

Tutorial

Ontology Based Situation Awareness and High Level Fusion: Methods and Tools

Mieczyslaw M. Kokar
Department of Electrical and Computer Engineering, Northeastern University,
Boston, MA, USA
mkokar@ece.neu.edu

Duration: Half day

Intended audience: This tutorial is directed towards both researchers and practitioners in various areas of information fusion.

Prerequisites: Basic knowledge of logic. Familiarity with declarative programming is desirable but not required.

Description: In this tutorial the participants will learn:

- how “situation” can be formalized
- what an ontology is
- how to represent ontologies in the OWL language using a freely available OWL tool
- how to check consistency of an ontology
- how to build rules on top of an ontology
- how to use a general reasoning tool to monitor or query situations
- what kind of situation-related reasoning can be performed and how

Higher-level fusion involves identification of abstract entities - sometimes called “situations” - that can be represented as relations among objects, both physical and conceptual. Unlike features of physical objects, features of relations are not directly measured by sensors. Instead, the existence of a relation is derived from a domain theory relevant to a specific scenario.

This tutorial will cover both theoretical and practical aspects of situation awareness and high-level information fusion. First, a motivational example will be given to demonstrate the importance of relations and to introduce the concept of *situation*. This will be followed by a presentation of some methodological techniques and some technologies that are needed for establishing an ontological approach to higher level information processing. The notion of *ontology* will be introduced in theoretical, computational and practical terms. Examples of specific ontologies will be discussed using both a graphical representation and an evolving standard language used for communicating ontologies and annotations as well as for processing and fusion of semantic annotations (OWL – Web Ontology Language). An overview of OWL constructs will be provided using Protégé, the most popular and freely available tool for editing ontologies, and some graphical plugins. Other publicly available tools will also be demonstrated in the context of a

methodology for ontology engineering. Situation awareness and high-level information fusion will be discussed using an illustrative example.

Outline:

Hour 1: From Level 1 to High Level fusion. The notions of “situation” and “situation awareness.” A motivational example.

Hour 2: Ontologies and Web Ontology Language (OWL). Ontology engineering and ontology tools.

Hour 3: Situation awareness scenario, demo and analysis. Research directions in situation awareness and higher level information fusion.

Bio information: Mieczyslaw M. Kokar

Professor Kokar is with the Department of Electrical and Computer Engineering at Northeastern University in Boston. His technical research interests include Information Fusion, Ontology-Based Information Processing, Software Defined Radios, Self-Controlling Software and Modeling Languages. In particular, he is interested in higher-level information fusion and situation awareness, ontology-based software radios, the specification and design of self-controlling software using the control theory metaphor, ontology development, ontological annotation of information, logical reasoning about OWL annotated information, consistency checking, formalization of the UML language, consistency checking of UML models vs. UML Metamodel and of UML Metamodel vs. MOF. Dr. Kokar teaches various graduate courses in software engineering, formal methods and artificial intelligence. He has an M.S. and a Ph.D. in computer systems engineering from Wroclaw University of Technology, Poland. He is a senior member of the IEEE and member of the ACM.

More information about Professor Kokar can be found at his web site:

<http://www.ece.neu.edu/groups/scs/kokar>