Reconciling Experts' Ontologies for the Semantic Web

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1 Motivation

Just as the World Wide Web in its current form has become the defacto medium for sharing information and data resources, the emerging Semantic Web will certainly become the common fabric and the enabling factor for knowledge sharing and collaboration. In addition to (re)using existing knowledge repositories, there will be a need to share and reuse knowledge with several collaborating experts. Ontologies can be the facilitating technology for this purpose. However, it would be necessary to reconcile separately developed ontologies and evolve a consensus among them before the underlying knowledge can be shared or reused.

To illustrate how significant it is to maintain and manage heterogeneity between ontologies, we present 3 interesting scenarios that can contribute to the Semantic Web:

- Participating experts can proffer to *share* or *export* their individual domain conceptualisations so that a consensual ontology can be evolved to enable the sharing/reuse of common knowledge.
- Experts (as well as users) can utilise their personal ontologies to *acquire* required knowledge from diverse sources. *Import* filters and *mapping* mechanisms would enable this whilst preserving the distinct flavours of each expert's/user's individual domain perspectives.
- As experts' conceptualisations vary and evolve over time, ontologies deployed over the Semantic Web can *track* these changes. For instance, we might want to ensure that the latest *version* of consensual knowledge is always available for sharing by all subscribing users.

Hence, to operate in a distributed heterogeneous environment such as the Semantic Web, ontology mismatch management is of vital importance.

2 Experts' Ontologies

Hitherto, most ontologies prevalent today have been constructed as abstractions over existing software artefacts (viz., knowledge bases, database systems, etc.), or built from published/documented reference sources. There is little evidence in the literature on building and managing *experts' ontologies* – inherent conceptualisations elicited directly from human experts. These are quite distinct from the typical *artefact ontologies*. We believe management of experts' ontologies is an important and as yet overlooked issue.

We have constructed a set of ontologies modelled on conceptual structures elicited from several domain experts. Protocols were collected from various experts and analysed from the perspective of both the processes and the domain knowledge to reflect each expert's inherent conceptualisation of the domain. Since background knowledge was also captured from the experts, we are able to take advantage of it to resolve mismatches. Moreover, experts can be invited to intervene and collaborate during the evolution of the consensual ontologies.

We are particularly interested in analysing discrepancies within and among experts' ontologies and have identified a range of ontology mismatches. A systematic approach to the analysis has been developed [Hameed, *et al.*, 2001, 2002], and we are now designing software tools to support the ontology management process.

3 Ontology Management

We have sought to assess the effectiveness of the state-of-the-art in ontology management tools, based on a comparative evaluation and empirical evidence. Key features of prominent tools such as Anchor-PROMPT[1], Chimaera[2], ONION[3], SHOE[4], OntoView[5] were appraised, first with sample ontologies provided by the respective designers, and then with full-fledged ontologies in a common domain that we had constructed from independently elicited knowledge.

After experimenting with these tools, we have obtained a clear understanding of both their strengths and their limitations. An analysis of the limitations has helped us to focus on developing techniques that should address issues/problems that these tools have not yet tackled. An insight into each of their strengths has also enabled us to identify particular algorithms and techniques that are currently best-in-class.

It is envisaged that these tools will be encompassed within a workbench environment – the OntoManager[6], which would be able to employ or at least recommend the most suitable tool/technique that could help resolve a specific type of ontological mismatch or discrepancy.

It is conceivable that when this workbench is deployed in a distributed environment like the Internet, it could provide an innovative and a valuable knowledge management service for the Semantic Web.

References

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