

Finding Lane Lines on the Road

Udacity CarND Project 1

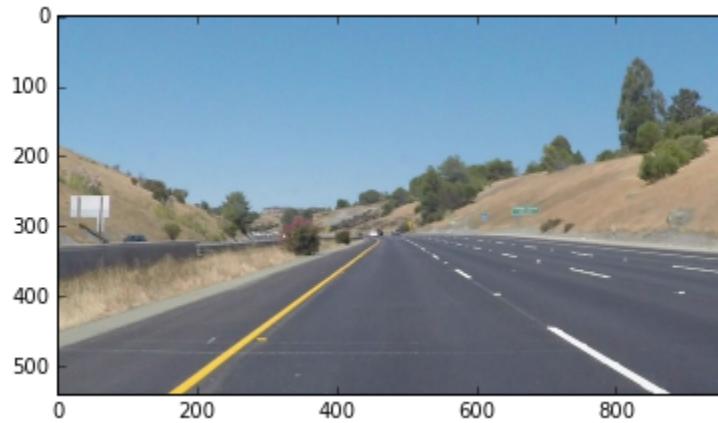
Brian Meier – 2/23/17

Pipeline Description

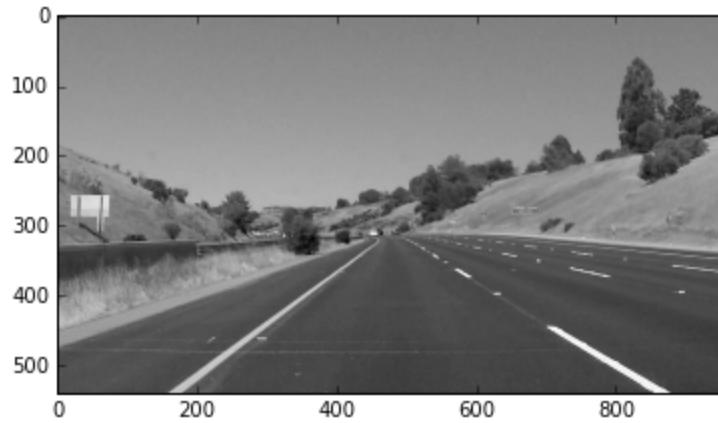
Finding Line Segments

Below the steps are documented for the solidYellowCurve2 image, as are the results for this and five other images.

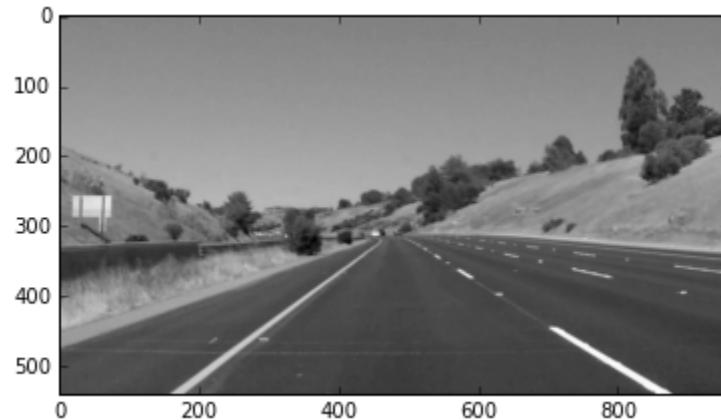
1. An image is loaded



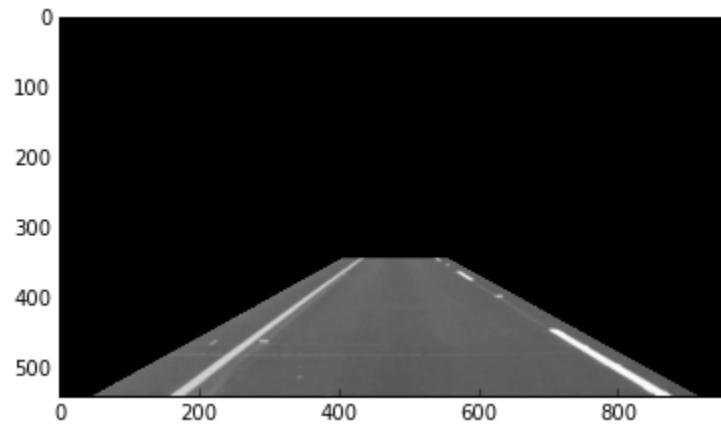
2. The image is converted to grayscale



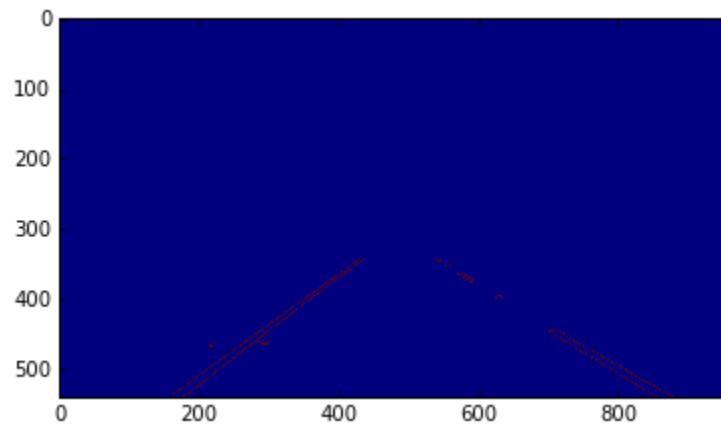
3. A Gaussian kernel of size 5x5 is used to blur the image



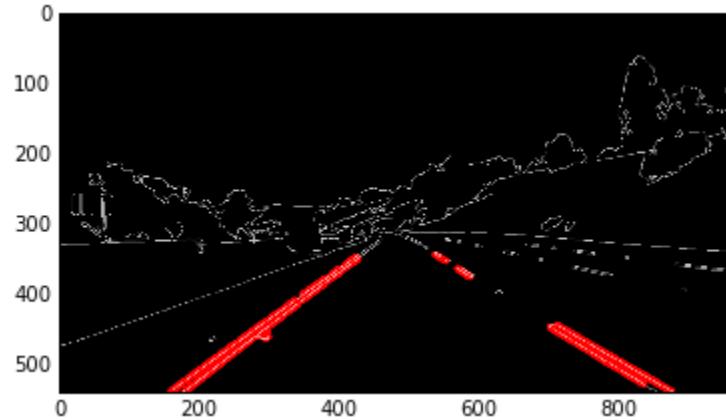
4. The image is masked to focus on the area of interest



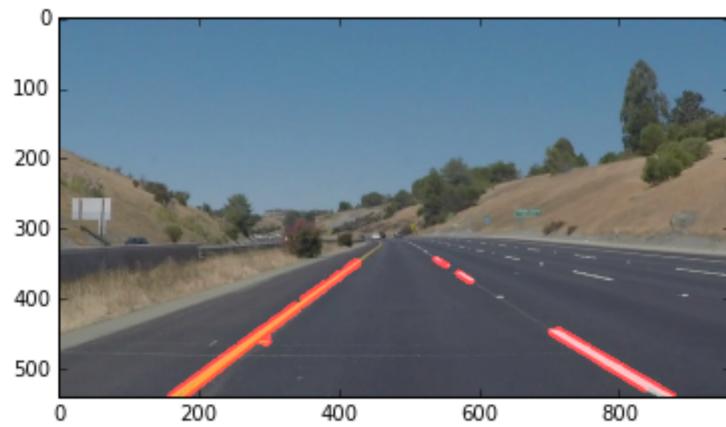
5. The Canny edge detection algorithm is used to identify edges



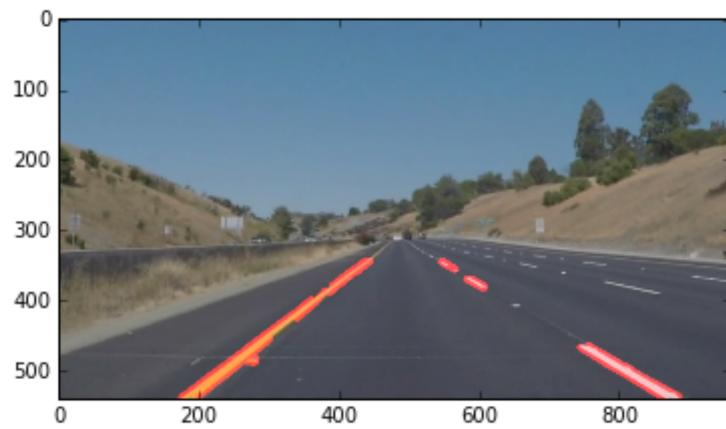
6. The Hough line transform is performed to obtain straight lines



7. Detected line segments are placed on top of the input image



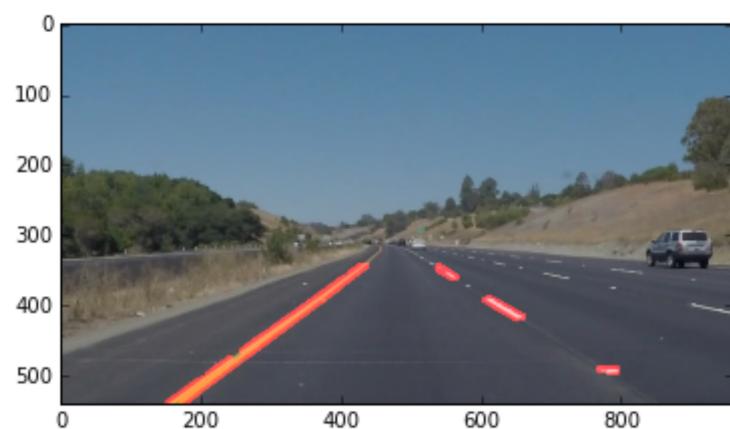
solidYellowCurve2



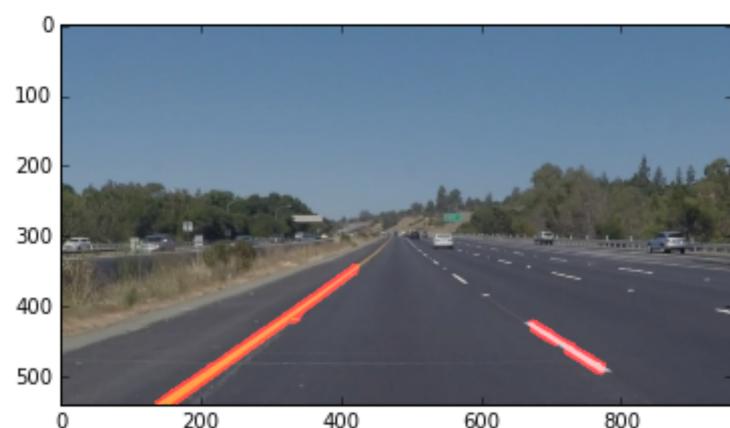
whiteCarLaneSwitch



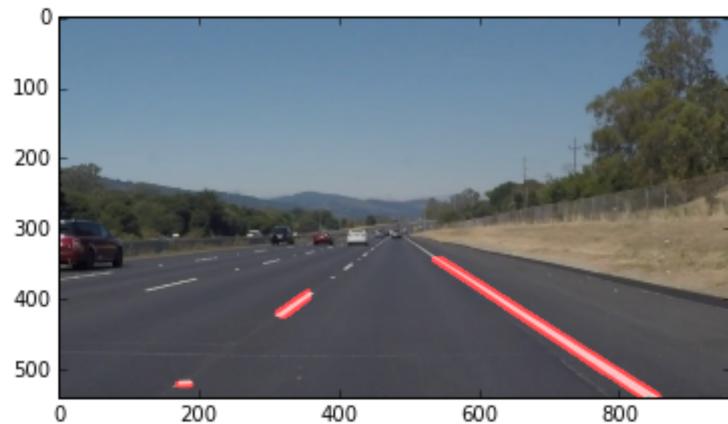
solidWhiteCurve



solidYellowCurve



solidYellowLeft



solidWhiteRight

Using Line Segments to Find Lane Lines

The final two steps used on the standard video are documented and selected screenshots of video images are shown.

8. The image is split into left and right sections
9. An orthogonal least squares fit is performed on each section to produce the line markers



solidYellowLeft



solidWhiteRight

The challenge video provided more difficulties. The field of view differed from previous examples and the light and shadows caused spurious edges and lines. To improve performance, the below modifications were made.

1. The field of view was modified.
2. The as-shown slope of lines in the left half of the screen needed to be between 0.5 and 2.0 to be considered marking lane lines.
3. The as-shown slope of lines in the right half of the screen needed to be between -0.5 and -2.0 to be considered marking lane lines.
4. The minimum line length threshold was increased from 15 pixels to 50 pixels.



challenge

Reflections

Pipeline Shortcomings

Pipeline shortcomings include:

1. Jitter as new lines come into view, or erroneous line detections are made.
2. Erroneous line detections are caused by shadows and other markings, especially tar.
3. Missing line detections. This is more common with the increased minimum line length needed for the challenge video.

Possible Improvements

Possible improvements include:

1. The use of a low-pass filter to improve stability and use past images to provide a signal.
2. The use of close parallel edges to suggest a lane marker.
3. The use of color to better find yellow lines.
4. Normalize contrasts to better adjust to different light conditions.
5. Cross validate parameters and test on new video streams.