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Editorial

Enriching ontology mappings with semantic relations

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ABSTRACT

There is a large number of tools to match or align corresponding concepts between ontologies. Most tools are restricted to equality correspondences, although many concepts may be related differently, e.g. according to an is-a or part-of relationship. Supporting such additional semantic correspondences can greatly improve the expressiveness of ontology mappings and their usefulness for tasks such as ontology merging and ontology evolution. We present a new approach called STROMA (*Seman*T*ic* *R*efinement of *O*ntology *MA*ppings) to determine semantic ontology mappings. In contrast to previous approaches, it follows a so-called enrichment strategy that refines the mappings determined with a state-of-the-art match tool. The enrichment strategy employs several techniques including the use of background knowledge and linguistic approaches to identify the additional kinds of correspondences. We evaluate the approach in detail using several real-life benchmark tests. A comparison with different tools for semantic ontology matching confirms the viability of the proposed enrichment strategy.

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1. Introduction

Ontology matching has been the focus of a large amount of research that led to a broad range of techniques to discover the corresponding or matching concepts between ontologies [26,8,2]. Match techniques include lexicographic, structural and instance-based approaches as well as the use of background knowledge and previously found match results. Typically, two related ontologies are matched with each other. The output of the match process is an ontology mapping consisting of the correspondences between matching ontology concepts. Ontology mappings are useful for ontology evolution and different information integration purposes, e.g., for ontology merging.

A restriction of most match tools, such as COMA++ [1], AgreementMaker [4] or Falcon [14], is that they focus on finding truly matching or equivalent pairs of concepts. However, it would be of great value to determine more expressive mappings including further kinds of correspondences, such as is-a or part-of relations between concepts. Such semantic mappings have been shown to substantially improve ontology merging [21] (see Section 3.2) and to be helpful for ontology evolution [11]. The existing approaches have even difficulties with finding truly equivalent concepts, since similarity-based match approaches are inherently approximative, e.g., if one assumes a match when the concept names have a string similarity above some threshold. Hence, the correspondences often express only some "relatedness" between concepts that can reflect equality or some weaker (e.g., is-a) relation. The importance of semantic ontology mappings has also been recognized by the Ontology Alignment Evaluation Initiative (OAEI),[1] an initiative for evaluating match tools. They provided a full track for detecting both equivalence and subsumption correspondences in 2011, but had to cancel this track because of insufficient participation [7].

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[1] http://oaei.ontologymatching.org/.

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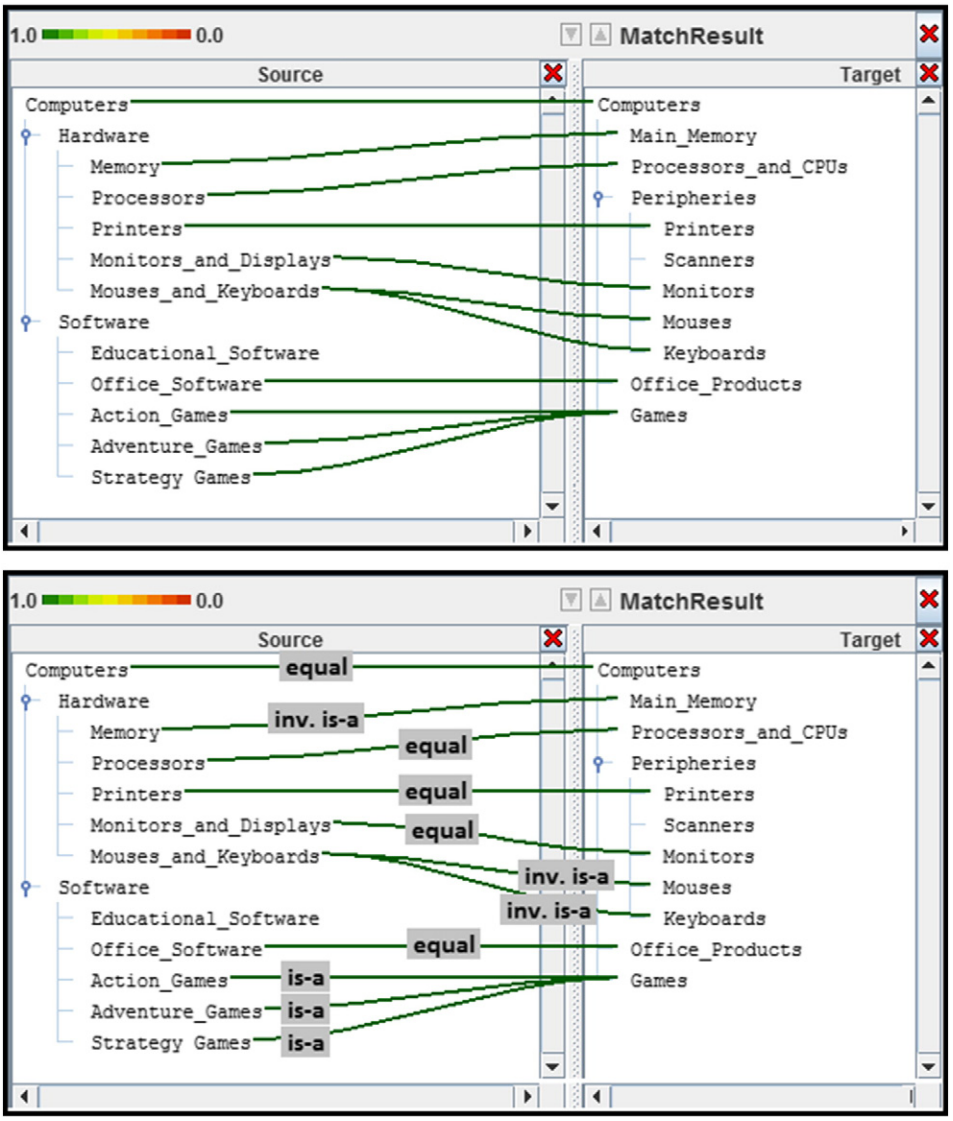

Fig. 1. Example of input (top) and intended results (bottom).

To illustrate the results of current match tools, we show in Fig. 1 (top) the result for matching two simple ontologies with the community edition of the state-of-the-art match tool COMA 3.0. Each line represents a correspondence between two concepts. The example shows that not all such correspondences represent equality relations, e.g., *Action_Games—Games*. The figure below illustrates the intended output of our approach with semantically enriched correspondences.

We present a new approach called STROMA (*S*eman*T*ic *R*efinement of *O*ntology *MA*ppings) to determine more expressive ontology mappings supporting different kinds of correspondences, such as equality, is-a and part-of relations between ontologies. There are already a few previous approaches to identify such mappings (see Section 2), but they are still far from perfection. They have in common that they try to directly identify the different kinds of relationships, typically with the help of dictionaries such as WordNet. By contrast, we propose a so-called enrichment strategy implementing a two-step approach leveraging the capabilities of state-of-the art match tools. In a first step we apply a state-of-the-art match tool to determine an initial ontology mapping with approximate equality correspondences. We then apply different techniques (including linguistic approaches and the use of dictionaries) to determine for each correspondence its most likely kind of relationship. In Fig. 1 (bottom) we illustrate how the enrichment approach can improve the mapping by identifying several is-a and inverse is-a relations. The two-step approach has the advantage that it can work in combination with different match tools for step 1, and that it has to process relatively compact mappings instead of evaluating a large search space as for 1-step semantic match approaches. As we will see in the evaluation, we can still achieve a high match effectiveness.

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