EPSRC CDT in Distributed Algorithms

PhD Project: Machine Learning for Target Detection and Classification Using Multi-Modal Airborne Sensor Data

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Project Description

Machine learning (ML) algorithms have been applied successfully for many years to databases of visual imagery for the recognition of objects in a scene. Sensors working at radio frequency (RF) mostly produce low-resolution data where the signals detected are more abstract and require algorithmic processing to present the information to the human operator.

RF sensors can operate actively (detecting reflected signals from objects illuminated by their own transmission) and passively (intercepting emissions and reflections from objects). The characteristics of a target can depend on both reflections and interceptions of RF emissions, which are likely to be at different frequencies and are often context dependent. Long-established classical detection methods tend to work by removing everything that does not look like the signal of interest, which may throw away valuable information and context in the process. This process is typically performed on each type of data separately and only the processed outputs are combined. Real-time co-processing of multiple sensor data streams is analytically and computationally challenging. Fusion of this data usually does not occur until after the individual classical detection processes. However, ML techniques may be able to learn to extract the beneficial features from sensor data of the scene to detect all objects of interest and provide classification of object types earlier in the processing than is usually possible, and with improved confidence compared to classical methods.

This PhD will seek to establish whether multi-modal airborne sensor data, used early in the signal processing chain, can be used to detect and classify objects earlier in the processing chain leading to improved detection and classification performance.

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