Expert Systems with Applications 42 (2015) 2798–2807

Contents lists available at ScienceDirect

Expert Systems with Applications

journal homepage: www.elsevier.com/locate/eswa

An adaptive collaboration evaluation model and its algorithm oriented to multi-domain location-based services

Mingjun Xin *, Manli Lu, Weimin Li

School of Computer Science and Engineering, Shanghai University, Shanghai 200444, China

ARTICLE INFO

Article history:
Available online 4 November 2014

Keywords:
Location-based services
Composite evaluation
Quality of Service
User preferences
Collaboration evaluation algorithm

ABSTRACT

With the rapid development of communication technology and mobile Internet, masses of location-based services which can meet users' requirements are appearing explosively. So the problem that how to select the personalized service with the best quality, which satisfies the requirement of different users, is becoming the research hot spot under mobile Internet environment.

As the different QoS of each LBS sequence, it is reasonable to rank all candidate services and then get the best one. In this paper, to solve how to evaluate the LBS sequence service effectively and accurately, first of all, it organizes services which meet the requirement of users according to their location information, the geographic information and preference information. Then, it designs an adaptive control mechanism and select strategy to choose a suitable collaboration evaluation method for the current composition service. And the LBS composition optimization process is presented, which is mainly to find and acquire the appropriate LBS sequences based on user's local QoS constraints. Furthermore, it establishes a collaboration evaluation model to choose the suitable evaluation method for different cases. Finally, the collaboration evaluation method to measure the LBS sequences based on QoS indexes is adopted, which can get the service scheme with globe QoS optimum for different users. These above procedures accomplish the evaluation for location-based services, which can satisfy user preferences efficiently.

© 2014 Published by Elsevier Ltd.

1. Introduction

With the rapid development of wireless communication technology and smart mobile terminal, location-based services (LBS) have been widely applied in almost every field of the social life (Tang, Xu, & Shen, 2012). The value-added service can get user's current time, place and the environment by using the mobile location technology. Then the mobile terminal provides relevant services with user's location-related information. Different from traditional web services, LBS can satisfy user's personalized demand based on their location information with real-time and local position. So the kind of location-based service brings more convenience to users during the daily life.

The multi-domain services are such as restaurant, movie, traffic, hotel, and so on. Each of the filed has a huge number of atom services. While a single service often cannot meet the requirement for different users, it is necessary to combine the atom services (Zhang, Dou, & Chen, 2013). We can get the service sequences with high and powerful function, through the process that combine the small granularity services to large granularity. As different users have different requirements on service quality (Xiong, Luo, Song, & Jin, 2011), an ideal service system will provide different composition services based on user preferences.

Service description, service discovery, service composition, service selection and service evaluation are the key technologies in service system research. QoS (Quality of Service) evaluation directly affects the success or failure of service selection and service composition. So as the most important step in service recommendation, the research of evaluation has become an indispensable part in the service system. Nowadays, the study of uncertainty and correlation about non-functional attributes is very little in the field of LBS research. What is more, the traditional evaluation methods cannot deal with the relationship between space factor and time factor when considering the impact on individual user. In addition, it is more complex to define and calculate the QoS attributes of LBS than traditional web service, so it is not enough to evaluate the quality of LBS with only one method. It needs to combine the methods to complete the evaluation of LBS. Since there are a lot of evaluation methods, how to choose an evaluation method for specific cases is an issue to be solved. For a given service composition method, different evaluation methods will

* Corresponding author.

http://dx.doi.org/10.1016/j.eswa.2014.10.014
0957-4174/© 2014 Published by Elsevier Ltd.

cause different results. There is not a uniform evaluation criterion for a variety of web services. So it is essential to design a unified and standardized evaluation mechanism. In this paper the mechanism can adaptively give a relevant strategy and establish an appropriate evaluation model for a given collaborative service and then complete the process of evaluation based on QoS.

In this paper, Section 2 gives related work about service evaluation. Section 3 describes the framework of service collaboration evaluation, and puts forward an adaptive evaluation mechanism for LBS. Section 4 discusses the algorithm of service evaluation and describes the process with pseudo codes. A prototype evaluation system to verify the proposed algorithm is realized in Section 5. Finally conclusion and comments on future work are given in Section 6.

2. Related work

In the mobile Internet, we hope that we can get the accurate information or service quickly at any time, any place through a wireless network. The service is called service-based location. Gediminas Adomavicius & Tuzhilin, 2011 sort four types of context that in mobile service environment: physical context, social context, interaction media context, and modal context. Jia & Yi, 2013 discuss what is context-aware information, how to use context-aware information providing intelligent and useful recommender commodity or service in mobile environment.

Current researches present much focus on service composition methods (Dustdar & Schreiner, 2005; Fu, Liu, & Jin, 2007). When combining smaller number of services, most of the methods can achieve good results. But when there are a large number of services, it will take such a long time to combination that customer cannot endure. To select atom service to a composition service scheme, Xia, Cheng, Chen, Meng, & Liu, 2012 puts forward an algorithm named Multi-pheromone and Dynamically Updating Ant Colony Optimization Algorithm, which includes global optimizing algorithm and local optimizing algorithm.

There are three ways commonly used to evaluate the composition services, which are based on customer's satisfaction, credibility, and Quality of Service (QoS) separately. QoS describes the ability of location-based services to meet consumer's demand. The quality of LBS can be described in many ways, such as response time, cost, distance, reliability, availability, and so on.

With prevalence and convenience of network services, the Quality of Service (QoS) has become one of the biggest concerns for Internet Service Provider (Sha, Yu, Zhang, & Wu, 2010). In service selection, user often has personal preferences imposing on a candidate service's non-functional properties. A QoS-aware service evaluation method is presented for a shared service's co-selection taking advantage of AHP theory in Wanchun, Chao, Xuyun, & Chen, 2011. A novel architecture and reputation appraisal model to monitor, store and evaluate the physical usage and post-condition of requested web services in a requester-located network is proposed(Lo & Wang, 2007). But these models result cannot understand easily by user. Furthermore, most existing methods are proposed for the single request condition without considering the overload of web services (Liang, Zou, Guo, Yang, & Lin, 2013). In our paper, the problem will be solved by combining ant colony algorithm and Fuzzy Evaluation Algorithm. Askaroglu & Senkul, 2012 aims to keep track of web services in terms of QoS parameters and to generate QoS values automatically. In our paper, QoS data is got from users' history evaluation score, which is persuasiveness on personal preference.

Comprehensive Evaluation method is various. But for a particular LBS composition pattern which is related to the location context, it is not applicable with any one method. This paper will give the framework of service evaluation, use CBR (case-based reasoning) strategy to select an appropriate evaluation method dynamically, and come up with the collaboration evaluation algorithm to achieve the ranking of LBS sequences as well (Xin, Jiang, Liu, & Niu, 2013). The process of LBS service QoS evaluation includes three steps, which are establishing nonfunctional attributes system, getting the value of QoS and calculating comprehensive value.

3. Modeling of collaboration evaluation for LBS

3.1. Framework of service collaboration evaluation

The framework Fig. 1 proposed in this paper can be divided into three modules. The first part is service organization and description. It organizes and aggregates related web services for user to find and choose, according to the current location and preferences. The second part is composition service matching and optimization module, which can ensure the accuracy of the composition services result and estimate whether the services can meet the function of the user's requirements or not. After that, it uses a collaboration optimization method to select several composition service sequences with user QoS constraint. The third part is service evaluation module. The process is mainly designed to choose a suitable collaboration evaluation method and calculating quality of LBS which has been optimized in the second part. The goal is to ensure that users can get the most satisfactory composition service sequences.

(1) **Service sequence classification:** To solve service's mass problem and cold-start problem, it uses the classification description technology to classify the multi-domain location services. It computes the similarity of services and sorts the result of matching between LBS and user request. Then, it judges the user requirement category and gets the correct location service quickly and easily, to improve user search experience sense.
(2) **LBS case matching:** The three case libraries in above figure can be separately named as Composition Library, Evaluation Library and Evaluation Strategy Library. The suitable case and its corresponding method are selected by retrieving Composition Library and Evaluation Library. Then, the matching cases are put into Evaluation Strategy Library for next selection. The fusion of many libraries is used for case matching and implements strategy of sharing.
(3) **Composition service optimization:** The composition of LBS is composed by multi-domain specific atom service. This part is to select the personalized services with higher quality. In this paper, it adopts swarm intelligence algorithm such as the ant colony algorithm to find the paths with higher QoS. The composition service sequences are satisfied with the user's function and preference requirement.
(4) **Evaluation and sorting:** The input of evaluation is the output of composition optimization, which is the candidate composition scheme for LBS. The process establishes the QoS model and gets the user's historical QoS score data to evaluate the candidate schemes and get the ranking result. Finally the best one scheme is chosen and recommended to the user.

3.2. LBS services organization and description

About the research of finding services, the OWL form is used to describe LBS and user requests. Service description is an interface standard between service provider and requester. It is the founda-

Download English Version:

https://daneshyari.com/en/article/382873

Download Persian Version:

https://daneshyari.com/article/382873

Daneshyari.com