Finding Lane Lines on the Road

Reflection

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

I am using the follow steps for the pipeline.

- Find the canny edge from image
  - edges = find_lane_canny_edges(image)
- Get the polygon of the region of interest and apply this to canny edge image
  - vertices = get_vertices(edges)
  - region_select = region_of_interest(edges, vertices)
- Find the hough line and apply the draw lines function
  - lines = get_hough_lines(region_select)
- Apply lane image to the original image.
  - output_image = weighted_img(lines, image)

In order to draw a single line on the left and right, I modified the draw_lines function with the following steps.

1. With the output of hough lines, I separated the left lines and right lines with slope value and try to calculated weighted length slop for left and right line. During this step, I excluded vertical lines which the slope could be too big and also skip lines too flat(abs(slop)< 0.2). The left line should not extend to right side of the image and the right line should not extended the left side of the image.
2. With weighted_left_slope, I excluded the lines the slope are very different from the the weighted value and get all valid left lines and right lines
3. The I will try to liner fit all left lines and right lines and calculate one single line for left and one single line for right.
4. In order to have better vision effect for both lines, we try to take the max_height and minimal height from both lines and apply same range for both lanes
5. Draw the line with liner weight and heigh range

2. Identify potential shortcomings with your current pipeline

There are several shortcoming for the existing pipeline

1. Some short lines(e.g dot in lanes) are valid points for left, but the slop could be flat or in opposite direction. The existing pipeline will miss these points.
2. The exiting pipeline is very sensitive to the output of hough lines. Sometimes, hough lines could be very limited.
3. The region of image is fixed, it can not change dynamically.
4. When there are shades like the video in challenge, it does not work.

3. Suggest possible improvements to your pipeline

There are some possible improvements I could make if I have more time

1. Tune canny edge and hough_lines parameters and try to limits the shades impact on images
2. Better unitize the region information for left line points and right line points detection

Reference Images