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Web Services Recommendation Leveraging Semantic Similarity Computing

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Abstract

With the popularity of Web services adopted for supporting domain applications, recommending and composing appropriate services with respect to user requirements is a challenge. This paper proposes a dynamic programming and variable length genetic algorithm for the recommendation and composition of Web services. Generally, starting and ending services are determined leveraging the constructed service network model. Based on which, services are selected and composed, such that these services should be more appropriate on satisfying users' requirements.Experimental evaluation result shows that our technique is effective and can improve the accuracy of service recommendation.

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1. Introduction

With the rapid development and widespread adaptation of Web services in various domains [1], applications can be implemented as Web service compositions, and these services can be invoked through the Internet. In recent years, a number of open standards have been developed, such as Web Map Service, Web Feature Service, Web Coverage Service, Web Process Service and Service Observation Service [2, 3]. They greatly improve the efficiency of geospatial information acquisition, and promote the development of Open Geospatial Consortium (OGC) and Open Web Services (OWS).[4, 5]Web service clustering, discovery and composition techniques [6] are increasingly mature, where clustering techniques are adopted mostly for grouping services into different categories. Besides, to satisfy the specific requirement of different users, these methods implement the task of discovering and composing complementary services. In the process of service composition, the core is to check services which can be combined into a work sequence. Generally speaking, service composition is a knowledge-intensive task. Furthermore, service fragments im-

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plements the service composition process, instead of rediscovering the relationship between services for each service composition requirement. In recent years, researchers in the field of service computing have investigated the relationship between a large number of Web services. At the same time, the wide use of the identified service composition fragments has greatly improved the reuse of services. The strategy is to discover the invoke relationship or execution state between Web services from event logs, then construct service network model, and check the structural or social features of the network, finally propose solutions to solve problems. At present, there are some ontological methods about how to provide a reasonable sequence, but some domains do not exist ontology. Therefore, we need an effective recommendation mechanism to facilitate our service composition using the discovered service fragments.

In the field of service computing, there are two kinds of techniques related to our method. One is sub fragment discovery [7, 8, 9], and the other is sub segment recommendation [10, 11, 12]. Typically, a separate OGC Web services provides a simple function. In order to achieve relatively complex tasks, a number of services need to be combined, and build a processing workflow to satisfy user requirement. In the field of service computing, service composition has been extensively studied. At the same time, the exploration of service composition promotes the combination of OGC Web services and the interaction between them. In addition, Earth Cube Community has designed the available road map for the workflow of Earth Sciences, and suggested that workflow should be applied to solve complex computation that have many steps or large amounts of data. The workflow system helps scientists to choose the appropriate model and defines the appropriate parameters for proper and efficient operations. The workflow system assists scientists in choosing the right model and configuring the appropriate parameters for proper and efficient operation. The main contribution of this work can be presented as follows:

- Service network model is constructed through computing the semantic similarity between operations. Starting and ending states are determined according to text descriptions of certain user requirements.
- An improved variable length genetic algorithm is developed for composing and recommending services. This technique is compared with the dynamic programming algorithm, and the result shows that out technique is better in performance.

The remainder of this paper is organized as follows. Section 2 introduces the preliminaries. Section 3 explains how to construct a workflow network model. Section 4 presents the user requirements identification and two different service recommendation methods. Section 5 demonstrates evaluation results. Section 6 discusses related works. Finally, Section 7 concludes the paper.

2. Preliminaries

2.1. Concept Definition

Definition 2.1 (*Web Service*). *A web service ws is a tuple (nm, op), where*

- *nm is the name of web service.*
- *op is the operation of web service.*

Typically, each web service consists of its name and service operations, and some web services may contain multiple operations.

Definition 2.2 (*Operation*). *A operation op is a tuple (nm, dsc, inp, outp, time, location), where*

- *nm is the of operation.*
- *dsc is the description of operation.*
- *inp is the input parameter of operation.*
- *outp is the output parameter of operation.*
- *time is the time information of operation.*
- *location is the spatial information of operation.*

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