

EPSRC CDT in Distributed Algorithms

PhD Project: Maximising Detection Performance Using High Performance Processing of Multi-Sensor Data

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Project Description

This project will develop state-of-the-art in signal processing algorithms to be used in submarine warfare. Future sensing of submarines will involve robotic submarines and surface-ships as well as autonomous sensors deployed on the seabed. To avoid the potential to give away the position of the sensors and for the ability of a submarine to avoid detection, passive listening for signals using an array of hydrophones is preferable to active sensing. Unfortunately, the underwater propagation of acoustic energy is complicated.

Signal processing algorithms called Track-Before-Detect have been developed to detect stealthy targets from single sensors. These algorithms use sequential numerical Bayesian inference algorithms to process the raw sensor data over long timescales over which the trajectories of the targets cause sensor artefacts that are unlikely to be the result of noise. These algorithms are computationally demanding but amenable to parallel processing and have been demonstrated to provide significant advantages in terms of detection performance.

Advanced variants of such fusion algorithms carefully consider a combination of physical and statistical models: physical models can accurately predict the data but are typically very computationally demanding or difficult to calibrate robustly; statistical models can capture the effect of phenomena that are not modelled physically, but cannot, by definition, predict what will be sensed as accurately as physical models.

The focus of the project will be developing Track-Before-Detect algorithms with models for multiple sensors that consider a combination of physical and statistical models while configuring the signal processing to maximise detection performance.

Go to the [EPSRC CDT In Distributed Algorithms](#) website.