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Dr John A H Miles
QinetiQ plc, UK
QinetiQ PTP, Portsmouth, UK, PO6 3RU
44 2392 312320
jamiles@qinetiq.com

Automated Situation Assessment

John A H Miles, QinetiQ plc, UK

Abstract

Situation Assessment is a key element in Command and Control; it is the 'orient' phase in Ensley's OODA model. Situation Assessment provides the cues (needs for action) and context (situation awareness) which lead to and enables effective decision making. The concept of automating such an apparently human process may seem alien but there is a case for at least assisting parts of the process where the reasoning is not too deep and where human abilities are limited.

Humans have deep knowledge and reasoning powers including a capacity for innovation but they are unable to focus on more than a few threads of activity at once. An example is monitoring a battle-space where many things are already happening and there is potential at any moment for more significant events to unfold. Humans also have great abilities in pattern recognition and memory of past events when concentrating on a particular sequence of such events but they cannot keep track when there are tens or hundreds of such sequences occurring in real-time and extending over many hours or days. Uncertainty is difficult for humans to deal with especially when the only way to reduce it is to gather snippets of evidence over a period of time. The human failing of performance variability depending on training, experience and fatigue is also significant.

Machine reasoning has the strengths of being able to track in real-time as many sequences of events as can occur, to remember everything required, to reason over periods of time, and to give consistent performance. What it lacks is the reasoning required for a particular circumstance and the ability to adapt its reasoning when circumstance change. Machine learning is developing but has yet to reach the stage when it can be given free rein.

Having been successful in applying knowledge-based techniques to generating real-time tactical pictures for warships and surveillance aircraft, QinetiQ has conducted research (sponsored by UK MoD) into automated situation assessment. Early approaches to this used rules for specific pieces of reasoning such as grouping closely spaced platforms, associating tracks with plans (e.g. Air Tasking Orders), and threat assessment. In the latest research we have taken more generic approaches including the use of user-defined patterns and an initial exploration of the application of machine learning techniques.

The paper describes the techniques used and the results of experiments using both simulated and live data. Technology Readiness Level is assessed and the way-forward in terms of trials and integration with combat systems is outlined.