

Enabling the Semantic Reasoning in the Health Level 7 Clinical Document using the Web Ontology Language

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1 Introduction

The Health Level 7 (HL7) organization [1] has developed the Clinical Document Architecture's (CDA) [2], an XML-based document based on the Reference Information Model (RIM) [1], to provide a structure for clinical data exchange. The XML Schema Definition (XSD) language has been used to describe the CDA's components and as a basis for the semantic conversion. Expressed in the Web Ontology Language (OWL) [3], an ontology, which is a model that defines the domain concepts, has been constructed based on HL7 CDA.

This project maps the main elements and attributes of the CDA's XSD to the equivalent constructs in OWL that represent classes and properties. A Visual Basic.Net application called "CDA2OWL" has been developed to demonstrate the conversion from XSD of CDA to OWL. The aim is to enable the semantic reasoning in the CDA documents using OWL to create a comprehensive and profound knowledge base of clinical information for electronic health records.

2 Mapping Methodology

The mapping methodology derived for the CDA's XSD to OWL is a 1-to-1 mapping of XSD tags to the equivalent OWL constructs, as suggested by Ferdinand et al [4]. The CDA2OWL tool consumes the XSD file of CDA as input, and transforms it into an OWL ontology.

3 Experimental Results

The CDA2OWL application has been tested with the full CDA schema as an input, delivering an OWL ontology as an output. An ontology editor, Protégé [5], has been successful in importing the resulting OWL ontology and displaying all the classes, attributes, and domain/range values. In addition, this ontology has been validated with the OWL Validator [6] and reported no violations of syntactic or semantic constraints of the OWL ontology.

4 Conclusions

Based on the specifications of this project, it has been demonstrated that the CDA2OWL tool is able to convert the CDA schema to an OWL ontology. The CDA2OWL application has been designed and customized to transform the XSD constructs found strictly in the CDA to the OWL language and the resulting ontology can be viewed and amended in Protégé.

One of the main benefits of creating a CDA's XSD-OWL system is the automatic generation of ontologies in minimal time and effort, rather than building them from scratch for each of the CDA schemas. As well, this HL7 CDA-OWL ontology can be a key instrument as a knowledge representation in developing electronic health records. The resulting ontology expresses the semantics of the health information captured in the original CDA document, ultimately enabling semantic interoperability, and facilitating machine interpretability of and reasoning over the clinical knowledge.

References

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