Schema Management in a Semantic Wiki

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Abstract. A semantic wiki for tactical intelligence requires collaborative, iterative schema management. Application developers can provide users with control and visibility required to tailor an ontology to meet unique requirements.

1   Introduction

Military and law enforcement operations rely on good tactical intelligence. That intelligence is derived from information sources that vary depending on the location and nature of the operation. Some data sources are highly structured and amenable to computer processing; others are characterized by semantic and syntactic incompatibilities that inhibit automated integration. These differences result in underexploited data [1]. Emerging technologies can help intelligence analysts exploit disparate datasets and better understand the tactical situation.

One application that helps analysts organize and manipulate information from disparate sources is a semantic wiki. A semantic wiki promotes rapid dissemination of information and collaborative analysis in a distributed, virtual environment. It does so by parsing information into a repository using an ontology, and by using that ontology to help discover and represent additional relationships in the corpus of knowledge.

2   Challenge

Different military and security situations deal with different types of information. Changes in information type require changes in schema structure. One ontology does not fit all situations. Accordingly, a semantic wiki must allow for changes in its ontology so that it can be adapted for use in various environments and continually developed in an iterative manner. As environments evolve, new types of information appear and terminologies change.

The requirement to adapt poses conflicting challenges. First, maintenance and evolution of a structured schema must be managed. A user faced with a new classification of information must be able to define the new entity in the schema. Second, this process must be managed collaboratively. Designated stewards of the ontology in a user organization must be able to make necessary modifications without having to resort to calling for technical support.

3   Approach

Harnessing the collective intelligence of an application's user community is an effective way to address challenges [2]. This is exactly how a web-based semantic wiki tackles the problem of ontology management. The approach recognizes that the end user has the expertise to define the granular descriptive characteristics of data, and empowers the user to do so directly through the wiki interface.

Using initial input from the targeted user community, the developers of a semantic wiki determine the structure of the ontology and an initial baseline lexicon of options. Once the software is deployed, the user interface allows the operator to create new sub-types in the supporting schema, and populates these new sub-types to the displays of all other users. All users are instantly able to take advantage of the modifications made by the designated data stewards, resulting in the collaborative tailoring of mission-specific schema to meet unique requirements.

Application developers carefully consider two aspects of schema management when designing an interactive, collaborative capability: control and visibility. These complementary properties help prevent an ontology from becoming fragmented and losing functionality. Control is established by level and by action. Designers determine the level of the structure—where in the hierarchy tree—at which a user can modify the schema. Designers also determine the specific actions that the user can take (Create new? Rename? Delete?). Visibility is maintained by repopulating the display with changes, by providing users with a read-only view of the entire schema, and by a recommendation engine. Visibility of the full range of existing options helps schema control by limiting the creation of duplicative sub-types.

4   Demonstration

The demonstration uses an ontology developed under the Information Networking for Operational Reporting and Monitoring (INFORM) project, designed to facilitate collaborative analysis and work flows for elements of the U.S. Marine Corps, the U.S. Special Operations Command, and the Department of State. The demonstration uses a semantic wiki to process data from disparate sources and semantically link it based on the ontology. Due to the wide range of environments and use cases, such as human-centric analysis supporting Psychological Operations, the application assists the user in ontology management by offering a certain level of control and visibility.

References

1. Hughes, T.: Toward Semantic Integration of Data in the Wild. Invited talk, Ontology for the Intelligence Community 2007, Columbia, Maryland (2007)
2. Alag, S.: Collective Intelligence in Action. Manning, Greenwich, Connecticut (2009)