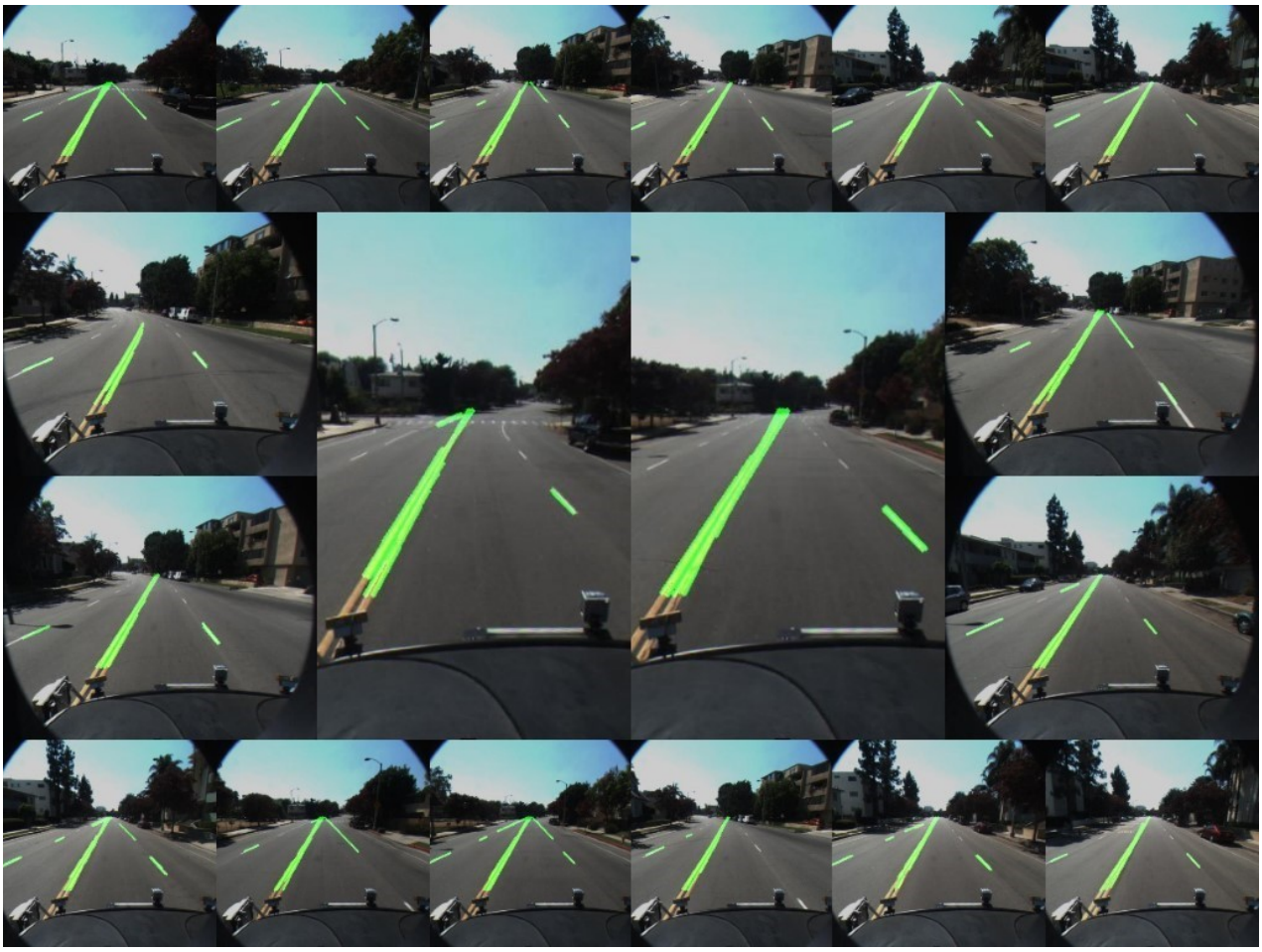
In the third approach I took the reference from one the paper "Real time Detection of Lane Markers in Urban Streets

Mohamed Aly" [1]. In this the image was first changed to the inverse perspective and then the road lanes start to appear vertically. Applying Prewitt filter only the X axis would detect the road lanes. But it was tough to implement since when the image was changed to inverse perspective there was too much noise. So, Prewitt edge detection was not able to capture the road lanes properly. In that paper they have applied some curve fittings to detect the lanes, but it was not working the way they have shown in the paper. The reason for this could be due to noise introduced in the image due to inverse perspective. So, I had to drop this approach.

In the fourth approach the image is first cropped to get only the road area (interest region). Then this interest region is de-noised by taking insights from the segments using KNN. Since the dataset I took didn't had much noise running Canny edge detection on the Interest region was more than enough to get the lanes in edge detection. Still this edge detected image had some unnecessary detected edges in the border. This was again masked by again selecting only the interest region. After this Hough transform was done on the desired image to plot the road lanes in the image.

Section 2: Results

Plotting the result in the images and comparing is shown below:



The above images show the lanes detected in the road lanes. It worked very efficiently but it had some drawbacks. Like the Zebra crossing was also being detected. If these is a manhole or pothole coming in between it was also detected. Turns were also detected but they were only a little bit noisy. If a shadow was coming, then there were some irrelevant lanes detected due to change in segment. But despite these drawbacks this worked better than the other three approaches.

References:

[1] Real time Detection of Lane Markers in Urban Streets

Mohamed Aly