EPSRC CDT in Distributed Algorithms

PhD Project: Non-myopic approaches to sensing and surveying

University of Liverpool

PhD Student: George Jones
Project Partner: Cubica

Supervisors:
Angel Garcia-Fernandez, University of Liverpool
Prudence Wong, University of Liverpool
Scott Page, Cubica

Project Description:

This PhD project tackles the development of high quality but efficient multi-sensor non-myopic sensor management algorithms for controlling sensors and unmanned autonomous systems (UAS) such as unmanned aerial vehicles (UAVs) and unmanned ground vehicles (UGVs). These distributed algorithms are needed in order to exploit the ever-growing capability of autonomous systems for security, monitoring and surveying applications. The algorithms are used to make decisions on things such as where the platforms travel, what direction the sensors are pointed in, and what configuration the sensing will take. Sensor management algorithms typically use Bayesian information theoretic approaches to evaluating the “utility” or “value” of different combinations of sensor and platform actions. Even when such action combinations are evaluated over a single discrete time-step (“myopic” approaches), the problem begins to suffer from combinatorial explosion as the number of sensors is increased or the space of actions enlarges. In order to achieve high quality task choices, non-myopic approaches that consider different combinations of actions over multiple time-steps are required; these approaches are able to trade off short-term gain for higher long-term gain. Non-myopic approaches are able to identify and mitigate for real-world challenges such as obstacles (to gathering information). Due to the high levels of computational complexity, a key focus of the project is likely to be understanding the potential for exploiting multi-core computing hardware such as GPUs and/or FPGAs. Another area of interest is how such approaches can generate solutions as part of a human-machine teaming concept, in order that they promote trust and transparency and help end-users understand the inherent trade-offs in the optimisation process.

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