PID Control Project

Introduction

In this project I tried to build a PID controller and tune the PID hyper-parameters by applying the general process flows as described in the classroom and then tested the solution on the simulator. The simulator gives us the cross-track error (CTE), speed, and steering angle. The PID responds with steering and throttle accordingly to move the car in the simulator track.

Rubric Points Discussion

Describe the Effect of the P, I, D component of the PID algorithm in your implementation

The proportional or "P", component has a directly observable effect on the car's behavior. It is responsible for the car to steer in proportional (steering-angle) to the car's distance from the lane center (Cross-Track Error) - if the car is at the right it steers hard to the left, if it's slightly to the left it steers to the right.

The integral or "I", component eliminates the bias in the CTE which prevents the PD controller from reaching the center line. This bias can be a steering drift , as observed that after impleminting integral component the CTE around curves is diminishined hence it helped in supression of the bias term which was causing an hinderance in reaching the centre line.

The differential or "D", component counter balances the P component's tendency to overshoot the center line. While steering to the left or right in accordance to the cte the vehicle may overshoot from the centre position, so to avoid this the d oor the differential component comes into picture.A tuned D parameter helps the car in steering the center line smoothly without oscillating.

The overall tunning of these hyper-parameters hepled me in reducing the oscillation and controlling the

vehicle in the simulator properly.

Discuss how final hyperparameters (P, I, D coefficients) were chosen

I started with the the manual tunning of the hyper-parameter values.To start with i set the value for p to be around 0.24 and kept the values for the other two hyper-parameters as 0 which gave me an unsteady movement of the vehicle in the track.

To proceed with I tried with different values of "I" and the value 0.004 gave me the best result with minimum oscillations and closer to the middle of the track in the simulator. Accordingly, I procceded with different values for the "d" hyper-parameter field and attained the best result with the value 5.5.

Hence, the overall values for p,i,d which i came up was with (0.24,.004,5.5)