HOMER: Ontology alignment visualization and analysis

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Abstract. We present HOMER, an analysis and visualization tool for ontology alignment. HOMER features a radial-graph display GUI, a complete execution trace that allows the user to override and navigate to any match decisions during at runtime and a comparison mode that displays multiple alignments in parallel. HOMER contains a builtin plugin for the ILIADS ontology alignment algorithm, but other algorithms can be plugged in as well.

1 Introduction

A number of alignment tools have been proposed to help in automating the creation and analysis of ontology alignments. Examples include Anchor-PROMPT [1], OLA [2], COMA++ [3] and ILIADS [4]. All these tools share three important characteristics: (i) the tools use a human-in-the-loop paradigm in which a human may convey background knowledge that would otherwise be unavailable to a fully automated tool; (ii) they employ heuristics to estimate which are the best alignments and (iii) they select, at each step, the best candidate alignment constructed from a set of likely matches. Given these characteristics, we believe it is critical to have a tool that allows the user: (i) greater control by allowing her to control and override each decision on candidate matches; (ii) the capability to compare alignments for different *execution traces* (the set of decisions on candidate matches that lead to an alignment). We present the HOMER tool that addresses these user requirements.

2 The HOMER features

Ontology GUI. HOMER features a two radial-graph display, one for each of the ontologies involved in the alignment. Each edge between two nodes represents a fact or axiom in an ontology. The user can select any node as the center of one of the graphs, which immediately puts the node's neighborhood into focus[3]. HOMER also allows *linked* graph navigation; when this option is active, selecting a node n as the center of one radial graph makes the node n' most recently matched to n become the center of the other radial graph. Matches are represented by color-coded edges[4] whose width depends on how close the nodes aligned are to the centers of the radial graph.

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[3] In our experience with aligning large ontologies, we have observed that focusing on neighborhoods saves the human reviewer a great deal of time and effort.

[4] The color code indicates whether a match was chosen by the user or by the algorithm; the color fades as the match becomes "older" in the step-by-step trace.
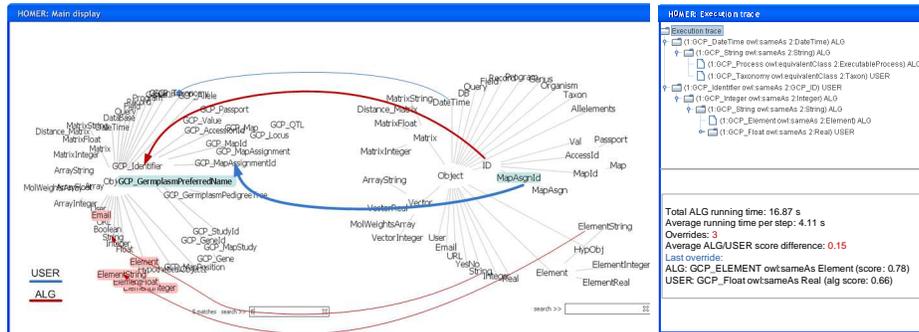
Fig. 1. (a) The HOMER radial display interface; (b) Execution tree example

Alignment trace. This mode allows a user to trace through the ontology alignment algorithm step-by-step (execution tree featured in Figure 1(b)). At each step, the algorithm will present the user with a list of candidate matches between entities (classes, instances and properties) and its choice of the best match, along with an explanation of that choice (for instance, the scores used to rank the candidates). The user has the possibility of accepting the algorithm's choice or selecting one of the other candidates; a decision by the user to override creates a new branch in the execution tree. The decision is then fed back into the algorithm and will affect future matches. HOMER allows the user to navigate back to any point in the execution tree, choose an alternate decision and resume the alignment process from there.

Alignment/Ground truth comparison. This mode of operation allows a user to compare an alignment with another alignment proposed by a human or another alignment tool. When two alignments are compared, the interface displays at each step the common/different matches. The alignment steps are synchronized, allowing the user to identify the points at which the two traces diverged. Each trace is fully interactive, as in the single-trace display above.

References

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Demo description

In this demo, we present HOMER, a tool for the visualization and comparison of ontology alignments. The goal of the tool is to enable (i) tighter control of ontology alignment algorithms by allowing the user to step in at any intermediate point in the algorithm and choose an alternative to what the algorithm believes to be the "best" match in that step and (ii) comparative analysis of the decision points in alignment algorithms by allowing the user to view multiple alignments (with different match decisions) being processed in parallel. The demo will be conducted as a three-stage process, each stage describing one of the feature groups in HOMER.

We will start the demo by giving an overview of the HOMER GUI. As a testbed, we will use multiple pairs of real-world OWL Lite ontologies used to evaluate the ILIADS algorithm. After loading a pair of ontologies, we will show the radial graph display and the ways in which the user can navigate and search the graph. We will also show the linked navigation mode, in which selecting a node in one of the ontologies brings into focus the matches that reference that node. The user will also be able to view details about the non-graphical features of the ontologies, such as namespace and import information, axioms that cannot be displayed visually (such as property and functional axioms). We will end this first stage of the demo by describing how alignments can be saved for future analysis and how they can be exported to OWL.

In the second stage, we will describe the HOMER execution trace environment. In this mode, HOMER can execute an ontology alignment algorithm step-by-step and allow the user to control and potentially override any of the match choices made by the algorithm. We will do this using the builtin plugin for the ILIADS algorithm. The algorithm will run for a few steps to demo the step-by-step results display, containing a list of candidate matches and the "best" match according to ILIADS, along with supporting similarity scores. We will show how this display allows a user to focus on any match candidate pair in the radial graph display and see how the similarity scores were derived. We will also detail how a user can override the decision of the algorithm by choosing an alternate match candidate and describe the trace navigation process, in which a user can come back on any decision made by her or the algorithm and alter them.

In the third stage, we will demo the comparative analysis display. We will use three distinct traces a pair of OWL ontologies that show how HOMER can be used to identify decisions of the algorithm that have repercussions on the overall quality of the alignment. The traces will be executed synchronously, showing the user how to identify points in the algorithm where the partial results diverge and then demonstrating how the differences in the partial results impact the choices of the algorithm in subsequent steps. We will also show that any of the traces loaded in parallel for comparative analysis allow all the features that we described in the single-trace display. Finally, we will demo the comparison of one of the traces with the ground truth. We will finish the demo by offering a hands-on experience for the interested users.