Chapter 12
Context-Sensitive Ontology Matching in Electronic Business

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ABSTRACT
In today’s global economy, electronic business has offered great advantages to enhance the capabilities of traditional businesses. In order to satisfy the imposed requirement for businesses to coordinate with each other, electronic business partners are chosen to be represented by service agents. These agents need to understand each others’ service descriptions before successful coordination happens. Ontologies developed by service providers to describe their service can render help in this regard. Unfortunately, due to the heterogeneity implicit in independently designed ontologies, distributed agents are bound to face semantic mismatches and/or misunderstandings. This chapter introduces an innovative algorithm, Context-Sensitive Matching, to reconcile heterogeneous ontologies. This algorithm takes into consideration contextual information, via inference through a formal, robust statistical model based on confidence interval. In addition, an Artificial Neural Network is utilized to learning weights for different semantic aspects. At last, an agglomerative clustering algorithm is adopted to generate the final matching results.

INTRODUCTION
A wide range of online business activities for products and/or services are referred to as electronic business, which is increasingly being utilized by many different types of enterprises due to its potential to provide new opportunities and unparalleled efficiencies. In most cases electronic business is associated with buying and selling over the Internet, or conducting transactions involving the transfer of ownership or rights to use goods or services through a computer-mediated network. Broadly speaking, electronic business can be regarded as any business process that relies on an automated information system, which typically incorporates Web-based technologies. Thus, electronic business enables companies to link their internal and external data processing systems in
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a more efficient, effective, and flexible way. As a result, such companies will be more agile and responsive to their customers.

Because of the fact that electronic business is usually conducted using the dynamic environment of the Internet and the World-Wide Web, it is advantageous to introduce software agents into the electronic business area. Considering the two fundamental characteristics of software agents, i.e., autonomy and proactiveness, if services or business partners are represented by agents, it might enable us to increase the extent to which the data process is automated.

Previous research has found that exposing formerly internal activities to external business collaborators can yield increased value. Undoubtedly, there is value in accessing the service provided by a single agent through a semantically well-founded interface; at the same time, greater value is bound to be derived through enabling a flexible composition of electronic businesses, which not only creates new services, but also potentially adds value to existing ones (Singh, & Huhns, 2005). Before the communication and integration of electronic business activities can possibly happen, mutual understanding of semantics for interacting services is an indispensable precondition during such coordination process.

Ontologies serve as a declarative model for the knowledge and capabilities possessed by an agent or of interest to an agent. Not only are ontologies a core technology in the Semantic Web and Web 2.0, but they have also get deeply woven into the modern business world, as indicated by the vast amount of research in Enterprise Engineering and Enterprise Modeling. In essence, ontologies form the foundation upon which machine-understandable service descriptions can possibly be obtained and, as a result, automatic coordination among agents is then made possible. By providing a more comprehensible and formal semantics, the use of and reference to ontologies can help the functionalities and behaviors of agents to be formally and explicitly described, advertised, discovered, and composed. Eventually, each pair of ontology-conforming agents would be able to interoperate, even though it has not been specifically designed to do so.

However, because it is impractical to force all agents to adopt a global, “all-in-one” ontology that describes every concept that is or might be included as part of the services represented by these agents, ontologies from different agents typically have heterogeneous semantics. Due to this inherent characteristic, it is unavoidable for agents to reconcile their individual ontologies and form a mutual understanding before they interact with each other. Only via this means will agents be able to comprehend and/or integrate the information from different sources, and enhance process interoperability thereafter. In other words, during ontology management, of which the matching among heterogeneous ontologies is one of the most critical components, ontologies should be made dynamic, i.e., they should be associated with a certain degree of context-awareness. This being said, clues drawn from context should be taken into consideration during ontology reconciliation, if a more accurate, meaningful matching result is expected. In this chapter, we present an innovative algorithm, Context-Sensitive Matching, to reconcile ontologies from heterogeneous sources.

BACKGROUND

We give a brief review of the state-of-the-art ontology-matching techniques; in particular, we analyze the pros and cons of the existing two categories of matching algorithms: rule-based and learning-based algorithms. In addition, we also present an overview of current research in ontology and context, confidence interval applications, and ontology-based e-services.
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