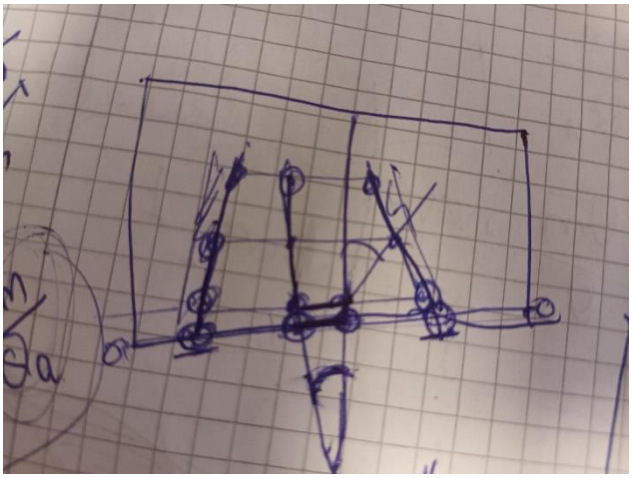
Lane detection algorithm:

Keep track of “at least” four points. These points will help to understand where the track is. If points from the left side is missing, we will understand that it is the right lane we are seeing. If points on the right side is missing, we understand that this is the left lane.

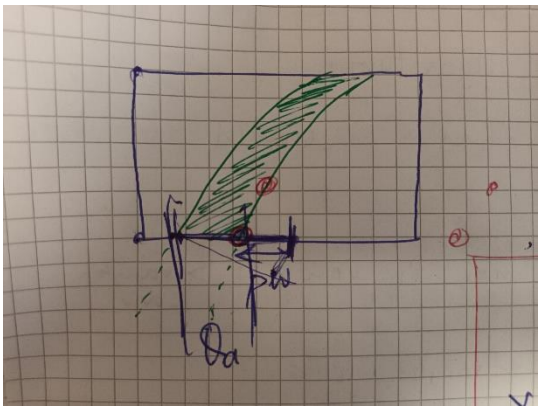
These points should be stored in variables. In the next frame these values can then be used to know approximately where the track should be, and limit the amount of time needed for searching for the edges of the lane.

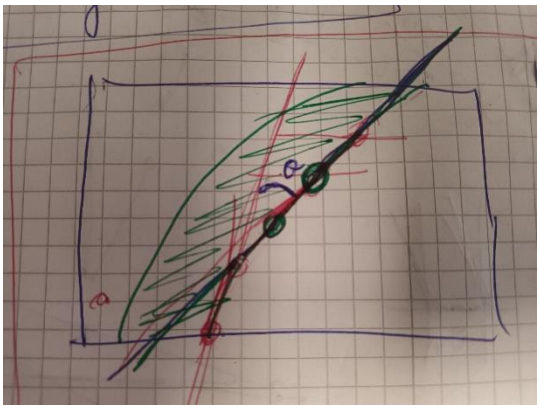
Straight lane:

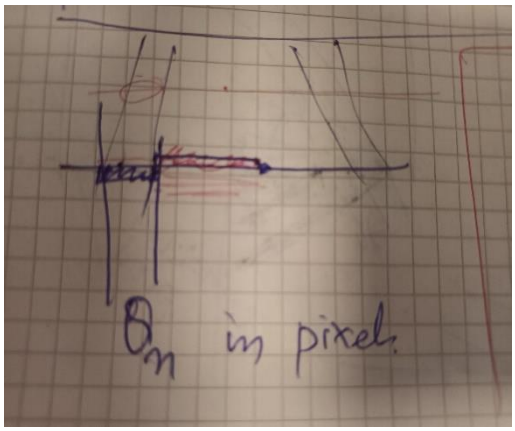


Here we will ideally always see two lanes. We can then scan from the middle to the left, and from the middle to the right. We do this for 3 horizontal rows in the image. We then calculate the heading error as the angle between the middle vertical of the image and the middle line of the track. The lateral error will be the distance between the middle line of the heading to the middle vertical of the image.

Curved section:







In a curved section we also need to calculate the width of the lane.

On a straight lane we will have a distance θ_{normal} that is the width of the lane, while on a curved section we will get a distance θ_{actual}. Both in pixels.

We can calculate the heading error by:

$$\cos(\psi) = \frac{\theta_{normal}}{\theta_{actual}}$$

Must make sure that $\frac{\theta_{normal}}{\theta_{actual}}$ never gets above 1. Will normalize the value between -1 and +1.

The expected lateral distance must be measured and calculated beforehand to measure against the actual lateral distance.

The actual lateral distance can then be calculated as:

$$\cos(\psi) * pw * converstion\ constant$$

Where:

pw is the pixel width between the middle of bottom row and the inner edge of lane.

Conversion constant is the constant converting from pixels to a distance in cm.

The curvature can be calculated as follows:

Try finding as many points as possible on the curved edge, draw a line based on the top two points, draw another line based on the bottom two points. Calculate the curvature by calculating $\tan(\theta)$ between the lines.

A tan ≈ 0 could also be used to detect that the lane is straight.

A tan close to 1 will indicate that we are close to a curve.