CS545 lab 3: Motion Planning with a 6-DOF Manipulator

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Question 6

Explain why it is not a good idea to call *get_random_sample_near_goal* with probability 1.0. Also present an example where this could be problematic.

Answer

The RRT algorithm explores the state space by building the tree in the direction of the randomly sampled points. The default *get_random_sample* function, samples these points randomly across all the dimensions of the state space while the *get_random_sample_near_goal* function only samples points closer to goal state. As a result, the tree only grows in the direction of the goal in a somewhat linear fashion and does not explore the surroundings (refer fig. 1). In an ideal case where there are no obstacles between source and destination, this approach would find a path that is closer to the optimal solution (straight line). But if there is any obstacle in between that is relatively bigger than the step size, then the algorithm will very likely exhaust the maximum iterations in search of a path avoiding obstacle and as a result will not find a solution (refer fig. 2). Consider using RRT for autonomous vehicle navigation. On a straight road in flowing traffic, using the *get_random_sample_near_goal* randomizer makes it easier to navigate to the destination and even the path would be a smooth ride. But in case there is a truck in front of the car that breaks down, then the probability of circumventing the obstacle and finding a path is minimal. In this case, though the *get_random_sample* randomizer generats jerky paths, it will still be able to circumvent the truck and reach the destination.

Note

Link to coding assignment videos

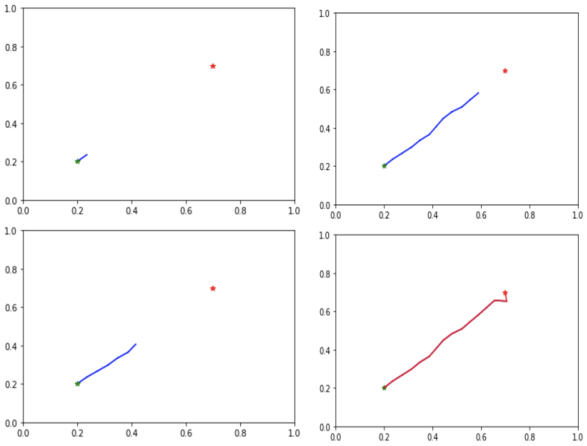

Figure 1: Scenario where the points are sampled within the range of goal and there are **no** obstacles in the path.

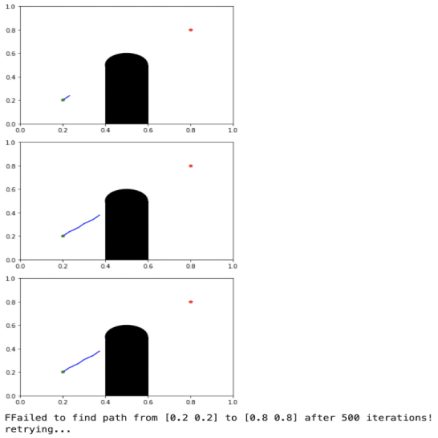

Figure 2: Scenario where the points are sampled within the range of goal and there are obstacles in the path.