Title: Dynamic construction of analytic applications using shared coalition sensors and services

Military / Coalition Issue

The Military relevance of this task is in a future coalition context where analytics applications can be automatically composed from sensors and services that may be distributed across the coalition network and owned by different coalition partners. This is sometimes referred to as the Internet of Battlefield Things (IoBT). How is it possible to discover the required component services and compose the necessary workflows to perform distributed analytics tasks? Is it possible in contested environments to be resilient against network fragmentation and loss of computational assets?

Core idea and key achievements

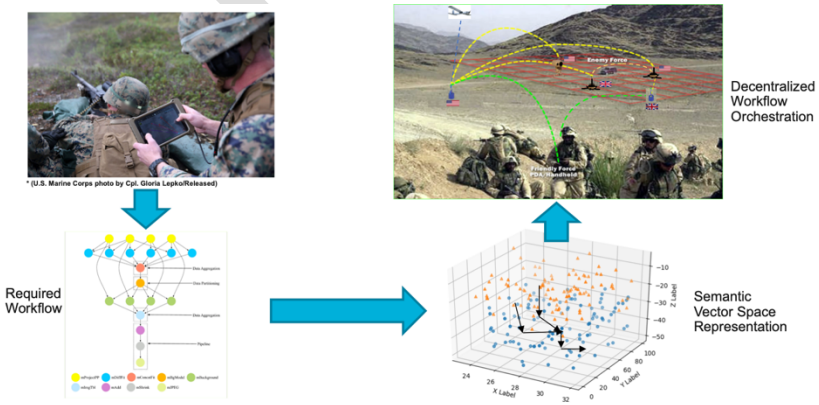
The core idea is that sensors, data and services (essentially anything) can be described as symbolic semantic binary vectors. Essentially everything is described as a vector of vectors. These vectors have mathematical properties that can be exploited to provide a new way of performing service decentralized peer-to-peer service discovery with no requirement for centralized control. Our key achievement has been to show how to create these vectors from service and sensor descriptions and how these vectors can be bundled together to create new vectors that describe the service workflows that describe the required analytics applications.

Implications for Defence

Using vector representations of sensors, data and services provides an important new way to rapidly configure available assets to perform new tasks in highly dynamic military operations. In a coalition setting the use of semantic vector representations offers the potential to discover and make use of assets owned by other coalition partners to perform required tasks.

Readiness & alternative Defence uses

We have already demonstrated that how the vector representation can be used to perform tasks such as dynamic communications re-planning and to discover and orchestrate NATO FMN services. These demonstrations have used representative simulations of MANET environments. Higher TRL levels could be archived by demonstrating the technology operating in actual wireless networks.



Resources and references

COLLA 2018: A Scalable Vector Symbolic Architecture Approach for Decentralized Workflows https://dais-ita.org/node/2397

FGCS 2019: Constructing Distributed Time-Critical Applications Using Cognitive Enabled Services https://dais-ita.org/node/2398

FGCS 2020: Efficient Orchestration of Node-RED IoT Workflows Using a Vector Symbolic Architecture https://dais-ita.org/node/5183

Organisations

IBM UK, Cardiff University, IBM US