

Defence Innovation Network Grant Scheme: Pilot Project

Autonomous Analyst for Force Design

CONTEXT:

Force Design

Force Design is a cyclic process to translate Government's strategic policy and guide the development of an affordable and capable future force for Australia. It specifically involves the following activities:

1. Baseline the current force, strategy and investment plan, and assess gaps and opportunities;
2. Collate and understand the gaps and opportunities;
3. Prioritise the gaps and opportunities, and develop options;
4. Recommend responses to the gaps and opportunities; and
5. Synthesise the responses and develop future force options for consideration by Government.

The Defence Science and Technology (DST) Group is interested in researching and developing an intelligent decision support system capability to support Force Design. This work is inspired by a concept known as the Autonomous Analyst.

Autonomous Analyst

Autonomous Analyst is not a particular technology, but a problem choice to drive technology and analysis capability development, comprising of two interlocking components: firstly, and most obviously, we wish to employ emerging autonomous machine technologies to analytical advantage; secondly, because this is neither as straightforward nor as comprehensively beneficial as often assumed, Operations Analysis has to drive artificial intelligence and machine learning forward in the first place in order to obtain sufficiently capable algorithms. Moreover, the latter component is really part of a broader requirement for Operations Analysis to enable the development of autonomous systems that are properly robust within known limits under normal conditions of typical environmental and operational uncertainty.

A use case of an autonomous system is in knowledge synthesis using the large quantities of information within Defence, Industry and open literature. Defence literature could include a wide variety ranging from publications and reports to data from discussion exercises, analytical wargames and simulations. This would require:

- A Defence domain of knowledge corpus containing relevant data that are discoverable and reusable,
- Analysis and visualisation of the corpus data using emerging technologies,
- Trained machine and deep learning models that will output answers with precision, confidence and justification

RESEARCH QUESTIONS:

- How could data from a variety of sources be collected and collated? Data may come in the form of quantitative data from Defence assets or qualitative in the form of subjective matter expert (SME) text data, workshop data, open and closed source literature. Data may also be inherently coded such as coming from a wargame.
- How might we deal with 'continuous' time based data such as audio and video recordings? How would we fuse this data with types mentioned previously?
- How would we analyse the context in which data is collected? Is there a way to establish Defence context taxonomy in a semi/fully autonomous manner?
- Defence personnel and experts have background knowledge and context behind their language and terminology. How might we disambiguate different Defence domain language and terminology? This is a broadly-applicable research question about understanding domain specific language through learning context.
- Similarly if we are to ask a question of our autonomous analyst, how might we disambiguate the question to understand the intention? And like-wise return an answer in a similar domain specific language.
- How might we establish themes and topics amongst this varied and ambiguous data?
- How could we determine a quality or trustworthiness of the knowledge behind the qualitative data? For example, if two subject matter experts have different views, how do explore the reasons for that?
- How might we determine the quality of our own analysis? How do we validate data for a hypothetical event or situation?
- How might we use data visualisation to convey a message from an autonomous system?
- How could we establish trust in the autonomous system?
- When automation is introduced to handle big data challenges, the human analyst needs to understand the relationships and context within the data in order to understand their significance. What visualisation and data storytelling approaches are suitable for an autonomous analyst to explain its reasoning and results to the human analyst?

