Assessing the Role of Information Sources in Track Identification Decisions

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Introduction

Successful performance in complex dynamic environments relies on accurate and timely acquisition and interpretation of information, typically from multiple sources, to guide decision making and action. Within a ship's Combat Information Center (CIC), tactical decision making teams continuously interpret ongoing events, based on information from a variety of sources, in order to detect and identify contacts, evaluate potential threats and take appropriate actions, in direct response to those events. Part of our work on the Shipboard Instructor Training Support (SITS) program, has included identifying methods to support assessment and diagnosis in scenario-based training. This presentation discusses our efforts to assess performance of the track identification process by diagnosing the role of various information sources in track identification decisions.

Track identification requires a team of operators to initially *detect* the presence of a contact, usually through observation on a display. The team may have received notification from one or more sources of a potential contact that may soon become apparent on the display, thus priming the team to be observant for it. Once a contact appears on the display, it is officially a track, and the system assigns a number to it. At this point, the team must attempt to *identify* the track in terms of its threat potential to the ship and other friendly or neutral contacts. Once a track is identified, the team monitors it to determine whether or not the track should be reassessed with regard to its threat potential, and, thus, requiring a change in identification and, possibly, any action taken toward it.

To make a correct track identification, the team uses information from sources such as intelligence data, electronic sensors, IFF, point of origin, and characteristic maneuvering patterns that correlate highly with different types of tracks. The identification process involves active information seeking, communication among team members and with external sources, and console interaction.

Approach

One objective is to use operator keystroke patterns to assess performance on the track identification task and to diagnose which of the available information sources participated in the identification process. There are a number of sources of uncertainty in assessing the identification process. First, there is uncertainty inherent in the task, the confidence level associated with each source of information differs, so it is important for the team to use high reliability information sources and to use multiple sources. Second, an accurate identification can be based on various combinations of information, available to the team at different times. Finally, the keystroke observables provide only one window into the process, communications between team members and with external sources provide another window on the identification process. So assessing the identification process in terms of the information sources that contributed to a decision is a task well suited to probability-based inference techniques (e.g., Martin & VanLehn, 1995; Mislevy, 1995).

The Bayesian network for the track identification process is made up of variables representing the observable keystroke actions, the observable values of the relevant information sources, and the inferred role of each information source in the identification decision. The input to the network is a set of values representing: the identification assigned by the operator, keystroke actions related to accessing a particular information source, the correct identification of the track, and the content provided by each information source at the time of the operator's identification. The output from the network is a set of values representing the probability that each information source was accurately used, inaccurately used, or not used at all in the decision process.

References

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