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October 9, 2022

Project Writeup

Question 1. Add the plots to your report and explain them (describe what you see)

Step 1 screenshot and all PID plots are shown below.

FIGURE 1. Screenshot for step 1

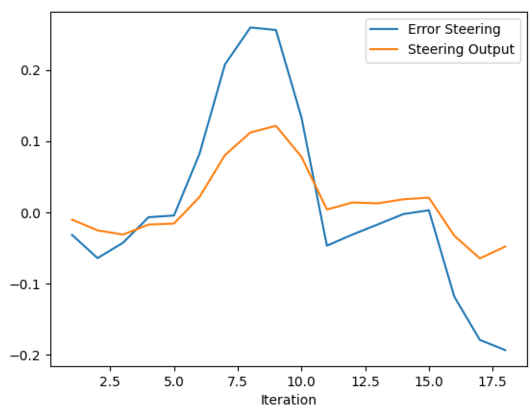

FIGURE 2. Screenshot for part 1 iteration 1

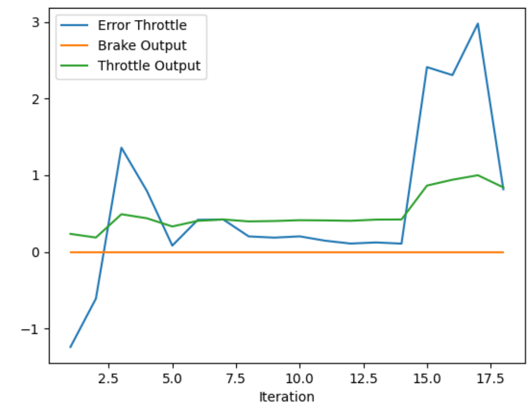

FIGURE 3. Screenshot for part 2 iteration 1

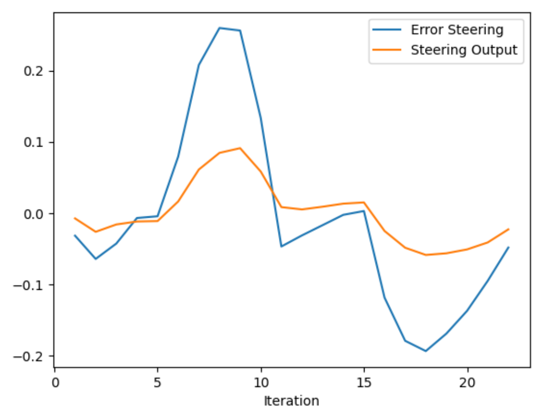

FIGURE 4. Screenshot for part 1 iteration 2

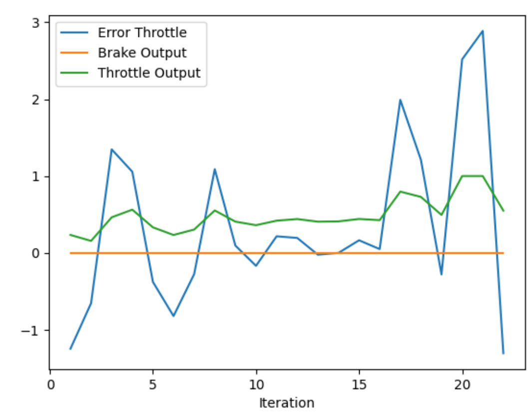

FIGURE 5. Screenshot for part 2 iteration 2

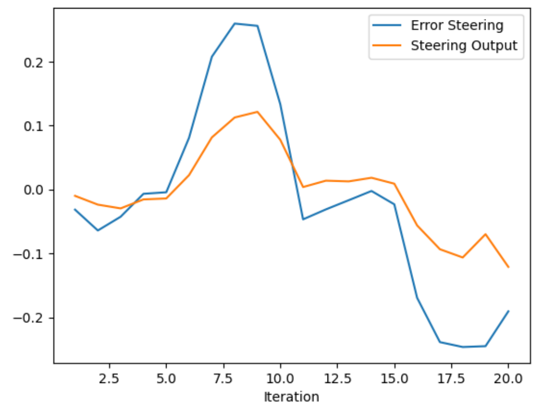

FIGURE 6. Screenshot for part 1 iteration 3

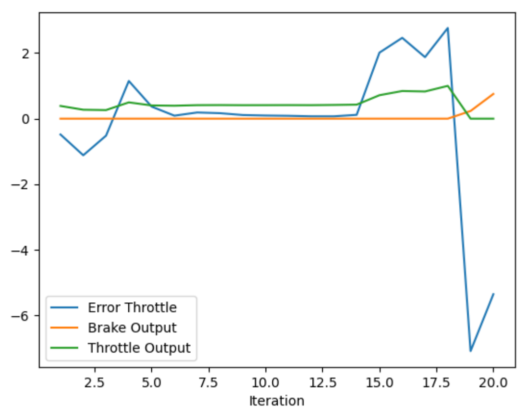

FIGURE 7. Screenshot for part 2 iteration 3

Figure 6 and Figure 7 are the outputs after tuning the PID parameters for the third time. After tuning the controllers, the ego-vehicle seem to move towards the wall after avoiding the car. This is why we see a huge error in throttle control towards the end in Figure 6.

Question 2. What is the effect of the PID according to the plots, how each part of the PID affects the control command?

Proportional element (P) gives a control input based on the difference between current and the desired control variable. If the difference is larger, the P value is larger. Derivative element (D) operates in the change between the current error and error at previous timestep. The integral element (I) uses the integral below the error over time to apply a control input. It helps in combating biases and drifts in our control variable.

Question 3. How would you design a way to automatically tune the PID parameters?

We would need to incorporate optimization techniques like Twiddle described in the course to tune the PID parameters.

Question 4. PID controller is a model free controller, i.e. it does not use a model of the car. Could you explain the pros and cons of this type of controller?

One major merit in PID is its simplicity in implementation and tuning. By defining a few parameters, we can obtain satisfactory results for various systems. Model based controller take different variables into account to model the given system which might need more computational effort while implementation.

However, a model based controller can apply optimal input to reach the desired goal in a given time which is not the case while using a PID controller as it might run into limiting constraints.