

Reflection

1. Pipeline description

My pipeline consisted of 5 steps.

1. I converted the images to grayscale.
2. I used Gaussian smoothing to blur the image and canny function to find the edges in the gray-scaled image.
3. I created an image mask that only keeps the region of the image defined by a polygon. This polygon is the region of interest and reflects the region in front of the vehicle. The rest of the image is set to black.
4. I defined Hough parameters and used Hough transform to find the lines in the region of interest. And highlight the lane lines in red.

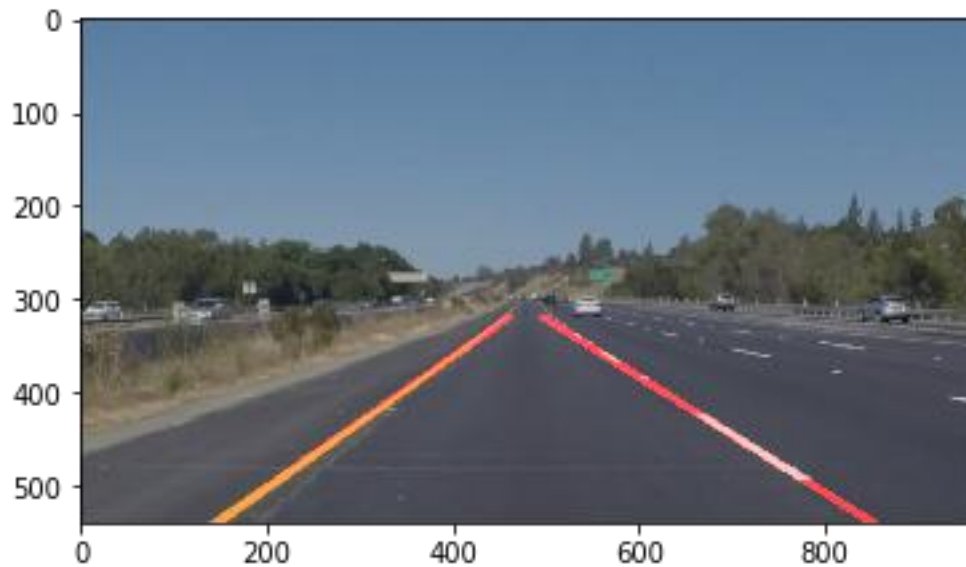
In order to find the left and right lane lines, I need to extrapolate the points in the lane lines to their top and bottom because sometimes only part of the lane lines are captured. To do so, I first distinguished the right and left lane lines by calculate the slope $(y_2 - y_1) / (x_2 - x_1)$. A positive slope refers to right lane and a negative slope refers to left lane. There might be some horizontal lines on the highway (this was found in solidYellowLeft.mp4). To avoid this, I skipped the slopes in the region of -0.15 to 0.15.

Then I averaged the position of each lines and extrapolate to the top and bottom of the lane. The top y-label was set to be 340 and the bottom y-label is the same as the image's lower boundary.

This was achieved by modifying the "draw_lines" helper function.

5. Draw the lane lines on the edge image.

The following image shows how the pipeline works.



2. Potential shortcomings with my current pipeline

One potential shortcoming would be what would happen when the lane is not straight or the curvature is big because this pipeline only draw straight lines.

Another shortcoming could be the sensitivity to the lane lines. Sometimes the dashed lines are not clear and the pipeline cannot capture those lanes in a video.

3. Possible improvements to my pipeline

A possible improvement would be to extrapolate the lane curves based on multiple points instead of a single line from one single point. Another possible solution is to lower the threshold in the Hough function to include more data on a curve. But this may introduce more error from the environment.

A possible solution to the second shortcoming is to use the historical data. If the road condition, especially the curvature, does not change too frequently, we can keep the same lane lines from the previous frame. And we can even reduce the sampling frequency of capture frames.