Albert-Ludwigs-Universität Freiburg
Institut für Informatik
Lecture: Introduction to Mobile Robotics
Summer term 2015
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Sheet 11

Topic: Iterative Closest Point Algorithm and Recapitulation

Submission deadline: July 23, 2015

Submit to: `mobilerobotics@informatik.uni-freiburg.de`

Exercise 1: Data association

In the icp_framework tarball, you will find a complete implementation of the basic ICP algorithm. By commenting in one of the lines 121 to 124 of `icp_framework.py` you can test it on four different datasets. It already works well for datasets with known correspondences (i.e. P1 and P2), but it does not work for datasets with unknown correspondences (i.e. P3 and P4). If the correspondences between the points are unknown, they have to be estimated at first. Implement closest-point matching (line 27 of `icp_framework.py`) and test it using the two data sets P3 and P4.

Exercise 2: Rao-Blackwellization

Explain the idea of Rao-Blackwellization in general. How is the principle utilized for landmark-based SLAM, how for grid-based SLAM and where does the performance gain come from in both cases?

Exercise 3: Bayes Rule and Bayes Filter

- What is calculated in a Bayes Filter?
- What are the underlying assumptions?
- Can you derive the equation of the Bayes Filter and point out where the underlying assumptions are used?

Exercise 4: Probabilistic Motion Models

- Name two types of motion models that are often found in practical applications in robotics.
- Explain the two models using a small drawing for each.
- What are the differences between them?
- Which problem arises in the velocity based motion model and how to overcome it?