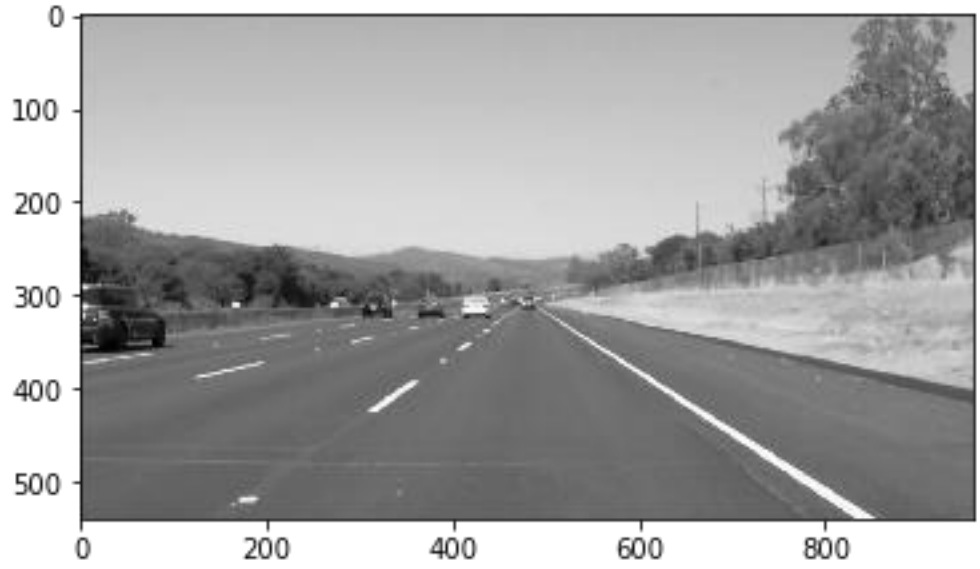
Reflection

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

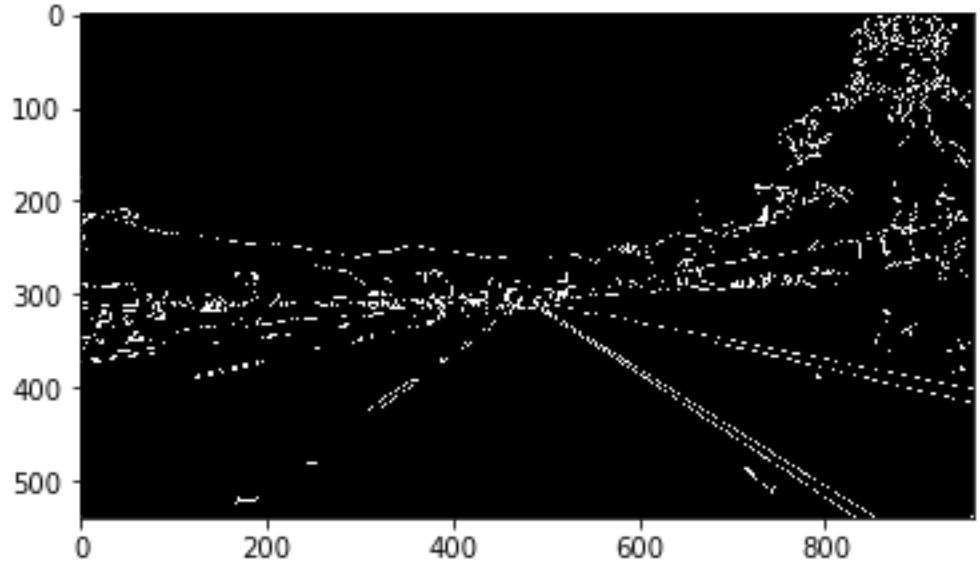
Step 1:

First of all, I need to convert the original image to grayscale which is shown below.



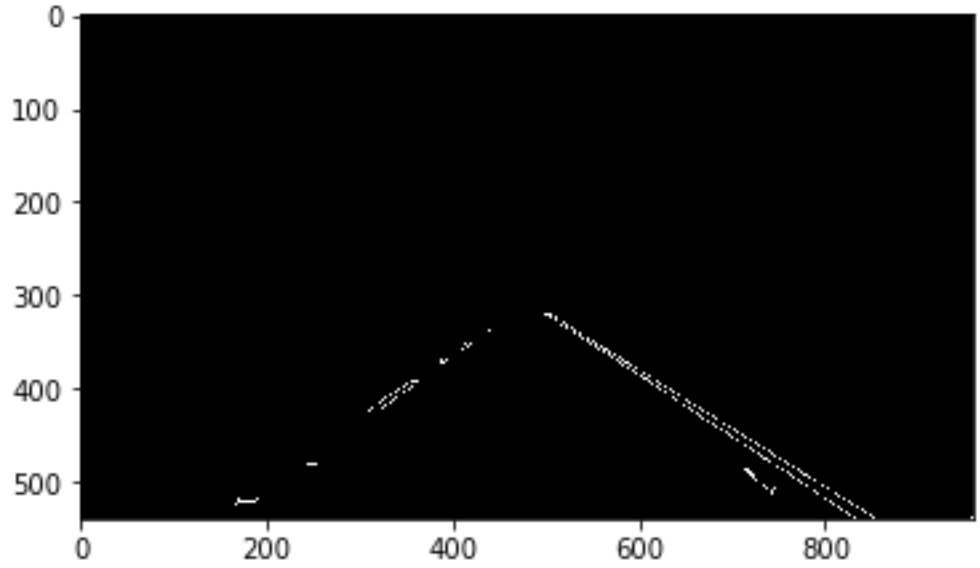
Step 2:

Then I need to apply Canny Edge detection techniques, so I applied canny algorithm to the grayscale image.



Step 3:

I then defined the region of interest. I applied the region of interest which is polygon to the image and obtained the masked image as below.



Step 4:

Then I modified the draw_lines function. For each line obtained from Hough Transform function, there are four values which are x1, y1, x2, y2. I calculated the slope of each line segment and grouped them by the slope. If the slope is greater or equal to 0 and fall between 0.40 and 0.70, then this line segment will be marked as right lanes. If the slope is less than 0 and fall between -0.80 and -0.6, then the line segment will be marked as left lanes. The slope of each line segment and the x1 and y1 coordinates were saved in three separate arrays to calculate the average slope and the average y intercept. Then I calculated the average slope of both left lanes and right lanes. Then I found the average values for x1 and y1 coordinates. Next, I obtained the average y intercept of both left lanes and right lanes by substituting the average values of x1 and y1 coordinates into the function b = y1 average-average slope * x1 average. Since the y coordinates of the two lane lines are fixed values, I substituted the average slope values and average y intercept values into the function x = (y-y intercept)/slope. Finally, the x coordinates can be obtained from this function. The last step was to use cv2.line function to draw lines using the obtained x and y coordinates. As a result, the left and right lane can be drawn and extended on the image.

Step 5:

After the draw_lines function has been modified, I applied the draw_lines function to the hough_lines function. Then I applied the weighted_img function to the output image of the hough_lines function. Finally, the image with lines drawn on it can be obtained.

2. Identify potential shortcomings with your current pipeline

Since the two videos are taken while driving straight, one potential shortcoming would be whether this pipeline will work if the car is driving around a sharp curve.

Another shortcoming could be the region of interest is hard coded which makes the pipeline not able to work under every condition. The pipeline probably won't work at night or on a snowy day.

3. Suggest possible improvements to your pipeline

A possible improvement would be to update the average slope and the average y intercept constantly by adding new line segments to the buffer so that the draw lines function can become smarter.

Another potential improvement could be to automatically detect the region of interest without hardcoding it.