Post-Graduation in
Electrical and Computer Engineering

TOPICS ON ADVANCED ROBOTICS
2020/21
Homework 1

Hand-out: 22 March 2021   **Due:** 12 April 2021

The objective of this homework is to provide the course students the opportunity to get familiarized with the practical aspects of single robot localization and mapping under uncertainty, taking a probabilistic approach. For this purpose, students must

- i)   get acquainted with ROS (Robot Operating System) middleware, and
- ii)   in particular with some of the available ROS packages for SLAM and self-localization.

The homework will be evaluated taking into account the quality of reporting on the work done, the results presented and the ability to explain them. The report should be no longer than 10 pages A4, one column, 12pt, 1.5pt spacing.

The dataset to be used (**mandatory**) was recorded in the halls and corridors of a hospital, is available at   http://users.isr.ist.utl.pt/~yoda/tar/   (courtesy Rodrigo Ventura, ISR/IST) and includes   laser   range-finder   and   odometry   data   from   ISR-Cobot (http://mediawiki.isr.ist.utl.pt/wiki/ISR-CoBot).

Due output:
1. Apply the FastSLAM algorithm to the data set to estimate an occupancy gridmap of the environment
2. Use the map obtained in 1. and apply EKF and MCL to localize the ISR-Cobot in the environment along some defined trajectory.

Students can use any available ROS package, and are strongly encouraged to explore and modify relevant parameters e.g., measurement noise and process noise models, number of particles), so as to be able to present a diverse set of results and justify the differences among them as a function of the parameters used.

Extra note:
Though this year it was decided not to move ahead with new datasets yet, the students might want to take a look (and even use) at these datasets:
- http://www.cvlibs.net/datasets/kitti/
- https://github.com/aamirahmad/read_omni_dataset
- http://thewiki.rockinrobotchallenge.eu/index.php/Datasets