

Reflection

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

P Parameter: It keeps the car in the center of lane, it works directly proportional to the CTE, it is the most important parameters but it's not enough to avoid the overshooting.

D Parameters: This parameter normalizes the oscillation occurred from the P-Parameters, it prevents the car from overshooting.

I Parameter: This parameter counteracted the bias error produced from drift.

Observation:

- Removing I Parameter has made the car go from time to time close from the lane line, it does not get totally out from lane however, it performs much better when it was added
Check this video <https://youtu.be/P-YE9cnxS7k>
- Removing D Parameter cause car overshooting to the line

Check this video <https://youtu.be/famSDgp859M>

- When we add the three parameters we can see that the car is able to complete properly the lap.
Check this video https://youtu.be/GVeFY_rhfM

Describe how the final hyperparameters were chosen.

The parameters are selected with both manually and using Twiddle function. The algorithm is working as following first I have to tune the parameters(k_p, K_I, K_D) around the correct range then I use Twiddle function to update them to the minimum error. The twiddle algorithm is running at the start of each run it select best parameters value and use it in the calculate.

The Ranges are selected by an intuition first K_I should be a very small parameter as it is multiplied by the are of CTE, in the contrast for K_D which should be a big value as it is multiplied by diff.