OPTIMIZED SENSOR MANAGEMENT FOR AIRBORNE AUTONOMOUS SYSTEMS

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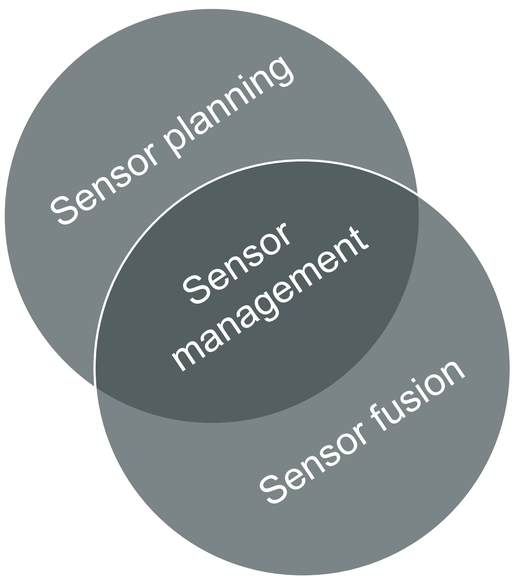
Description:

This project will explore high level control of flying autonomous systems and their onboard sensors. The goal is to increase sensor system performance by providing autonomous functionalities that can support either the system itself or a human system operator. Today's air operators are facing an increasing amount of targets and sensors, leading to an overwhelming amount of data. The project aims to significantly reduce the operator workload by providing techniques for autonomous cross-platform multi-sensor management.

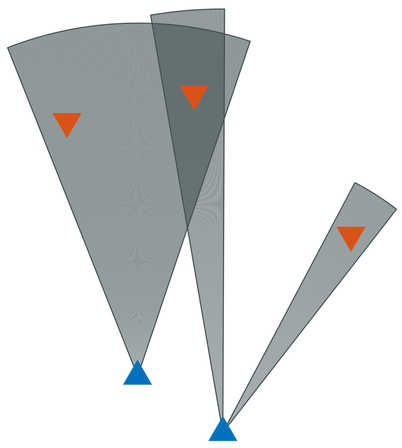
Background & Motivation



The current trend in the aero-space industry is that products have an increasing number of capabilities formed by integrated autonomy, such as resource management, sensor fusion, and situation assessment.

Combining these autonomous capabilities could result in both useful and interesting new functionalities.

Research Goal & Questions



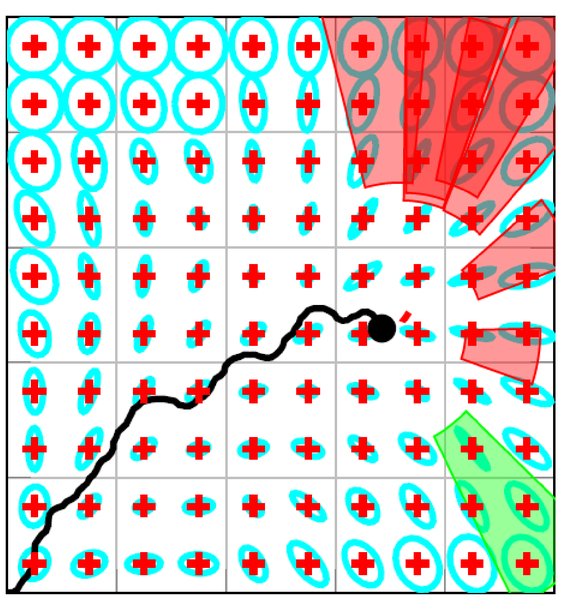
How can sensors distributed over multiple aerial vehicles be autonomously coordinated to increase the performance of

- Search and track
- Area surveillance

Focus will be on combining

- Sensor fusion
- Information theory
- Predictive control theory
- Planning algorithms

Methods & Preliminary Results

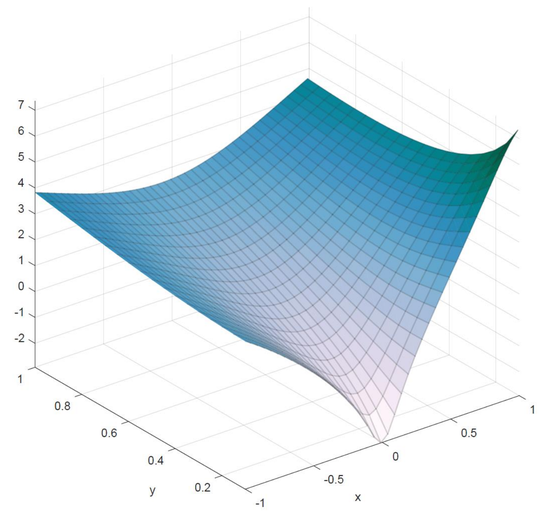


No platform selected yet, but the aim is to use small UAVs for evaluations.

Implementation of state-of-the-art algorithms to jointly plan sensor pointing direction and trajectory of an airborne sensor platform in a surveillance scenario.

Ideas on how to improve the performance of these methods and formalize the connection to predictive control theory.

Roadmap & Milestones



The figure illustrates how the logarithm of the determinant of the information matrix varies as we select different vantage points for a target located at the origin.

Investigate how to quantify tracking quality and information.

- Needed for optimization of search and track.

Develop algorithms for single vehicle scenarios.

Develop algorithms for multiple vehicles scenarios.

Evaluate algorithms in simulations as well as on real hardware in WASP autonomous research arenas (WARA).

Snapshots from a simulation of a road surveillance scenario. The size of each cyan ellipse represents the uncertainty of the corresponding grid point.