

Collaborative Localization in GNSS Denied Environments



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Background

Modern society **relies heavily on GNSS** for precise localization. However, recent events have shown that GNSS is **susceptible to jamming and spoofing**.

Promising **alternative** is to use **natural signals**, e.g.

- visible landmarks,
- elevation maps,
- Earth's magnetic field irregularities.

This project explores **how** natural signals can be utilized to localize a swarm or group of collaborating agents with the goal to:

- **increase accuracy** compared to single agent,
- **reduce requirements** on the **inertial system**.

Research Questions

The project aims to answer questions related to collaborative localization using natural signals

- how to **best** use **natural signals**,
- the importance of the **agent geometry**.

Thus, motivating the following research questions:

- Are there **novel** ways to utilize **natural signals** given access to a **group of agents**?
- What is the **relationship** between the agent geometry and the **quality of the estimates**?
- Does the relationship **differ** depending on the **type** of natural signal?

Early Results

To answer questions regarding the **importance** of the **agent geometry** the project has started to explore **measures of information and performance**.

Given a map-based estimation method, such a measure could

- motivate the shape of the agent geometry in relation to the map,
- provide means to **minimize** the resulting **ambiguity**.

In the figure below, the **combined measurements** of the altitude of three agents lead to an **unambiguous** (i.e. unimodal) position estimate when compared to an elevation map.

