1. Describe your pipeline. As part of the description, explain how you modified the draw_lines() function.

Pipeline

My pipeline consisted of 6 steps. First, I converted the images to grayscale, then I ....

i) Convert to grayscale image

ii) Apply Gaussian blur

iii) Find canny edges. Edges with changes greater than 100 are accepted. Gradient less than 50 are rejected

iv) Crop the canny image obtained by a quadrilateral in front of the car. The sides are cropped out

v) Using the cropped image find hough lines. Number of sine curves to intersect is set to 20. Minimum line length is 30 pixels and max gap between line segments is 80 px

vi) Overlay the lines obtained from hough transform onto the original image

draw_lines()

In order to draw a single line on the left and right lanes, I modified the draw_lines() function

i) Iterate through line segment

ii) Classify each line segment as either positive or negative slopes. Push points corresponding to positive slope in one array and points corresponding to negative slope in another array

iii) Iterate through points corresponding to positive slope. Connect points as we iterate. Do the same thing for points corresponding to negative slope as well

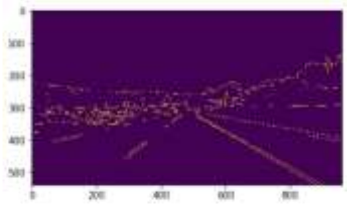
If you'd like to include images to show how the pipeline works, here is how to include an image:

Below is an example describing the pipeline for one of the images

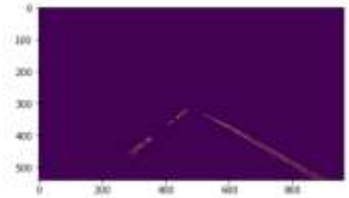
i) Original Image

ii) Grayscale Image

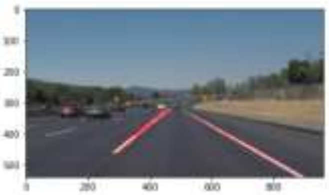
iii) Canny Image



iv) Cropped Image



v) Overlaid Image



2. Identify potential shortcomings with your current pipeline

i) It is assumed that the car is already in a lane and the image is cropped accordingly. Also for drawing lines positive slopes are considered to be left lanes and negative slopes are considered to be right lanes. This is true only when a car is in a lane.
ii) Also draw lines just draws straight lines. In case of curved lanes this might not be a desirable solution

3. Suggest possible improvements to your pipeline

i) For the problem of drawing lines, we can fit curved lines and then draw as opposed to just drawing straight lines
ii) The order in pipeline can also be changed. Crop first and then do grayscale and canny edge detection. If we crop first we will have lesser points in the image matrix for finding gradient (used by canny edge detection)
iii) The region of interest is obtained only using position. We can also use color information since we already know what color the road is.