Finding Lane Lines on the Road

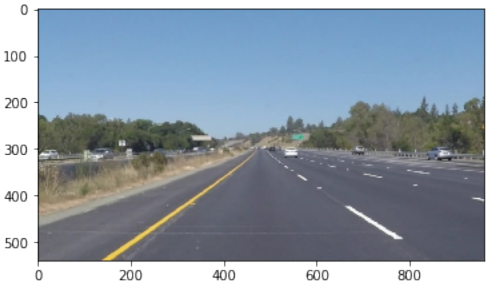
***Summary*:**

This report contains the following information:

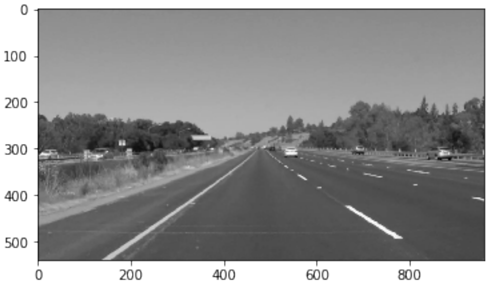
- Steps to identify lane lines on a road from an image or a video
- Potential shortcomings of the current method
- Suggestions for improvement

***Methodology*:**

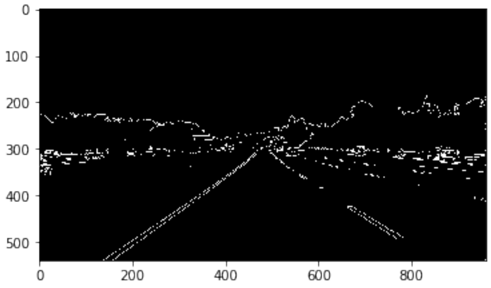
Given an image, my pipeline consists of 6 steps:



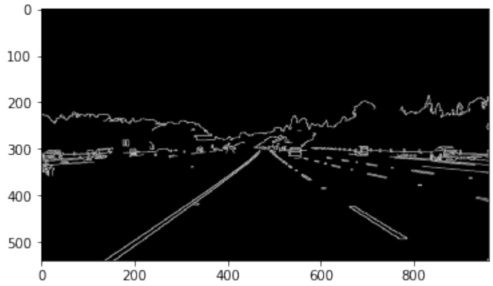
Step 1 - Convert the given image into grayscale



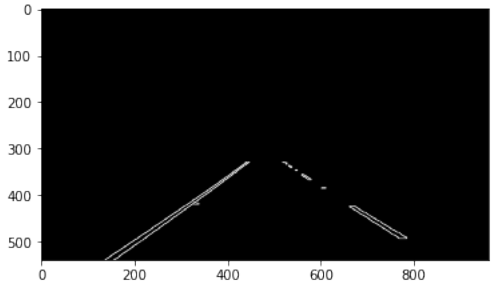
Step 2 - Use the canny edge detection to calculate all the gradients in an image that are above a given threshold



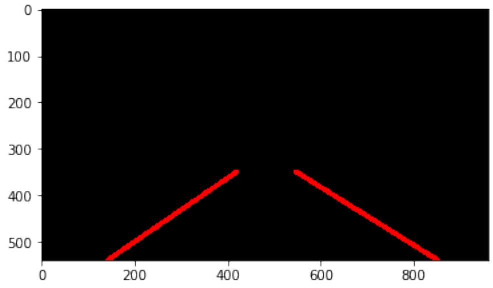
Step 3 - Use Gaussian blur to smoothen the edges in the image from step 2



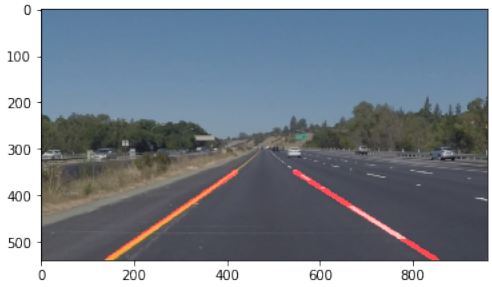
Step 4 - Select only the region of interest from the figure in step 3(i.e. where the lane lines are usually present in an image, which is a polygon)



Step 5 - Use the Hough lines function to identify the line segments from the image and plot 2 continuous lines in our region of interest, one for left lane and the other for right lane. As you can see from the image in step 4 the right lane consists of several broken line segments. In order to draw a single line for the right lane, I defined additional function called average_slope_intercept() which calculates the average slope and intercept all the line segments that correspond to the left lane and all the line segments that correspond to the left lane(All the lines with slope<0 correspond to the left lane and >0 to the right). Once you have the slope and intercept of both the lines you need to select 2 points in order to draw the line. I selected those 2 points based on the "y" co-ordinates from our region of interest.



Step 6 - Superimpose the image from step 5 on the original image to get the final output



Potential shortcomings of the current method:

- This method will not work for curved roads where it is difficult to select a region of interest
- If a car goes out of lane due to any error, then this method will not work
- If the slopes of left and right lane are really close, then using the average_slope_intercept() function as is might cause errors

Suggestions for improvement

- Instead of considering all line segments with slope<0 as part of left lane and with slope>0 as part of right lane, we can implement ML algorithms to cluster the line segments into groups and then calculate the average
- We need to be able to select our region of interest actively instead of a fixed region of interest as we did in this project