Continuous informative path planning with a drone-based measurement unit

Autonomous Systems Lab

UNIVERSITÄT ZU LÜBECK

Project Summary

The goal of this project is to develop algorithms that yield an informative mapping of a 5G mobile network signal strength using a drone-based measurement unit utilizing Gaussian Processes. The challenge is to create the path of a continuous mapping flight for the measurement unit, not just sequential sample locations in the search space.

Project Type

- BA Thesis (3 months)
- MA Thesis (6 months)
- Internship (3-6 months)

Required Qualifications

- Programming skills in Matlab/Python
- Experience with Drones (UAVs)

Contact

- Jonas Gruner, j.gruner@uni-Luebeck.de
- Dr.-Ing. Hossam Abbas, h.abbas@uni-luebeck.de

Detailed Description

In this project, prior information like previous measurements or simulations are incorporated in an intelligent mapping algorithm using Gaussian Processes. Furthermore, Bayesian Optimization is utilized to determine the next sample location.

The mission goal is to define a path for the UAV to collect informative measurements of the 5G mobile network signal strength. The path should also take the prior knowledge into account. It should also be adapted when new measurements allow updating the prior. This path planning problem is also known as informative path planning (IPP) or robotic information gathering (RIG).

The algorithm is first implemented in a simulated flight and afterwards deployed on a drone for live measurements flights.

References

- Marchant, R. and Ramos, F. (2014), Bayesian Optimisation for informative continuous path planning, ICRA 2014.
- Chen, W., Khardon, R. and Liu, L. (2023), 'Adaptive Robotic Information Gathering via Non-Stationary Gaussian Processes'.
- Taranto, R. D., et al. (2014), 'Location-Aware Communications for 5G Networks: How location information can improve scalability, latency, and robustness of 5G'.