



Adding Semantics to and Interconnecting Semantic Graphs

Benefit: Computer support for predicting homeland security threats and emergency response often requires representing general or specific knowledge about a domain, including objects and their inter-relationships. Semantic graphs are simple, easy to use structures used for this task. However, they can be ambiguous or inaccurate. Our project is developing methods to augment and enhance semantic graphs with additional intelligence from one or more ontologies.

Collaborator(s):

- Rutgers University
- Alcatel-Lucent Bell Labs
- Texas Southern University

Funded by: US Department of Homeland Security

Mission

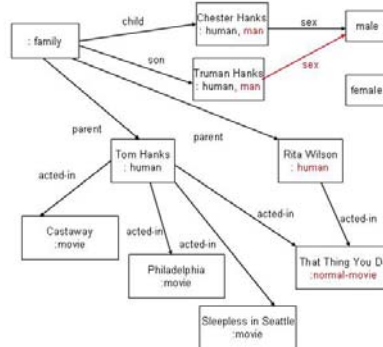
This project is investigating augmenting shallow representations of information in semantic graphs or networks with richer information, expressed as ontologies in formal representation languages (such as OWL). Our objective is to help avoid ambiguity and potentially expose infidelities and inconsistencies in the shallow information. We are studying the use of expressive ontologies to augment and correct information in semantic graphs by developing a combined formalism for shallow representation and expressive ontologies. One project goal is then to point the way toward effective reasoners that combine large amounts of both shallow and ontology information, and facilitate their application by end-users.

Since there will not be a single, universal ontology, it is important to allow concepts to be used from multiple ontologies (e.g., “infection” from a medical ontology and “airplane” from a transportation ontology). Another goal of the proposed research is to investigate the notion of “importing from an ontology” and its relationship to ontology modularization. A more general long-term goal is to study the integration of information from multiple semantic graphs. Such research relates to the issue of ontology integration, which has wide-ranging importance for DHS.

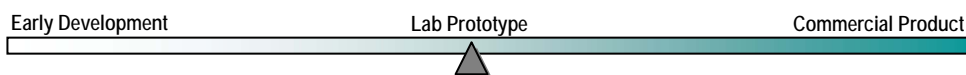
Recent progress on the topic of importing from ontologies includes characterizing the desired formal specification of such a mechanism, a critical evaluation of currently available techniques, and first results on algorithms for importing from very simple ontologies. We have also looked at using ontologies to extract structured information from intensive care unit accident reports and have explored using high-performance ontology reasoners for reasoning in Semantic Graphs augmented with ontologies.

Outreach

Project participants co-organized a workshop on “Associating Semantics with Graphs” as a collaboration of the four University Affiliate Centers and Lawrence Livermore National Laboratory. The workshop, held on April 16 - 17, 2007 at Rutgers University, brought together about 50 distinguished researchers to discuss the design and use of graphs as representation formalisms.



A semantic graph is a graph whose nodes and links are associated with attributes enabling it to convey not only relational structure but also semantic information describing nodes and links. When information is incomplete we can apply reasoners to deduce additional information as shown in red.



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