PROGRAMME: DATA KNOWLEDGE OPERATIONAL EFFECTIVENESS

MISSION IN BRIEF

Increase the ability of NATO to reach information superiority and common situation understanding, required to detect and mitigate threats at sea by extracting and processing useful information from a large number of heterogeneous sources through efficient and advanced techniques and methodologies.

OVERVIEW

A major component of maritime security is maritime situational awareness (MSA), which ultimately addresses the enormous challenge of identifying vessel intents from the variety of available information sources. Situational awareness of surface maritime traffic is complicated by: a huge volume of data and information to be mined arising from sensors and humans; a significant lack of sensor coverage away from coastal areas; reliance on voluntary transponder-based information, such as the Automated Identification System (AIS); possible conflicting information; a requirement for both inter-national and inter-agency meaningful information sharing.

Researchers of the DKOE programme at CMRE are addressing these challenges developing advanced approaches in the various fields of statistical signal processing, machine learning, information and data fusion, artificial intelligence, reasoning under uncertainty, gamification and semantic knowledge representation in order to provide generic and flexible solutions suitable for a wide range of underlying MSA problems.

The programme focuses on the following research areas:

- **Scalable data fusion** which uses factor graphs and the belief propagation algorithm to efficiently deal with a large number of targets, measurements and sensors.

- **Anomaly detection** aiming to detect anomalous behaviours of vessels at sea, such as unexpected deviations from standard routes.

- **Maritime traffic knowledge discovery** which aims at modeling the maritime traffic in a statistic framework and exploits machine learning and big data techniques to analyse and extract meaningful patterns among large amounts of ship traffic data.

- **Multi-INT fusion and reasoning under uncertainty** combines information from any type of source through top-tier artificial intelligence techniques with proper uncertainty and source quality considerations for improved estimations.

- **Analysis of conflicting sources** supports the investigation of conflicting information in order to mitigate the impact of faulty sources and alert on possible malevolent vessel behaviour.

- **Serious games** aim to elicit expert abilities in dealing with imperfect information during threat assessment tasks through innovative human factor methods for a suitable cognitive assistance.

- **Object and activity classification** which improves situational awareness with the use of machine learning techniques

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