

Service Recommendation and Visualization System Based on SOM Methodology



Engineering

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ABSTRACT

The proposed system consists of two phases. The first phase is region creation, which deals about divide web users into different regions based on their location and historical user QoS experience on web services. Second phase finds the similar users for the current user and make QoS prediction for the unused services. First phase have three step process, they are Region feature extraction, region similarity calculation and region aggregation. In the second phase, predict the QoS value for active users based on their regions and the final service recommendations are put on a map to reveal the underlying structure of QoS space and help users accept the recommendations. Though the existing system provides result but it doesn't provide more user interactions. Thus proposed system builds the user interactions as searching web services on the QoS map (like Google map), able to zooming in and zooming out.

INTRODUCTION

Web Service

Web service, a software system designed to support interoperable machine-to-machine interaction over a network, is of great importance in Service Oriented Architecture (SOA). Web service discovery has been extensively studied, which mainly deals with functional properties, i.e., locating services that can meet a specified functional description.

However, due to the large amount of services with identical or similar functionalities, users will be overwhelmed by the candidates. While web service discovery alone cannot tackle this problem, effective approaches to web service selection and recommendation have become more necessary, which is a key issue in the field of service computing. With respect to the distributed and dynamic nature of web services, user preferences and more service properties should be considered in the phase of service selection.

Quality of Service

Quality of Service (QoS) is a set of properties including response time, price, reputation, correctness, etc. However, it's not practical for a consumer to acquire the comprehensive QoS information of each candidate service from his friends, nor to evaluate them by himself, since it is time-consuming, and some properties are hard to measure through several web service invocations, such as reputation and reliability. Several works has been done to apply collaborative filtering (CF) in web service recommendation. In these approaches, QoS values are predicted for an active user based on the QoS records provided by users who have similar historical QoS experiences on some web services. However, they failed to recognize the characteristics of QoS. According to our observation, QoS, regarded as a set of user perceived properties, highly relates to users' physical locations.

SOM methodology

A self-organizing map (SOM) or self-organizing feature map (SOFM) is a type of artificial neural network (ANN) that is trained using unsupervised learning to produce a low-dimensional (typically two-dimensional), discretized representation of the input space of the training samples, called a map. Self-organizing maps are different from other artificial neural networks in the sense that they use a neighborhood function to preserve the topological properties of the input space. This makes SOMs useful for visualizing low-dimensional views of high-dimensional data, akin to multidimensional scaling. The model was first described as an artificial neural network by the Finnish professor TeuvoKohonen, and is sometimes called a Kohonen map [7] [9].

A self-organizing map consists of components called nodes or neurons. Associated with each node is a weight vector of the

same dimension as the input data vectors and a position in the map space. The usual arrangement of nodes is a two-dimensional regular spacing in a hexagonal or rectangular grid. The self-organizing map describes a mapping from a higher dimensional input space to a lower dimensional map space. The procedure for placing a vector from data space onto the map is to find the node with the closest (smallest distance metric) weight vector to the data space vector [1] [6].

Recommendation Methods

In this section, it presents an online service searching scenario to show the research problem of this paper [14]. As Figure depicts, Alice is a software engineer working in India. She needs an email validation service to filter emails. After searching a service registry located in US, she gets a list of recommended services in ascending order of the service average response time. Alice tries the first two services provided by a Canadian company and finds that the response time is much higher than her expectation.

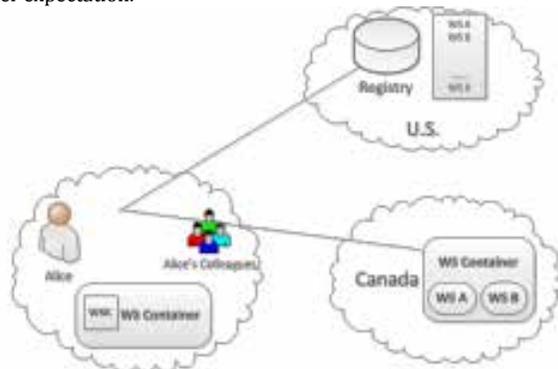


Figure 1: Alice's situational problem

She then realizes that the service ranking is based on the evaluation conducted by the registry in US, and the response time of the same service may vary greatly due to the different user context, such as user location, user network conditions, etc. Alice then turns to her colleagues in India for suggestion. They suggest her try service k provided by a local company though ranked lower than the previous recommendation list. After trying it, Alice thinks that service k has a good performance and satisfies her requirements.

The problem that Alice faces is to find a service that meets both functional and non-functional requirements. The current way of finding a suitable web service is rather inefficient, since Alice needs to try the recommended services one by one. To address this challenge, it proposes a more accurate approach to service recommendation with consideration of the region factor. More-

over, that try to provide a more informative and user-friendly interface for browsing the recommendation results rather than a ranked list. By this way, users are able to know more about the overall performance of the recommended services, and thus trust the recommendations [11] [14].

AVAILABLE SOLUTIONS

The abundance of Web services on the World Wide Web increase, designing effective approaches for Web service selection and recommendation has become more and more important. Web service recommender system, to attack this crucial problem, WSRec (Web Service Recommendation) includes a user-contribution mechanism for Web service QoS information collection and an effective and novel hybrid collaborative filtering algorithm for Web service QoS value prediction. WSRec is implemented by Java language and deployed to the real-world environment. To study the prediction performance, A total of 21,197 public Web services are obtained from the Internet and a large-scale real-world experiment is conducted, where more than 1.5 million test results are collected from 150 service users in different countries on 100 publicly available Web services located all over the world [4] [13]. The comprehensive experimental analysis shows that WSRec achieves better prediction accuracy than other approaches.

So that several approaches to web service selection and recommendation via collaborative filtering have been studied but seldom have these studies considered the difference between web service recommendation and product recommendation used in e-commerce sites. RegionKNN is a novel hybrid collaborative filtering algorithm that is designed for large scale web service recommendation. Different from other approaches, this method employs the characteristics of QoS by building an efficient region model. Based on this model, web service recommendations will be generated quickly by using modified memory-based collaborative filtering algorithm. Experimental results demonstrate that apart from being highly scalable, RegionKNN provides considerable improvement on the recommendation accuracy by comparing with other well-known collaborative filtering algorithms [7] [11].

The Web has undergone a tremendous change toward a highly user-centric environment. Millions of users can participate and collaborate for their own interests and benefits. Services computing paradigm together with the proliferation of Web services have created great potential opportunities for the users, also known as service consumers, to produce value-added services by means of service discovery and composition. They show an efficient approach to facilitating the service consumer on discovering Web services. First, they analyse the service discovery requirements from the service consumer's perspective and outline a conceptual model of homogeneous Web service communities [10].

The self-organizing map (SOM) is a powerful method for visualization, cluster extraction, and data mining. It has been used successfully for data of high dimensionality and complexity where traditional methods may often be insufficient. In order to analyse data structure and capture cluster boundaries from the SOM, one common approach is to represent the SOM's knowledge by visualization methods. Different aspects of the information learned by the SOM are presented by existing methods, but data topology, which is present in the SOM's knowledge, is greatly underutilized. The data topology can be integrated into the visualization of the SOM and thereby provide a more elaborate view of the cluster structure than existing schemes. This new visualization, CONNvis, also shows both forward and backward topology violations along with the severity of forward ones, which indicate the quality of the SOM learning and the data complexity [9].

RECOMMENDATION AND VISUALIZATION APPROACH:

In Service recommendation and visualization based on SOM methodology which processed splitting it into two phases. The two phases are namely Recommendation approach and Visualization technique. For recommendation approach already we

have discussed about it in the introduction part using one experimental scenario as a software engineer Alice faces some problem to getting e-mail validation. In recommendation approach we discuss about region creation and QoS value prediction and the visualization technique which presenting the self-organizing mapping (SOM) methodology.

RECOMMENDATION APPROACH

Region Creation

In region creation we need to collect group of QoS records for different users and different services, using that we can collect the QoS record based on user's physical location and QoS property because it is hard to find the similar user's based on useless knowledge. In this process we can easily obtain the QoS value by taking the response time and availability. For calculating the QoS record we want to find out RTT (round-trip time) and assume that there are n users and m services. In region creation process is processed by three step process they are region feature extraction, region similarity computation and region aggregation.

Region Feature Extraction:

In region feature extraction for each region we use region center as the main feature to obtained service by the users. Using the RTT value here it find the median and using that the region center in created and the region center act as average factor for the services which used by users. After that also we face some unstable performance by creating median and MAD (median absolute deviation) MAD is defined as the median of the absolute deviations from the sample's median

After calculated the median and MAD value the two estimators which produce and the region feature extraction which defines the three definition for the region feature extraction they are region-sensitive service, region sensitivity and sensitive region [1] [14].

Region Similarity Computation:

Determining whether two regions is similar or not, for that Pearson Correlation Coefficient (PCC) is mostly used in the recommendation system. Normally the PCC values differ from -1 to 1, so that the positive PCC value indicates the region having similar preference and the negative PCC value indicates the regions having opposite similarities and consider if M and N are different regions.

Using the above formulae where $S(n)$ $S(m)$ is the set of coinvoled by users from region M and N , but the PCC only considers the RTT difference of the both regions [14].

Region Aggregation

The each region formed by user's physical location at the out-set always have very sparse QoS data set, since users only use a small number of services and provide limited QoS records. For this case it is difficult to find similar users and predict the QoS values of unused web propose for the active user. For solving this issue by using one algorithm namely bottom-up hierarchical clustering algorithm, the input is a set of regions r_1, \dots, r_l . This algorithm aggregates pairs of the most similar nonsensitive regions until the stopping state, the algorithm with aggregate using two steps initialization and aggregation [14].

QoS Value Prediction

After the phase of region aggregation the many number of users are clustered to certain number of regions according to their physical location and historical QoS similarities. In this the service experience of user is represented by region center. In small amount of users QoS data it is easy to found the neighbors and make prediction among them is computer quickly, but traditional QoS method with need to search entire data set which is rather insufficient. So that in this method we find the similarity between active users and users in region computed by find the similarity active users and region center [4] [14]. And it is reasonable to predict the QoS value for active users based on their regions, for users in the same region are more likely to have similar QoS experience on the same web service, especially on those region-sensitive ones.

VISUALIZATION APPROACH

For visualization technique we using the Self-Organising mapping (SOM) which already discussed in the introduction part and mapping this SOM using the highly recommended QoS value showing the majority part for that recommended region or service. And this method add more user interactions such as searching web services on the QoS map, zooming in and zooming out. Graphic map like google map will be combined to help users for navigation [6] [7] [13].



Figure 2: Visualization through map

CONCLUSION

The proposed system provides a recommendation and visualization service which based on mapping which make easy to find the most recommended service in map based on the location provided by self-organizing mapping method.

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