Middle East Technical University
Uluç Saranlı

Homework 3 - Probabilistic planning methods

Assigned - Dec 14, 2023, **Due - Dec 28, 2023 (midnight)**

For this homework, you are asked to implement a simple PRM planner for a planar two-link robot that can freely move in a polygonal environment. The robot will have two rigid links connected with a rotational joint. The configuration space of your robot should hence be $R^2 * S^1 * S^1$.

As you did for previous homeworks, you should briefly describe the setting, give details of your formulation (for example, how you chose to coordinatize the configuration space, your sampling method and its properties for this domain, your neighborhood criteria etc.). Details are intentionally left unspecified so that you have freedom of choice but we expect that you will properly justify your choices and explore different alternatives. In doing so, please make sure to explore different parameters and minor variations within the algorithm of your choice.

Clearly, you will not be able to construct an analytic representation of the configuration space obstacles. Consequently, you will only be allowed to use a collision checker that can answer queries about whether a given configuration is collision free or not as well as possibly some additional pieces of information such as penetration depth. You can use external resources for this collision checker (i.e. any polygon intersection library), but you must implement the probabilistic roadmap planner yourself.

At the end, you should demonstrate with sufficiently rich examples that you can kinematically plan a collision-free path for a planar two-link robot. See http://msl.cs.uiuc.edu/rrt/gallery_chain.html for an example of how a successful plan should behave like except that your implementation will be only for a two link robot.

Once again, please make sure that your report is well organized into meaningful sections, with figures and captions properly references from within the text and an adequate number of citations to relevant resources from the literature. Note that using Matlab for visualization will probably a good idea but you can use any language as long as your report has sufficient detail, examples and discussion.

Submission

name and student ID. You should submit the following files on METU Class before the submission deadline: *lastname-firstname-report.pdf*, *lastname-firstname-sources.zip* with the ZIP file containing both the sources and the figures for your report as well as your implementation code and any other supporting material you might have. Your report should include your derivations, simulation results in the form of plots and detailed discussion on your findings and should be structured as a well-structured academic report or paper. **Late submissions will not be accepted except under special circumstances that you can document.**