FOAM – A Framework for Ontology Alignment and Mapping Tool Demonstration

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Abstract

In this work we present a novel tool for aligning and mapping ontologies. It is based on latest research efforts and shows very promising results. The tool is briefly explained and pointers to actual applications are given. It is available for download at `http://www.aifb.uni-karlsruhe.de/WBS/meh/foam`.

1 Introduction

Semantic alignment between ontologies is a necessary precondition to establish interoperability between agents or services using different individual ontologies. Thus, ontology alignment and mapping become a core issue to resolve when building a world-wide Semantic Web. As one can easily imagine, this cannot be done manually beyond a certain complexity, size, or number of ontologies any longer. Automatic or at least semi-automatic techniques have to be developed to reduce the burden of manual creation and maintenance of alignments.

In recent years we have seen a range of research work on methods proposing such alignments [1; 7]. When we tried to apply these methods to some of the real-world scenarios we address in other research contributions [2], we found that existing alignment methods did not suit the given requirements: high quality results, efficiency, optional user-interaction, flexibility with respect to use cases, and easy adjusting and parameterizing.

We wanted to provide the end-user with a tool taking ontologies as input and returning alignments (with explanations) as output meeting these requirements. Our Framework for Ontology Alignment and Mapping (FOAM) itself consists of a general alignment process, a description of the tool itself, and some pointers on how it is used in practice.

2 Alignment Process

We have observed that alignment methods like QOM [3] or PROMPT [7] may be mapped onto a generic alignment process (Figure 1). We refer to [3] for a detailed description. Here we will only mention the six major steps to clarify the underlying approach for the FOAM tool.

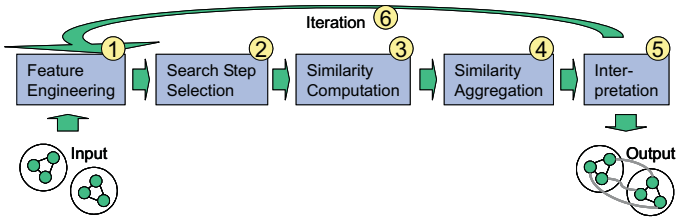

Figure 1: General Alignment Process

1. Feature Engineering, i.e. select excerpts of the overall ontology definition to describe a specific entity (e.g. label of an instance).

2. Search Step Selection, i.e. choose two entities from the two ontologies to compare (e_1,e_2).

3. Similarity Assessment, i.e. indicate a similarity for a given description (feature) of two entities (e.g., $\text{sim}_{\text{superConcept}}(e_1,e_2)$=1.0).

4. Similarity Aggregation, i.e. aggregate multiple similarity assessment for one pair of entities into a single measure.

5. Interpretation, i.e. use all aggregated numbers, a threshold and interpretation strategy to propose the alignment (align(e_1)='e_2'). This may also include a user validation.

6. Iteration, i.e. as the similarity of one entity pair influences the similarity of neighboring entity pairs, the equality is propagated through the ontologies.

Finally we receive alignments linking the two ontologies.

3 FOAM

The Framework for Ontology Alignment and Mapping (FOAM) has been implemented in Java. It relies on the KAON2-environment[1] [6] for processing of ontologies (in specific ontologies represented in OWL-DL). This direct procedural approach can be very focused on specific problems arising for the alignment process e.g. efficiency.

Ontology alignment is an enabling technology. The process does not finish after the alignments have been identified. The results have to be integrated in whatever application is

[1] `http://kaon2.semanticweb.org`

Figure 2: The FOAM Logo

requesting them. Therefore FOAM provides three ways of access. It can be accessed through the command line and a very simple parameter file. Further, it can be run through a Java API making it easy to use for other programs. FOAM has been run successfully on PCs under Windows and Linux. And finally, just for testing purposes, it can be directly accessed through as a service through a web interface.

Precisely, FOAM needs two ontologies as input. Further the user can either specify all parameters herself (strategy, number of iterations, semi-automatic or not, etc.) or let the system set the optimal parameters based on the ontologies to align and the desired use case [4]. The parameters are either written into a parameters file or directly handed over to the alignment class within the Java application. Further preknown alignments can also be entered into the system and improve results. The alignments finally are either provided in an XML-representation format [5] or as a comma separated list. Human interaction is included for some use cases through questionable alignments the user has to confirm or reject. If a gold standard is provided, the alignments are automatically evaluated and the results are saved as well.

4 Application

To give an example, our user Alice wants to align the two ontologies *sportSoccer.owl* and *sportEvent.owl*. The goal is to eventually merge these two ontologies. She therefore starts the FOAM tool from command line with the parameters, i.e. the two ontologies and the merging scenario. During the alignment process Alice is prompted to answer whether the presented alignments are correct. The whole process takes some time, but this is not a critical factor for this use case. After finishing FOAM saves the results in a file, which she can use as basis for merging of the two sports ontologies. The results are of very high quality with some interesting nontrivial alignments e.g. a *spectator action* in one ontology is called *viewer act* in the other one.

FOAM and its predecessors have been successfully applied in different applications. Within the SWAP-project[2], FOAM was used to align and merge identical entities which were returned in the Bibster application. Additionally it was provided to the ontology design board for the distributed ontology creation process as needed in Xarop. FOAM is a substantial part of the mediation component in the SEKT project[3]. The three use cases of an intelligent question answering system for judges, a semantically enabled digital library, and a collaboration tool for heterogeneous groups in media use this component for different actions ranging from query rewriting to ontology merging.

[2] `http://swap.semanticweb.org/`

[3] `http://www.sekt-project.org`

Finally, the methods implemented in FOAM have been tested in two ontology alignment contests of last year: I3CON and EON-OAC. In both cases FOAM behaved very favorable.

5 Concluding Remarks

The Framework for Ontology Alignment and Mapping is available through its webpage `http://www.aifb.uni-karlsruhe.de/WBS/meh/foam`. On the page one can find links to relevant publications, a download section of binaries and source code, installation guidelines and the documentation of FOAM, and some ontologies to test the tool. Further, there is a web-interface for internet users interested in very shallow testing. For real use we recommend downloading it. Requests have come from around the world.

In this paper we have presented an approach and a tool for ontology alignment and mapping. This included the general underlying process. Thereafter we have described the implementing FOAM tool in more detail. As pointed out FOAM has been successfully in applications and contests on ontology alignment. With semantic integration becoming a task of increasing importance. Our tool FOAM is a significant step forward on the road to a Semantic Web.

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