

Albert-Ludwigs-Universität Freiburg
Lecture: Introduction to Mobile Robotics
Summer term 2016

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Sheet 12

Topic: Iterative Closest Point Algorithm

Due date: 15.07.2016

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: ICP / SVD

Recall the formulas on the slides 5-7 of the ICP-lecture and prove the following:

$$\text{If } X' = P' \text{ then } R = I .$$

Hint: Find out, how singular value decomposition and eigen value decomposition are related to each other.

Exercise 3: ICP

Explain why the ICP algorithm is needed in robotics. For the four different variants of ICP, describe a robotics application in which this variant is especially useful.