УДК 681.5.015

PERFORMANCE STUDY OF SAMPLING-BASED MOTION PLANNERS WITH CHANGING THEIR PARAMETERS

Jaroukh A. (ITMO University)
Scientific supervisor – Kolyubin S. A., DSc
(ITMO University)

Abstract (All sampling-based motion planners have parameters need to be set before the path-planning process can start. Changing these parameters affects the resulted planning-time and path-length. So, a study to understand the performances of the sampling-based algorithms with changing these planners is proposed).

Introduction. In motion planning, a better combination of planning-time/path-length is always sought. Sampling-based motion algorithms randomly generate samples in the configuration space in the hope that a subset of the samples will define a suboptimal collision-free path. However, before the sampling and planning process can take place, there are number of planner-parameters have to be set, and choosing the right values of these parameters can highly improve planning-time and path length. In previous studies, there is a common goal for most of the researchers to improve the planning process, and that's by modifying some details in the core of the algorithms, and there is no literature provides experimental results of the performance of motion algorithms while changing their parameters. Moreover, it is unknown if the perfect choice of these parameters in one environment will be changed in another one for a specific manipulator. It is unknown too, if changing the manipulator in the same environment would affect the best choice of planners' parameters. To answer these questions, performance study of sampling-based motion planners with changing their parameters is introduced.

The main part. Along with other parameters, the most common ones are the "range" and "goal bias". The "range" represents the maximum length of a motion to be added in the tree of motions, while "goal bias" represents the probability for the algorithm to choose the actual goal state as a random sample. The Open Motion Planning Library OMPL includes all leading sampling-based algorithms and provides the facilities to freely tweak their parameters, and with the combination with MoveIt! every motion plan generated by OMPL can be viewed. Using model of redundant manipulator IIWA, we have studied the performance of the planners while changing the "range" from 0.05 to 10.0 with step of 0.05. For each "range" value, the average of planning time for 100 runs had been recorded. For some planners like "BiTRRT", "BKPIECE", "KPIECE", "LBKPIECE", and "SBL", planning time had a local minimum through "range" values, where for other planners, planning time tends to decrease and to stabilize after a specific "range" value. So far, we have studied planners' performance with changing "range" parameter, and the study is being continued to include all planners' parameters. The study will clarify too, if the parameters related to the manipulator and/or the environment.

Results. Results of this study as soon as it completes, are very important to understand how planners act, and then it would help in proposing an automatic way to tweak parameters towards reasonable values which eventually will get the best performance of each planner.

Jaroukh A. (author) Signature

Kolyubin S. A. (Scientific supervisor) Signature