Enhance Scalability of Location-Aware Web Service Recommendation Using EM Algorithm

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Abstract— **Web services are generally looked as incorporated software program components for the purpose of supporting the associated functional machine-to-machine interaction throughout multilevel internet network products and services which have been broadly applied intended for developing service-oriented programs in enterprise as well as academia lately. The amount of in public available web services is steady increasing on the internet. However we should mention, this proliferation makes it hard for a user to pick a correct web service among a large amount of service candidates. An unsuitable and inappropriate service selection could cause several issues (e.g., ill-suited performance) to the resulting apps. In this report we would like to suggest a distinctive collaborative filtering-based web service recommender program to steer applicants opt for products and services having the best possible Quality-of-Service efficiency. Our recommender program utilizes the venue information as well as High quality of Services values in order to cluster customers along with providers in addition to creating customized suggested program pertaining to customers with clustering outcomes. In comparison with current programs and suggested techniques our approach accomplishes an outstanding enhancement about the recommended accuracy. Comprehensive experiments are conducted involving over one and half million Quality of Service records of real web services to demonstrate the effectiveness of our approach.**

Index Terms— **Recommendation, Web service, Collaborative filtering, Quality of Service, Expectation Maximization.**

I. Introduction

Web services are utilized pertaining to machine-to-machine interaction over a system. Web services utilized WSDL Web Program Outline Language intended for user interface outline as well as SOAP Simple Object Access Protocol for alternate structured data web services tend to be mostly utilized by both enterprise as well as particular developers intended for constructing web service applications. Whenever a developer develop any kind of services which is application oriented, the initial phase would be to design the business enterprise procedure featuring a specification. Nowadays many developers lookup internet services determined by some public websites for instance Google developers, Yahoo, Programmable webs and so forth. However, none of them provide location-based QoS info for users. Such info is quite vital for software deployment particularly when trade compliance is concerned. Some web services are solely available in EU, therefore software using these services are not able to be shipped to different countries. Without knowledge of those things, deployment of service-oriented software is at great risk. Since choosing a top quality web service among an oversized range of candidates is a non-trivial task, some developers interested to implement their own services instead of publicly available, where incurs extra overhead in both time and resource. Using an inappropriate service, on the other hand, might add potential risk to the business process. Therefore, effective approaches to service selection and recommendation are in a pressing requirement, which might facilitate service users cut back risk and deliver high-quality business processes. In this paper Quality of Service is defined as a collection of properties including response time, availability. Among these QoS properties, values of some properties (e.g., response time, user-observed availability, etc.) ought to be measured at the client-side [12]. it is impractical to amass such QoS info from service providers, since these QoS values are liable to the unsure internet environment also user context such as user location, user network condition, etc. Therefore, totally different users could observe quite different QoS values of the same web service. In different words, QoS values evaluated by one user can not be utilized directly by another for service selection. it's also impractical for users to amass QoS info by evaluating all service candidates by themselves, since conducting world web service invocations is time consuming and resource-consuming. Moreover, some QoS properties (e.g., reliability) are tough to be evaluated as long-duration observation is needed. To attack this challenge, this paper investigates personalised QoS value prediction for service users by using the available past user experiences of web services from totally different users. Our approach needs no additional web service invocations. based on the expected QoS web services values, personalised Aware-QoS web service recommendations is created to help users select the best service among the functionally equivalent ones. using a large range of real-world service QoS data collected from totally different locations, we discover that the user observed web service QoS performance has sturdy correlation to the locations of users. Google Transparency Report has similar observation on Google services. To boost the prediction accuracy, we are going to propose an Aware-Location web service recommender system which we call it LoRec, LoRec employs QoS web service values and user locations for creating personalised QoS prediction. Users of LoRec share their past usage experience of web services. in return, The system provides personalised service recommendations to them. LoRec initial collects user observed QoS records of various web services and so group of users who have similar QoS observations together to get recommendations. Location info is also considered once clustering users and services. The main contributions of our work are :

- We propose a unique Aware-Location web service recommendation approach by using EM Algorithm in order to extend the existing approach, which considerably improves the recommendation accuracy and time quality compared with existing service recommendation algorithms.
- We conduct comprehensive experiments in order to evaluate our approach by using a real-world web service QoS information set. Over one and half millions real-world web service QoS records from over twenty countries are engaged in our experiments.Procedure for Paper Submission

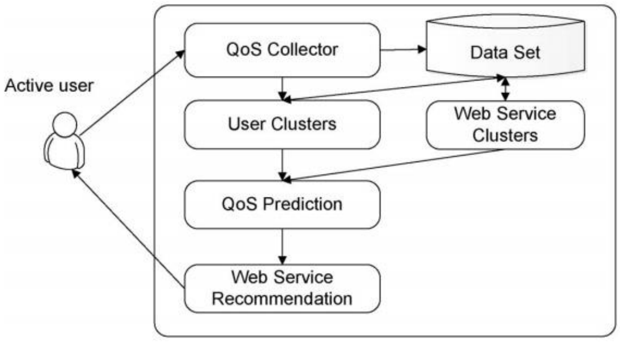


Fig.1: Overview of Existing System (LoRec)

II. INTRODUCTION EM ALGORITHM

The EM (Expectation Maximization) arises in several computational biology apps that involve probabilistic models. The EM is a terribly general iterative algorithm for parameter estimation by maximum Probability (likelihood) when a number of the random variables Concerned do not seem to be observed i.e., considered incomplete or missing. The Expectation Maximization Algorithm formalizes an intuitive plan for getting parameter estimates when a number of the data are missing:

i. Replace missing values by calculated values.
ii. Estimate Parameters.
iii. Repeat

Step-i using calculated parameter values as true values. Step-ii using calculated values as observed" values, iterating till convergence. This plan has been in use for several years before Orchard and Woodbury (1972) in their missing info principle provided the theoretical type foundation of the underlying idea. Expectation and maximization algorithm is an algorithm which maximizes the parameter value so as to find the hidden or near come value by comparing the unknown data with the know parameter.

EM algorithm uses log-maximum likelihood and maximum a-posterior method. It gives the value before and after the operation or computation. And then compare which is more accurate or near by the expected value.

Maximum likelihood:

Suppose we have a coin, head and tail. So according to the class distributed we will have the values

Class A- H H T T H H head-70%, tail-30%

Class B- T T H T T T head-80%, tail-20%

So by applying a simple logic we will conclude that in class A the priority of head is more similarly in class B of tail. Thus maximum likelihood only gives the abstract method to determine the event.

EM algorithm consists of two steps: Expectation and maximization. In first i.e. expectation we guess the hidden variable do not know based on expected probability. So if we know the complete value our dataset will be completed. Using log-maximum likelihood. In second we then give the weight of each component in the dataset. And thus this process is iteratively done when we get the maximum value of the variable.

III. PROPOSED SYSTEM

The researcher intend to suggest collaborative filtering-based program recommender process so as to support customers choose products and services having greatest Quality-of-Service (QoS) efficiency by utilizing EM method seeing that our contribution. Current recommender process utilizes the placement detailed data as well as High quality associated with the Services ideals for clustering customers along with providers which tends to make customized a service recommendation pertaining to consumers in line with outcomes. We tend to use a location-aware web service recommender system (named LoRec), that employs each web service QoS values and user locations for creating personalized QoS prediction.

Users of our system share their whole usage experience of web services in past, and in return, the system put out personalized service recommendations to them. at the beginning, LoRec collects user observed QoS records of various web services so group of users who possess similar QoS observations together in order to generate recommendations. Location data is also considered once clustering users and services.

Username	Location	S 1	S 2	S 3	S 4	S 5	S 6	S 7
Alex	India, In	20000		2000				2800
Bob	Houston, US	600	3300		3300	2000		
Caroline	Houston, US	650	2600	200				
Dave	Houston, US	620	2500	2000	500		2000	
Hasan	Hong Kong, CN	1000	2500	2000	5000		2400	
Raju	California, US	2500	3500		4000		1000	1500
Victor	India, In	1700		900		1850		1300

Table.1: Example of LoRec Data Storage

In this contribution, a recommendation associated with web services will be based upon the particular Quality-of-Service (QoS) records. QoS is described as an accumulation of attributes including response period, accessibility and so forth. QoS is employed in order to signify the actual attributes associated with web products and services, additionally it is viewed as a vital element in web service assortment process. This specific report concentrates on the expected QoS ideals associated with web products and services.

The user who will share their experiences of web services based on the QoS values which we call it "Training-User". User as a training user is who wants to get web service recommendation which we call it "Active-User".

First user login into LoRec system and Training user will submit their past web service usage experience with QoS records. Active user also gives an input in LoRec system with expected QOS values. The Collaborative Filtering (CF) algorithm is used to create cluster or group based on IP address i.e. Location. Based on cluster finding the mean and median values using MAE (Mean Absolute Error) approach. Recommendation algorithm consists of 3 steps:

1. User Region Creation: Cluster will be formed based on the location, and Recommendation will also compute based on cluster. i.e. User region (location).
2. Service Region Creation: Recommendation will compute based on web services.
3. QoS Recommendation & Prediction: Searching neighbor and making web service QoS prediction for an Active user.

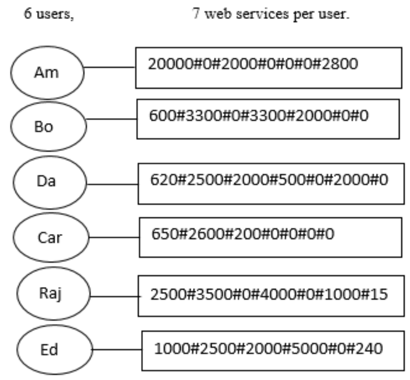
In short, if Training data & test data matched to each other exactly then there is better prediction, else find nearest values .Recommendation service result is based on similar QoS values.

In enhancement of future work, actually we have implemented another Clustering method that is EM clustering algorithm. EM stands for Expectation-Maximization.

In this algorithm, clustering is done based on mean, median & standard deviation. This algorithm is also called an iterative algorithm. It is also used when some parameters are missing. EM is nothing but alternate steps of guessing a probability computation (known as E-step), Probability or Expectation is computed based on the re-estimation of guessing values (known as M-step). By using EM clustering algorithm, improve our proposed LoRec approach.

IV. IMPLEMENTATION RESULTS

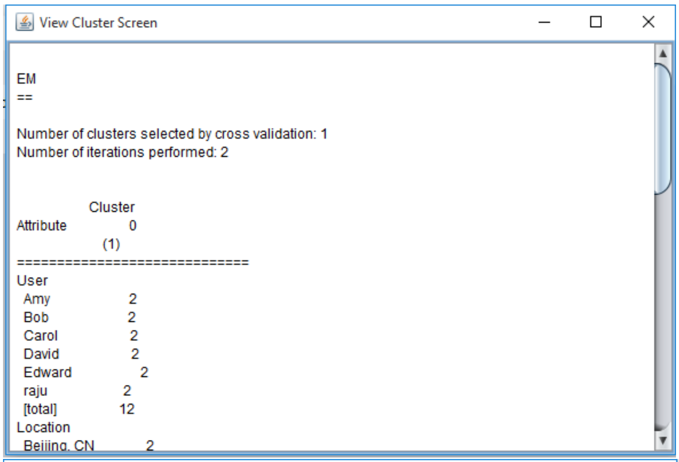
Maximum likelihood In LoRec Table:



Users	QOS values (G=QOS>=2000, L=QOS<2000) where, G=greater, L=Lower
Amy	2G, 1L
Bob	3G, 1L
Carol	1G, 2L
David	3G, 2L
Edward	4G, 1L
Raju	3G, 2L
Total	16G, 9L

Fig.2: EM algorithm in our implementation

Maximum Likelihood Formula:
Amy = {(total no. of Greater value of Amy) / (total no. of Greater value of Amy) + (total no. of Lower value of Amy)}
That is: Maximum likelihood (M) = (16/ 16+9) =~ 0.64



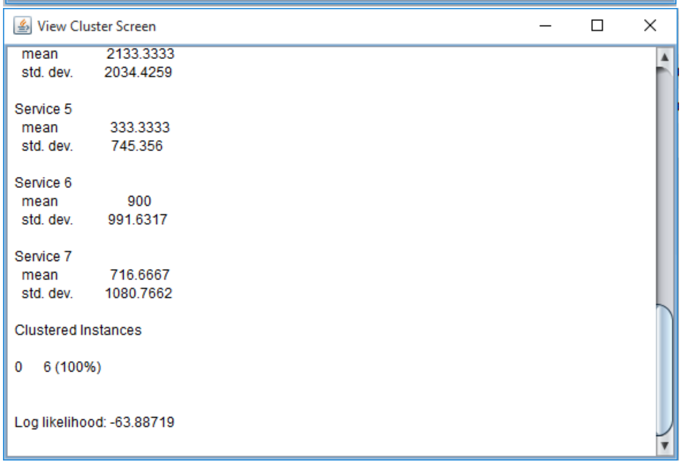


Fig.2: EM Clustering Result

V. CONCLUSION AND ENHANCEMENT OF FUTURE WORK

This specific report presents a QoS-aware web service professional recommendation approach. The fundamental concept would be to predict web services QoS ideals as well as recommend the most beneficial one pertaining to productive users depending on historical web service QoS data. We combine prediction results generated from service regions and user regions, which achieves better results than existing approaches. We also find that the combination result is much better than the result from any single method, either the prediction generated from user regions or the one generated from Web service regions. This is because these two methods analyze the problem from different aspects and the combination of them counteracts the error of individual methods.

In our enhancement, we have considered several aspects to further improve the proposed Web service recommendation approach. In terms of the clustering method, we have considered probabilistic ones like EM in order to enhance the scalability of Existing LoRec System. EM only requires only a scan of the DB (Database) with limited mem. With regard to recommended precision, we have founded that contextual data can easily and significantly have an effect on web service QoS efficiency, including the condition associated with network, server workload as well as tasks which users accomplish along with web services. Besides physical location, we have taken these factors into account and refined the steps of similarity computation and aggregation of region. In terms of the experiment, we use MAE to measure the overall recommendation accuracy currently. Similar to results of searching Web pages, users may only consider and try the three or five high-ranked recommended services. Therefore enhancing the accuracy of high recommended services is another task to analysis. Our development associated with long term work incorporates examining as well as evaluation the particular correlation between diverse Qualities associated with Service attributes and detecting detrimental users having inaccurate QoS detailed data.

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