

PID Controller Project

The goals / steps of this project are the following:

- Implementing a PID controller in C++ to control the car from the Behavioral Cloning Project simulator.
- Once the simulator is running, it will provide CTE that will be used to compute the steering angle.
- The CTE will be used to calculate the error for each of the three components P, I and D. Then the final steering angle is calculated to compensate these errors.
- The goal is to tune the P, I and D coefficients that are multiplied with the P, I and D errors respectively to calculate the steering angle, so that the car stays on the track.

Rubric Points:

- **Describe the effect of each of the P, I and D components had in your implementation.**

The P (Proportional) component had the most obvious effect on the car when I tried different values for its coefficient. When using relatively large values, the car would make steep steering angles to compensate for the CTE and ends up oscillating all over the track.

The I (Integral) component solves the systematic bias problem, when the car drifts over time away from the center due to misalignment of the wheels. The effect of this component was somehow subtle, maybe because I always used small numbers.

The D (Differential) component made the car turn a little bit smoother towards the center of the lane and minimized the oscillations.

- **Describe how the final hyperparameters were chosen.**

I started with the values that were set in the lectures (i.e. 0.2, 0.004, 3.0 for P, I and D coefficients respectively), the car started off fine but after around 10 seconds it began oscillating violently and ended up off the track. So what I did next is setting the I and D coefficients to zero and calculating the steering angle using only the P component. My idea was to try different values for P and choose the one that had not so large oscillations, I settled on 0.08. Then I added the D component and repeated the same process to choose a suitable value, which was 0.1. Finally, I used the same I coefficient value that was used in the lectures, 0.004.