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

My pipeline consists of 6 steps. First, I convert the image to a grayscale one, then I smoothen the grayscale image with the gaussian_blur helper function (with the size of the kernel being 3). In the third step, I detect the edges in the smoothened grayscale image using the canny helper function with the low and high thresholds being 50 and 150, respectively. In the next step, I marked out the interested region with a trapezoid in the lower portion of the image. In the fifth step, I detect Hough line segments from the masked Canny-edge image and draw them all in a separate picture using the hough_lines helper function. Lastly, I extrapolate the lane lines into only the left and right ones extending all the way to the bottom of the image, and overlay them on the original color image using the weighted_img helper function

In order to draw a single line on the left and right lanes, I modified the draw_lines function by finding the end points of the extrapolated left and right lines. To find these end points, the Hough line segments are binned according to the sign of their slopes. Then some spurious segments are filtered out and the bottom end points are extended all the way down to the bottom of the image.

2. Identify potential shortcomings with your current pipeline

Our extrapolation seems to produce extrapolated lane lines

that wiggle slightly (more than in the example in P1_example.mp4).

Another shortcoming about our extrapolation is that it does not perform as well with curved lanes (see the results in extra-extrapolated.mp4)

Another potential shortcoming of the current pipeline pertains to the situations when there are closer cars up front, for example, in city traffics when cars are travelling with lower speeds. Right now, we rely on the masked region to rule out Hough lines detected on the cars up front. In all the tested images and videos the cars up front are reasonably ahead so that they are out of the masked region; hence, the Hough lines in those cars are masked out. This might not be so when cars are travelling with lower speeds in heavier traffics.

3. Suggest possible improvements to your pipeline

To reduce the wiggling of the extrapolated lane lines, we could perform some averaging of positions of the lane segments as suggested in the comment to the draw_lines function.

To handle curved lanes, we could use some algorithms that perform curved extrapolations (may be some Bezier libraries would be helpful here) instead of the currently linear one.

Another possible improvement would be to further classify detected lines to figure out whether they are from the road or from the other cars so that we can rule out the latter

before doing the extrapolation.