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Updating Ontology Alignments based on New Concepts and their Context

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Abstract
Ontologies and their associated mappings play a central role in several semantic-enabled tasks. However, the continuous evolution of ontologies requires updating existing concept alignments. Whereas mapping maintenance techniques have mostly handled revision and removal type of ontology changes, the addition of concepts demands further studies. This article proposes techniques to refine a set of established mappings based on the evolution of ontologies. We investigate ways of suggesting correspondences with the new version of the ontology without applying a matching operation to the whole set of ontology entities. Obtained results explore the neighbourhood of concepts in the alignment process to update mapping sets. Our experimental evaluation with several versions of aligned biomedical ontologies shows the effectiveness in considering the context of new concepts.

Key words:
ontology alignment, ontology evolution, concept addition

Introduction

Ontologies are description of entities and their relationship of a certain knowledge domain. They are used to collect, organize and share informations. Using different ontologies from the same domain is very important, because one ontology may not cover all knowledge required [2].
Different ontologies from the same domain can represent the same concepts in different ways, but it is important to find concepts that have same meaning between them to be able to communicate and share informations. Mapping is the set of correspondence of pairs of concepts between two ontologies [1]. Those mapping can be created by manual effort, but the increasing size and constant evolution of ontologies make this unviable.
Evolutions are changes that happen to an ontology caused by updates in knowledge domain. Those changes can be classified as addition, deletion and revision [3].
Our research propose an algorithm to mapping newly added concepts caused by evolution of an ontology based on their context.

Results and Discussion

Our approach explores the context of each newly added concepts to find candidate concepts to be mapped. The context of a concept c_i is defined as union of super concepts, sub concepts and sibling concepts of the concept c_i with distance lesser than a given value. We developed an algorithm that compare two versions of the source ontology to obtain newly added concepts. For each newly added concepts, the context with distance γ of that concept is analyzed to search for concepts with mapping in a previous version. If there are such a concepts, each concept in the context of the concept from target ontologies with distance λ wil be added to candidate concepts and they are compared with the newly added concepts using a similarity measure. If the similarity is the highest among candidate concepts and it has similarity greater than a threshold τ, a new mapping is created.
We developed another algorithm that ignores the use of context of a concepts. It means that each newly added concepts are compared with all concepts from target ontology.

Table 1. Experimental Results

Ontologies	Threshold	Source level	Target level	F-measure
SNOMED CT - NCI	0.9	3	2	0.218
		Without context		0.557
SNOMED CT - ICD9	0.5	1	0	0.276
		Wihout Context		0.072
MeSH-ICD10	0.75	2	1	0.214
		Without Context		0.270

Conclusion

The use of different ontologies require the creation and maintenance of mappings between them. In this article, we propose a technique to refine ontology alignments based on evolving ontologies. Our algorithm considered the context of concepts in both ontologies as a way to find the matching between concepts.
Future work involves conducting exhaustive experiments in different domains to evaluate the quality of the detected refined alignments.

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