Introduction to Robotics WS18/19 – Version 1.01

10. Assignment: Control with Look-ahead Point and GPS

Please summarize your results (images and descriptions) in a pdf-document and name it, e.g., "RO-10-<surnames of the students - group name>.pdf".
There should not be any source code in the pdf document.
Source code will have to be submitted to your repository, provide the link to the repo in the Pdf.
Only one member of the group must submit the document.
Do not copy solutions to other groups.

By the end of this class you will need 60% of points.

1. Closest Point with Prediction (4 Points)

As in the second task from assignment 9 write a method, which finds the closest point, but now with respect to one of two possible ovals: If you think of to lanes between the inner and the outer white border, then the ovals shall lie in the center of each lane, i.e., at 25% and 75% between the inner and outer border.

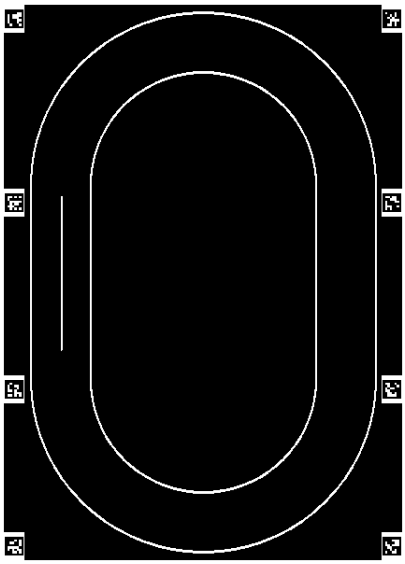
Furthermore we are no longer interested in the closest point but in a point at some distance (in drive direction (counterclockwise when seen from above) and on the oval, e.g., on the arc) on the oval to the closest point.

Your method shall take 2 parameters, like this: getClosestPoint(point, laneID, distance), where laneID would be 1 for the inner and 2 for the outer lane.

Submit the method in your repository, what would be the result for

Point (3,2) on lane 1 and distance 0.5 m;
Point (1,1) on lane 2 and distance 0.2 m?

Write the results in your Pdf.

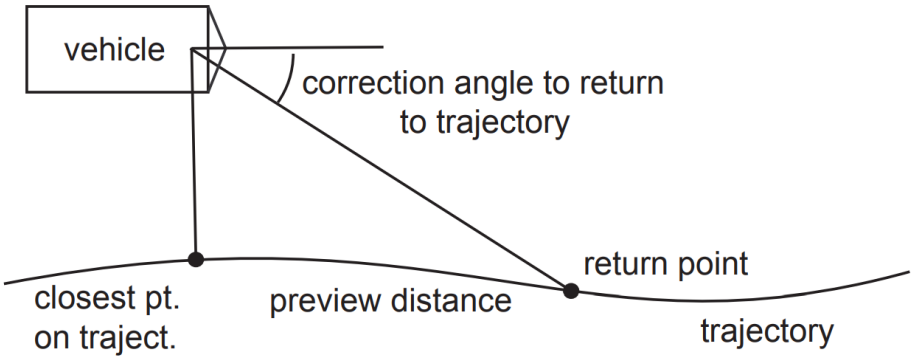


2. Follow lane with ceiling camera GPS (6 Points)

Now use your method from task 1 in combination with the ceiling camera to let the car drive on the inner lane (center of lane 1). The ceiling camera provides you with position and orientation data. Do not use any camera data for this task!

Therefore, implement a steering control method as described below, where you compare your heading angle (the orientation of your vehicle from the ceiling cam) with the vector pointing from the tip of your vehicle to the closest point on the trajectory.

Use the difference between these two angles for your steer controller (PD-controller).



If you can, drive quicker on the straights and brake before the curves, alternatively choose constant speed.

Take a video of your best lap (5 MB max) and plot the coordinates during this lap in your Pdf. Calculate the average squared lateral error w.r.t. the closest point on the desired trajectory and write it to your Pdf. Submit the code to the repository.