Project 5: CarND-PID-Control

PID Control Project

The goals / steps of this project are the following:

- Use the simulator lake race track from the Behavioral Cloning Project
- Implement the PID controller in C++ to maneuver the vehicle around the track
- The simulator provides the cross-track error (CTE) and velocity (mph) to compute the steering agle
- Summarize the results with a written report

Summary

The goal of this project is to learn about the PID controller.

The project helped in understanding the usage of CTE and velocity data to determine the steering angle to move the car within the track in the simulator environment.

P (Proportional gain):

Proportional gain computes an output proportional to the cross-track error(CTE). The P is most important to keep the car in the middle of the track. If the P is too low, the car steering will be moved little, goes away from the track with the constant speed. If the P is too high, the car tries to over correct and would see the car oscillates between the track with the constant speed. The correct P coefficient makes the car to be stable in the track.

I (Integral gain):

Integral gain sums up the cross-track error over time. If this coefficient too high, the car tends to sharper oscillations and car does not move in quick speed. Low coefficient will cause car to drift to the side and takes longer time to move forward.

D (Derivative gain):

Derivate is the change in CTE from one value to the next. Quick change in the derivative makes the car to correct faster during the scenarios such as curves. Too low D coefficient lead to higher oscillations and car moving out of the track.

Used the different parameters (P, I, D) and manually fine-tuned the values after several reruns of with different values for the parameters. Tried increasing and decreasing varous values of P, I and D to see the various behavior.

The final values for the Kp, Ki, and Kd after several tries are 0.1, 0.005 and 4.0 respectively.

double init_Kp = 0.1, init_Ki = 0.005, init_Kd = 4.0;

Files Submitted & Code Quality

Required Files:

Submission includes all required files
My project includes the following files:

- PID.cpp
- Main.cpp
- CMakeLists.txt
- Writeup_report.pdf
- Removed the video , as it took larger space. And it creates issue in submitting to udacity

Conclusion, Future Work

- Was able use the parameters P, I and D in fine tuning the car to run on the track.
- Also captured the video for the final run, not submitted here because of the space constraint.
- As a future work will try using Twiddle or SGD.