ELEC-E8126 Robot manipulation
Exercise 2

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mathematical equation of plan length computation

We already have Plan length, and to have the Cartesian space points to calculate the length, we use the *getGlobalLinkTransform()* function to get cartesian points. And then we use the Euclidean distance formula to calculate the length:

$$d = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2 + (z_1 - z_2)^2}.$$

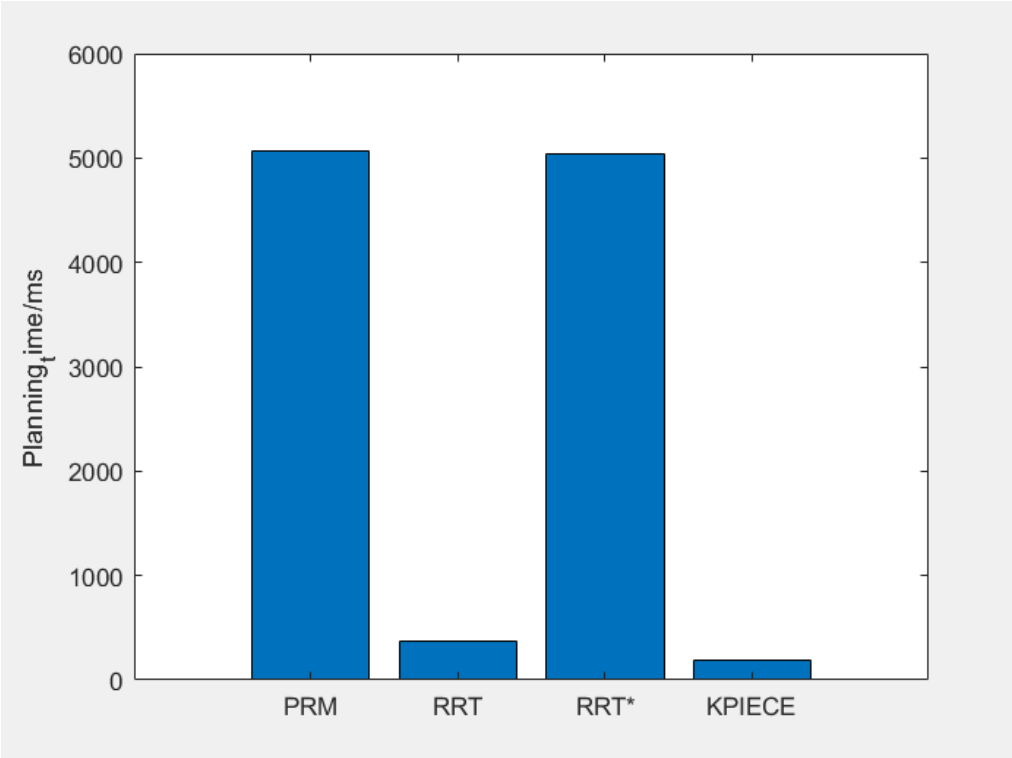
information necessary to replicate your results

Recording of planning length and time are as follow:

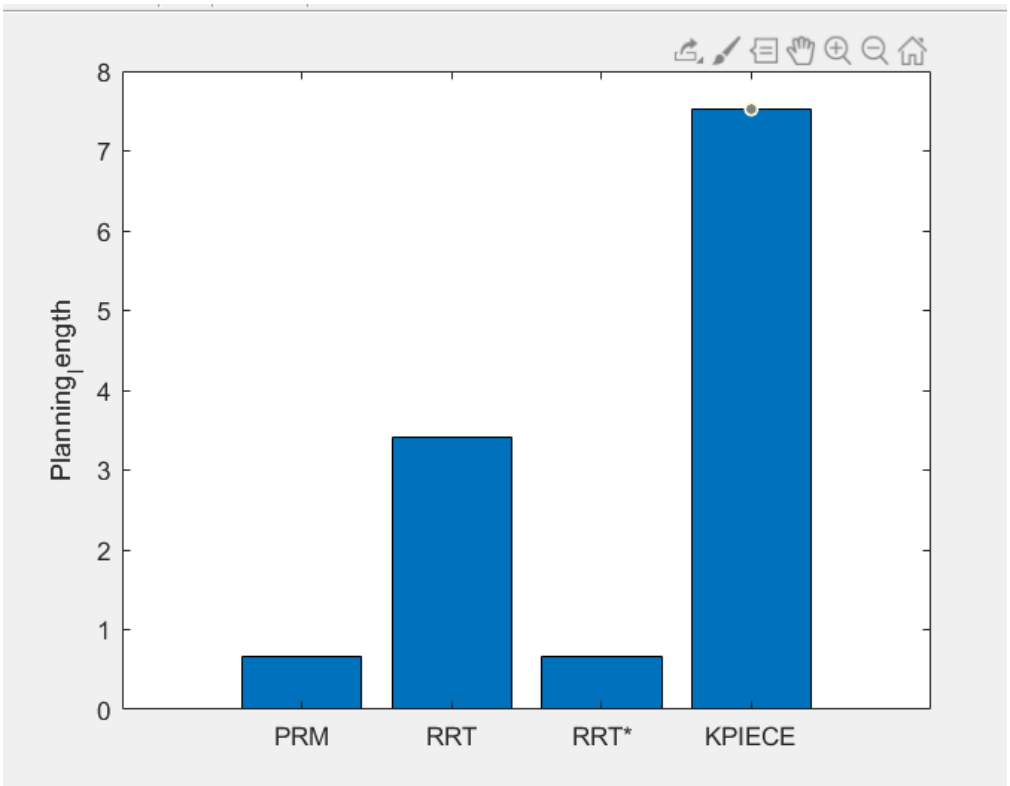
	A	B
1	PRM	
2	Planning time	Plan length
3	5059	0.672833
4	5067	0.672632
5	5028	0.672751
6	5103	0.672794
7	5095	0.672658
8		
9		
10	RRT	
11	Planning time	Plan length
12	333	5.84605
13	1186	2.88387
14	101	4.66889
15	35	0.672569
16	181	2.95081
17		

19	RRTstar	
20	Planning time	Plan length
21	5031	0.672699
22	5028	0.672627
23	5028	0.672618
24	5049	0.672595
25	5043	0.672927
26		
27		
28	KPIECE	
29	Planning time	Plan length
30	124	9.14707
31	211	5.76793
32	398	10.8988
33	118	8.2778
34	64	3.52387

Graphs visualizing the computed metrics for planned paths



Comparison diagram of average planning time



Comparison diagram of average planning length

Discussion of the results

PRM and RRT *It takes more time than KPIECE and RTT. In terms of plan length planner, the PRM planner is better than RRT and KPIECE because it creates more configuration space nodes and works better in many examples. The processing time of the RRT planning process is shorter than that of PRM and KPIECE, but the planning length results are not ideal. Compared with RRT and KPIECE, RRTstar's plan length shows better performance. In terms of plan length, KPEICE is worse than any other planner. The final path is very complicated and far from optimal.

Answering to the questions

1. If we have enough time RRT* will still cost a lot of time to finish calculate, for trying to optimize the path. But RRT will stop as long as it find the path. So the RRT* has higher possibility to find a better path.
2. The planners are probabilistic approaches, and they explore the joint space in a random way. Because of the randomness, we need to calculate few times and get the average data. Especially the RRT and KPIECE