16-662 Robot Autonomy

Assignment 3: Path Planning

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1 Path Planning via RRT

The hyperparameters used for the path planning via RRT without constrains are the same for all 5 seeds. They are listed as follow:

- project step size: 0.1
- constraint threshold: 0.001
- q step size: 0.01
- target p: 0.3
- max number of nodes: 1e5

The planning times, number of nodes sampled, and path lengths for running with the default start joints, target joints, and collision boxes for 5 random seeds are shown in the Table 1.

According to the table, the min, max, and mean planning time are 22.42s, 206.88s, and 75.796s, respectively.

Seed	**Planning Time (s)**	**Number of Nodes Sampled**	**Path Length**
0	89.63	1097	254
1	206.88	2529	385
2	33.63	634	237
3	26.42	579	226
4	22.42	512	233

Table 1: Path planning via RRT with different seeds

2 Constrained Planning

For the path planning via RRT with constrains of upright end-effector, the hyperparameters are slightly tuned for better nodes sampling. With the constrain, it is difficult for RRT to find the path. In order to increase the possibility to reach the target, the q step size and target possibility is increased. The hyperparameters are listed as follow:

- project step size: 0.1
- constraint threshold: 0.001
- q step size: 0.02
- target p: 0.2
- max number of nodes: 1e5

The planning times, number of nodes sampled, and path lengths for running with the default start joints, target joints, and collision boxes for 5 random seeds are shown in the Table 2.

According to the table, the min, max, and mean planning time are 59.23s, 824.31s, and 493.488s, respectively.

Seed	**Planning Time (s)**	**Number of Nodes Sampled**	**Path Length**
0	59.23	1187	191
3	824.31	5831	459
4	812.82	5831	459
7	623.67	3480	259
10	147.41	1187	191

Table 2: Constrained path planning via RRT with different seeds