Extensibility in Semantic Web Description of Syndromic Surveillance Systems

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OBJECTIVE

This paper proposes a semantic web description ontology to describe aspects of a syndromic surveillance system. Extensibility of a syndromic surveillance system built around a central ontology layer is explored.

BACKGROUND

The semantic web is an emerging technology for expressing rich descriptions of a problem domain in the form of ontologies. An ontology provides a domain specific knowledge base for the communication and sharing of knowledge between various human and computer agents [1].

Many public health organizations have adopted syndromic surveillance systems but criteria for the selection of appropriate data sources, syndrome definitions, and applicable outbreak detection methods have not been established [2]. Application of semantic web technology to the field of syndromic surveillance has been seen to be successful in an experimental environment through the BioSTORM project at the SMI labs at the Stanford University School of Medicine [3]. The semantic web shows promise for providing a universal problem description layer that will allow for easier integration between heterogeneous data sources and problem solving techniques.

METHODS

In order to allow for the development of an end-to-end system, our focus has been on the creation of additional ontologies to describe methods of data manipulation, data processing algorithms, and output presentation techniques to compliment the ontologies provided by the BioSTORM project.

In order to compare and contrast the extensibility of a semantic web based system, it was compared to the EARS and RODS syndromic surveillance systems [4,5]. Two approaches were used. First, a set of proposed metrics was applied to discover differences and similarities in design. Second, a case based review of common extensions has been performed for all three systems, where each *use case* corresponds to a different system design layer.

RESULTS

An example of an ontology fragment can be seen in Fig. 1. A demonstration system has been completed which uses these descriptions for simple automated syndromic surveillance analysis.

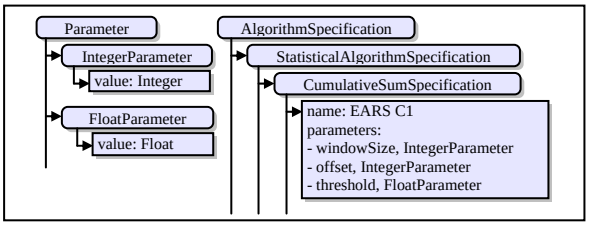

Figure 1 – Example of the definition of the EARS C1 cumulative sum algorithm within the Algorithm ontology.

The metrics and case analysis show that existing systems were not designed with extensibility in mind, and that the semantic web implementation shows promise at a metadata layer for syndromic surveillance systems.

CONCLUSIONS

A system based on the semantic web shows great flexibility and extensibility. Existing systems can also be extended, but doing so requires extensive labour and expertise. These systems could be reworked and improved with the adoption of a semantic web data layer.

The semantic web layer can be used to divide the system implementation details from actual system usage. This would allow domain experts (public health researchers) to make decisions on functionality without the need to understand the details of the underlying implementation.

Much additional work is needed before this technology can be widely used and accepted. The semantic web is still in development and many standards for its use have yet to be established. In order to allow for better domain knowledge description, agreement on a central set of ontologies within the field of syndromic surveillance is necessary.

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