Project writeup – Finding lane lines on the road

1. Objective

The objective of this document is to explain the following

- Explanation about the pipeline
- Potential short coming
- Possible improvements

2. Pipeline Explanation

Following is the sequence of steps in the pipeline

2.1. Read Image

Read the original image and store the information in an image variable

2.2. Greyscale conversion

Convert the color image in to a greyscale image. This is required to efficiently detect the edges in the image. Following is the greyscale converted image

2.3. Canny edge detection

Canny edge detection algorithm is used to detect the edges on the grey scale image. A low threshold of 50 & high threshold of 150 is used. Following is the canny edge detected image

2.4. Region of interest

To detect the lanes, at first the lines in the lanes should be detected. Since there are many lines in the edge detected image, we have to select a region of interest before detecting the lines. Following coordinates are used to select the region of interest

(0,imshape[0]), (450,320), (550, 320), (imshape[1],imshape[0])

2.5. Line detection using hough tranformation

The lines in the selected region of interest is detected using hough transformation algorithm. The following criteria's were used in order to detect the lines efficiently.

- Minimum no of pixels to consider as a line: 40
- Maximum gap between 2 pixels to consider them as part of a line: 20

By setting the above said values, the lines are detected efficiently.

Following image shows the lines detected after applying hough transformation
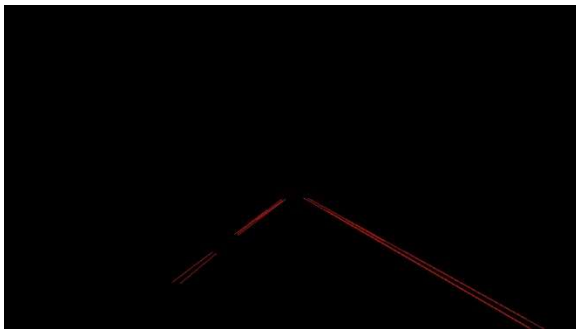
2.6. Drawing lane lines on the original image
- Calculate the slope of the lines
- If the slope is above a threshold, then it is considered as a line in the left lane
- If the slope is below a threshold, then it is considered as a line in the right lane
- The lines from the left and right side are extrapolated in to one long line. Finally, the extrapolated right & left lines are drawn on the original image
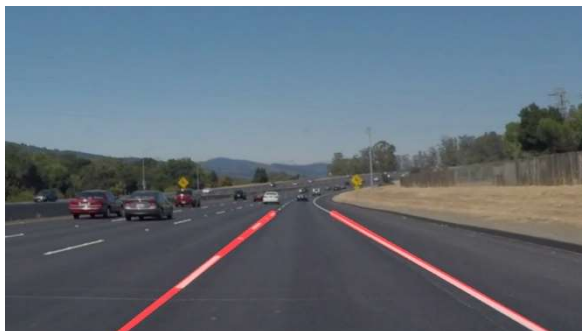
3. Potential shortcoming

The algorithm works with fixed parameters and a preselected coordinate for region of interest, therefore it may not efficiently detect the lines under the following scenarios

- Sharp curves while driving
- When there are many vehilces on the adjacent lanes
- Night time driving
- When the shadow of the objects (Eg : Trees, mountains) surrounding the vehicle falls on the lane
- Changing road colour

4. Possible improvements
- Edge detection threshold can be optimized such that low contrast edges are also detected. This is required as sometimes the road color is very light (Eg: Cement roads)

- After the hough transformation, an optimization algorithm is required to eliminate all the lines other than lane lines. May be the thickness of lanes can be used as a parameter to achieve this
- Hough transforms can be used to detect the curves. This will be helpful when there are sharp curves in the videos
- Information from the previous frames can be used to estimate the lane lines when they are not visible in the current image

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