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Praxis der Forschung:

Simultaneous Localization and Monitoring with Gaussian Processes

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Navigation and control of autonomous systems typically involves the simultaneous creation of a map for an unknown environment and the localization therein. The Simultaneous Localization and Mapping (SLAM) problem has been evolved into a widely recognized and active field of research. Different techniques have been proposed to build a map of the environment, which usually have in common that a landmark- or feature-based map representation is pursued. Recent research endeavors have been channeled into localization problems using physically motivated maps. A particular example is a geomagnetic field map employed for indoor positioning or train localization.

In this research project, we strive for providing techniques for the localization within a spatially distributed physical phenomenon and the simultaneous monitoring of the selfsame phenomenon. In particular, we study Gaussian process regression to reconstruct the phenomenon, where the measurements are accrued at uncertain positions. The measurement positions have to be inferred from the motion model as well as from the current map estimate. The proposed solution to this Simultaneous Localization and Monitoring problem will be evaluated with geomagnetic measurements collected by a robotic platform. The research project comprises the following work packages.

Work Packages:

- Literature review of related approaches, SLAM, and Gaussian process regression.
- Mathematical formulation of the inference problem.
- Development of efficient, possibly approximate inference algorithms.
- Evaluation in a simulation framework and with real data.

Prerequisites:

- Highly self-motivated and willing to take on challenges.
- Knowledge in state estimation, Bayesian inference, and sensor data fusion.
- Experience with Gaussian process regression is welcome.