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A Review of Web Service Recommendation Systems

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Abstract: ***In this paper, we are presenting a literature survey of the modern web service recommendation systems available in the world. Web services are integrated software components for the support of interoperable machine to machine interaction over a network. Web services have been widely employed for building service-oriented applications in both industry and academia in recent years. The number of publicly available Web services is steadily increasing on the Internet. However, this proliferation makes it hard for a user to select a proper Web service among a large amount of service candidates. An inappropriate service selection may cause many problems (e.g., ill-suited performance) to the resulting applications.***

Keywords: Web service, QoS, recommendation, filtering.

1. Introduction

With the proliferation of web services, effective QoS-based approach to service recommendation is becoming more and more important. Although service recommendation has been studied in the recent literature, the performance of existing ones is not satisfactory, since 1) previous approaches fail to consider the QoS variance according to users' locations; and 2) previous recommender systems are all black boxes providing limited information on the performance of the service candidates.

In this paper, we propose a novel collaborative filtering algorithm designed for large-scale web service recommendation. Different from previous work, our approach employs the characteristic of QoS and achieves considerable improvement on the recommendation accuracy. To help service users better understand the rationale of the recommendation and remove some of the mystery, we use a recommendation visualization technique to show how a recommendation is grouped with other choices. Comprehensive experiments are conducted using more than 1.5 million QoS records of real-world web service invocations. The experimental results show the efficiency and effectiveness of our approach.

A Web Services is a method which is used to communicate between two electronic devices over the web. Web Services are a set of methods and functions that are described by a Web Services Description Language (WSDL) and published using Universal Description Discovery and Integration (UDDI). Web Services are becoming a popular technology which brings great economic benefits to people in the development of complex web applications Web services describes a standardized way of integrating Web-based applications using the XML, Simple Object Access Protocol (SOAP), WSDL and UDDI open standards over an Internet protocol backbone. XML is used to tag the data, SOAP is used to transfer the data, WSDL is used for describing the services available and UDDI is used for listing what services are available.

Used primarily as a means for businesses to communicate with each other and with clients, Web services allow organizations to communicate data without intimate knowledge of each other's IT systems behind the firewall.

Web Services Architecture:
The following principles that make the implementation of the web service architecture are as follows:

- **Message Orientation:** Messages only used to communicate between services and messages often have a life beyond a given transmission event.
- **Protocol Composability:** This principle avoids issue of monolithic application through the use of communications protocol that may be used in nearly any combination.
- **Autonomous Services:** These services allows endpoints to be independently built,deployed, managed, versioned, and secured.
- **Managed Transparency:** It makes the endpoints are (and are not) visible to external services.
- **Protocol-based integration:** It is restricting cross-application coupling to wire artifacts only

2. Literature Survey

Surya Nepal et al. (2010) [10] developed a fuzzy based trust management framework for web service. Initially, they developed a data model based on consumer views on QoS attributes that evaluates the reputation of services. Secondly, they proposed the fuzzy based linguistic query model to parse the requested query to evaluate by different query processing algorithm. They have not addressed some issues such as trust bootstrapping, propagation, retaliation, reciprocation and dishonest or biased ratings. Priority based trust (PB) model presented in [11] for service selection in general service oriented environments. It follows Reputation based and Trusted Third Party approach. It overcomes the limitations of Certified Reputation Model. PBTrust model is also getting consumer expectation on trust for individual service attribute. Honest agent can give the feedback and ask other participants in same domain about the services. The reliability of the service is calculated as average of all the feedbacks from participants [13]. The consumer may give the dishonest about the service to make the reputation value

to be decreased. When the trust management center found this dishonest feedback, punishment can be given to the consumer [12]. Mangling Zhu et al. (2006) [13] designed the social rules on describing the trust relationship between the provider and consumer in the open environments. Self Confidence Rule which rate the self confident of service provider about their providing services. Persistence Rule says that a service provider should be persistent to their goals to achieve better performance. Honest Rule analyze whether service provider is trustworthy in their commitments. Motivation Rule checks for motivation in providing services. Reliance Rule estimates the trust from the reliability of service provider. If an agent was unreliable at previous transactions with a consumer.

The Semantic Web [1] [2] enables greater access not only to content, but also to services on the Web [3]. The objective of the semantic Web is to make possible the processing of Web information by machines (computers) and the efforts are on towards the creation of semantic Web. Semantic Web research community has developed standards such as the Resource Description Framework (RDF) [4] and the Web Ontology Language (OWL) [5] to enable the Web for sharing both documents and data with easier and reliable search and reuse of information [1]. The Web services are autonomous, self describing and self contained applications that are accessible over the Internet. The semantic Web should enable greater access not only to content but also to services on the Web i.e. semantic Web should enable users and software agents to locate, select, employ, compose and monitor Web-based services offering particular services and having specific properties with a high degree of automation. The use of semantic Web concepts to Web services technology build *semantic Web services* [6] which bring the semantics to Web services. Semantic Web services promise to add automation and dynamics to current Web service technologies, considerably reducing the effort required to integrate applications, businesses and customers [7]. The automation is achieved by providing formal descriptions of requests and service advertisements that can be exploited to automate several tasks in the Web services usage process, including dynamic discovery of services. WSDL-S [8], OWL-S [9] and WSMO [1] are the three major approaches to describe the semantics of Web services.

OWL-S [8] is ontology of services with three interrelated sub-ontologies known as the profile, process model and grounding. The profile is used to express "what the service provides" for the purpose of advertising, building service requests and service matching. The profile is used almost exclusively as an advertisement/request. The process model in OWL-S defines the exchange of messages with a service provider about a service and also defines how a service provider implements the functionality of a service as a process of component Web services [10]. Automatic Web service discovery involves automatically locating Web services that provide a particular service and that adhere to requested properties [3]. With semantic markup of Web services, the requester can specify the information necessary for Web service discovery as computer interpretable semantic markup. Furthermore many service providers publish their services by advertising the service capabilities. The service discovery engine can be used to match the requirements of a requester against advertised capabilities of many service providers [11]. In such a case, several services with similar properties, capabilities, interfaces and effects are yielded by the discovery process. To pick one from such similar services that matches the requester's requirements is a difficult task and it necessitates the use of an intelligent decision making framework. In literature, the semantic Web service selection is made based on nonfunctional properties like Quality of Service (QoS) [12] [11] [13] [14] and Usability [15]. So far no work has been done towards the discovery and selection of semantic Web services based on the service provider's business offerings.

3. Conclusions

In this paper, we have presented a review of the web service recommendation system. The working of each web service recommendation is discussed in brief. The Dynamic Web Service Selection Framework has a recommendation system, which recommends the best service satisfying the users requirements. When a user uses a web service, it asks user to rate a web service; so that users can help each other to get a better web service. This is especially important when there are more than one web services which have same functionality but their quality of service is different. Web service with better quality of service will get more rating than other service which offers same functionality but poor service quality.

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