# Finding Lane Lines on the Road

The goal of the project is to identify the lane lines on the road. The goals / steps of this project are the following:

- Make a pipeline that finds lane lines on the road
- Reflect on your work in a written report

Description of the pipeline

The pipeline takes in one image at time and consists of the following steps:

1. get image
2. convert image into gray-scale
3. smooth with a Gaussian kernel
4. find edges with Canny algorithm
5. define ROI with a four-sided figure
6. Hough-transform on found edges within the ROI
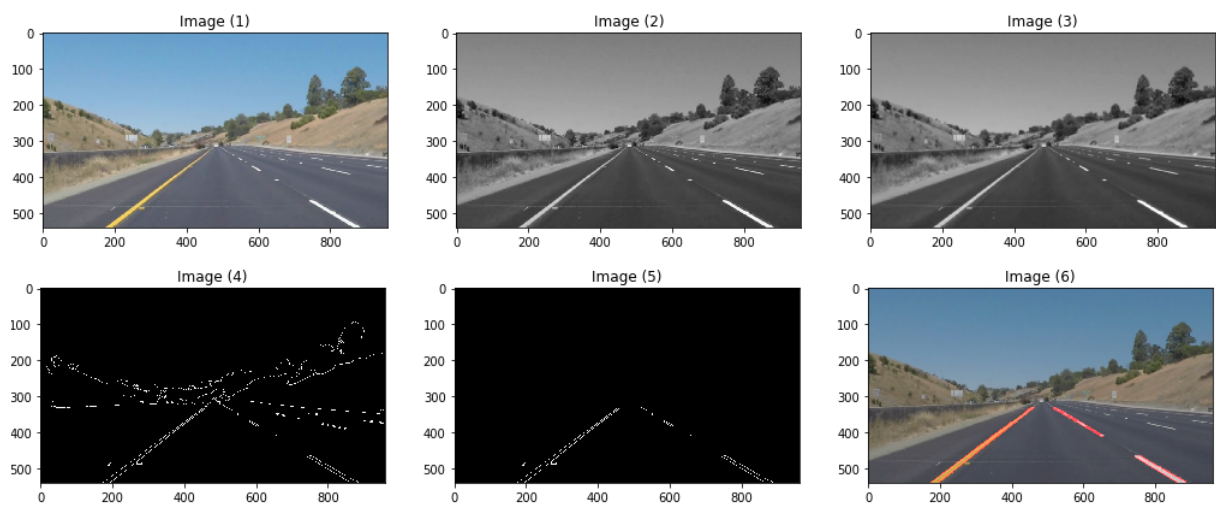
Example-outputs for each step mentioned in the pipeline.

In order to draw a single line on the left and right lanes, I modified the `draw_lines()` function by:

1. calculating the slopes of the lines found by the Hough-transformation

2. determine for each line whether it belongs to the right or left lane with the help of the algebraic sign of the slope and ignoring lines with slopes close to 0

3. calculate average line of lines belonging to one lane side

4. elongate these two average lines to cover the ROI

5. draw the lines
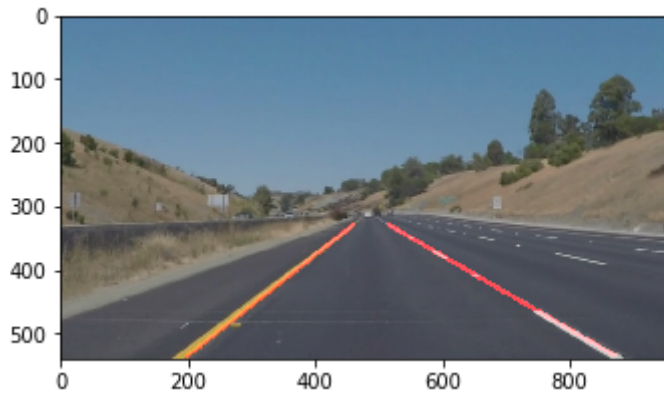
Final output after the `draw_lines()` function for one example image.

Potential shortcomings

- The ROI is fixed; finding the lane in sharp curves, down hill roads, or with different camera angles would be difficult/impossible.

- If lane markings are occluded (e.g. a lot of traffic) or simply not there, the lane will not be found.

- even short falsely detected edges will change the lane markings drastically;

- no correction for changing light conditions (day and night; sun and shadow).

Possible improvements

Besides from fine tuning the parameters for the image manipulation, the pipeline would benefit greatly from implementing likelihoods for sharp curves on a given road based on previous calculated lanes. Another improvement would be a flexible ROI frame to adjust for camera angles.