Assignment 8: Motion Planning

Mar. 19th, 2020

Objectives

- To generate smooth and comfortable trajectories for an autonomous vehicle
- To avoid dynamic obstacles based on sensor data
- To modify driving behaviour to follow the rules of the road

In this assignment, you will be developing a trajectory planner that can handle highway driving while surrounded by dynamic obstacles moving at various speeds. The planner will interface with a driving simulator to allow you to visualize the ego vehicle in motion.

Resources and Instructions

This assignment requires you to complete the following assignment:
https://github.com/udacity/CarND-Path-Planning-Project

Once you've cloned the repo, go to "src" folder, replace "main.cpp" with the one provided on Learn, and add "spline.h" (also on Learn) to "src" folder.
The two files are explained in this Q&A video by Udacity:
https://www.youtube.com/watch?time_continue=369&v=7sI3VHFPP0w&feature=emb_logo

Instructions for how to finish the project can be found in the README. But **we have simplified the requirements**. Please see the "Marking Scheme" section and tutorial slides for new instructions.

The simulator can be downloaded here:
https://github.com/udacity/self-driving-car-sim/releases/tag/T3_v1.2

Deliverables

The deliverable for this project is a zipped project folder containing your developed code (i.e. whatever files you modified/created in "src"), as well as a writeup in txt or pdf format. Your submission should **compile and run** because we will be testing your code. Please do not include the simulator in your submission.

Please follow the naming convention for your zip file: a8_<user_id>.zip .

Due Date

11:59 PM, Friday Apr. 3rd, 2020.
No late submissions will be accepted. There will be no extensions.

Marking Scheme

Assignments are marked on a 0-5 point scale.

Trajectory generation (2.5 points)

- Option 1 (2.5 points): watch Udacity's Q&A video, answer the following questions:
  - 1) how is lane following achieved? (0.5 points)
  - 2) how to use spline to generate a smooth trajectory? (1 point)
  - 3) how to avoid collision with the car in front? (0.5 points)
  - 4) how to avoid cold start? (0.5 points)
  - Can elaborate on 2), but be very concise (2 sentences max each) for 1) 3) 4)
- Option 2 (3.5 points): Implement jerk minimized trajectory successfully and explain your approach

Behaviour Planning (2.5 points)

During **2 miles** of driving, achieve the following:

- 1) Perform lane shift when front vehicle is too slow, done at least once. No points will be given for item 2 and 3 unless you can achieve item 1 (1 point)
- 2) No collisions (0.5 points)
- 3) (Count(Exceed(speed lim || acc lim || jerk lim)) <= 1) && (complete 2 miles within 3 min 30 sec) (0.5 points) Note: automatically lose this 0.5 if you exceed any limits for more than 2 sec continuously
- 4) Explain your approach concisely in the writeup (0.5 points)

Upon **successful completion** of items 1-4, you may attempt the following:

- Optional challenge (1 point): never exceed any limits
- Optional challenge (1 point): optimize lane shift so that you can complete 2 miles within 2 min 45 sec (without violating the aforementioned limits of course…)

Policies

Collaboration
You can discuss the problem with peers, but you must design and implement your own solution independently.

Use of online resources
You may consult online resources for inspiration, but you must develop your own code.