Approximate Ontology Translation and its Application to Regional Information Services

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1 Introduction

Coordination of multiple ontologies is one of the inherent problems for the realization of world-wide knowledge sharing. However, it is difficult to construct or standardize a single ontology for a domain that has some cross-cultural aspects. Regional information is a typical example of this because the cultural differences among multiple regions vary ontologies according to region. Cross-culturality becomes more pervasive in information space, as research on digital cities suggests. It is of course desirable for a user to obtain and publish information based on his or her own ontologies. Therefore, ontology translation is required.

When translating ontologies, a corresponding ontology frequently cannot be found. For example, there may be no corresponding class for Cajun restaurant in a Japanese ontology for restaurants. In such a case, one may use the American restaurant class in the Japanese ontology. An approximation mechanism such as this is required.

2 Approximate Ontology Translation

In order to overcome these problems, we propose an approximate ontology translation framework. In this framework, a query represented in one ontology is reformulated approximately to a query represented in another ontology by using an ontology mapping specification. In our framework, ontology mapping specifications are also represented as ontologies. Ontologies are assumed to be expressed in an ontology language with the same expressive power as DAML+OIL, but one may use multiple ontology languages with an upper-level ontology that relates these ontology languages.

A query is a boolean combination of *Subject-Predicate-Object* triples with allowing variables for *subject* and *object*. Our framework provides specialization and generalization operators for approximate query reformulation. These operators are defined with ontology description primitives such as *subClassOf*, *subPropertyOf*, *domain*, *range*, and so on. Approximated queries are evaluated by closeness metrics [Chang and García-Molina, 2001].

Approximate ontology translation enables users to obtain a subset of correct answers using only specialization operators. For example, suppose there is a description that "wineList" is a sub-property of "drinkMenu" in a ontology mapping specification. A query about a restaurant that has Chardonnay on its "drinkMenu" is reformulated to a query about a restaurant that has Chardonnay on its "wineList."

3 Prototype

We have incorporated the approximate ontology translation framework into the GeoLinkAgent system [Akahani *et al.*, 2002]. In the prototype system, agents coordinate regional information services provided by the GeoLink[1] system, which is used in the Digital City Kyoto prototype. For interoperability and openness, we adopt the Agent Communication Language standardized by the Foundation for Intelligent Physical Agents (FIPA) for inter-agent communication.

The prototype system provides Web search facilities with geographical conditions. The service provided by each information server is described with ontologies. Queries are translated approximately based on service description. Our framework enables agents to delegate requests according to service descriptions.

4 Conclusions

We presented an approximate ontology translation framework. Based on the framework, a prototype system was constructed. This prototype system is being used as a platform for our Real-World-Oriented Information Integration project. In the project, we are developing technologies for integrating real-world sensory information, constructing user models using user-behavioral data from distributed heterogeneous sensors, and providing adequate information user-adaptively. We envision that these technologies will enable us to make our daily activity much more diverse and effective.

References

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[Chang and García-Molina, 2001] K. C.-C. Chang and H. García-Molina. Approximate query mapping: Accounting for translation closeness. *The VLDB Journal*, 10(2-3):155–181, 2001.

[1] http://www.digitalcity.gr.jp/openlab/kyoto/map_guide.html