A QOS VALUES PREDICTION USING MULTIDIMENSIONAL DATA FOR SERVICE RECOMMENDATIONS

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Abstract-

Web service recommendation has become a hot yet fundamental research topic in service computing. The most popular technique is the Collaborative Filtering (CF) based on a QoS values. With increasing presence and adoption of Web services on the World Wide Web, Quality-of-Service (QoS) is becoming important for describing nonfunctional characteristics of Web services. With the increasing presence and adoption of web services, accurate QoS prediction methods are becoming increasingly important. Although some QoS prediction techniques have been proposed and analyzed recently, the performance is not satisfactory, since they didn’t take the relation between QoS values and users’ physical locations into consideration. In order to improve the precision of web service QoS prediction, we propose a probabilistic matrix factor model that fuses the users’ own properties and their physical neighbors’ performance together, so as to make a comprehensive use of both the users’ QoS records and their location relation.

Index Terms: QoS, collaborative filtering, Clustering, visualization, Service recommendation, Cosine Similarity Matrix, Ranking.

I .INTRODUCTION

With the increasing presence and adoption of web services, accurate QoS prediction methods are becoming increasingly important. Although some QoS prediction techniques have been proposed and analyzed recently, the performance is not satisfactory, since they didn’t take the relation between QoS values and users’ physical locations into consideration. In order to improve the precision of web service QoS prediction, we propose a probabilistic matrix factor model that fuses the users' own properties and their physical neighbors' performance together, so as to make a comprehensive use of both the users' QoS records and their location relation. Since many web services have the similar features, users have to make service selecting judgment without any awareness about service contender. The recommender systems endeavor at helping users in service selection. Some QoS properties are user independent, having matching values for different users while other QoS properties are user-dependent. For example, response time, invocation failure rate etc [9]. The user dependent QoS values are indefinite for the user, if the recommender system recommends user a service that has not been applied before. The increasing presence and adoption of Web services on the World Wide Web demand effective recommendation and selection techniques, which recommend the optimal Web services to service users from a large number of available Web services. With the number increasing of Web services, Quality-of-Service (QoS) is usually employed for describing nonfunctional characteristics of Web services [11]. Among different
QoS properties of Web services, some properties are user independent and have identical values for different users (e.g., price, popularity, availability, etc.). The values of the user independent QoS properties are usually offered by service providers or by third-party registries (e.g., UDDI). On the other hand, some QoS properties are user dependent and have different values for different users (e.g., response time, invocation failure rate, etc.).

II. LITERATURE SURVEY

The extract from literature based on the QoS prediction of the Web service composition has been discussed in this section with which we can get knowledge of how their works are being used to achieve the desired goal.

Web service composition based on dynamic QoS prediction [1] [3] Zhi Zhong Liu, Zong Pu Jia, Xiao Xue, Ji Yu [1] proposed a reliable Web service composition method based on global QoS constraints decomposition and QoS dynamic prediction. The approach includes two critical phases: firstly, before service composition, global QoS constraints are decomposed into local constraints, and the problem of Web service dynamic composition is transformed to a local optimization problem; secondly, during the running time, optimal Web service is selected for the current abstract service based on predicted QoS values.

A QoS-Aware Model for Web Services Discovery [2] Gang YE, Chanle WU, Jun YUE, Shi CHENG claim that the model discovers Web services with real-time, fair and authentic QoS information by its monitoring and valuation mechanism. A QoS-aware model for Web services discovery is proposed, by introducing QoS broker. So the client side software can transparently plug on without any extra modification, whereas relying on third party, broker is not reliable.

Hybrid approach end-to-end QoS constraints for Web service composition [4][3]: Mohammad Alrifai, Thomas Risse, Wolfgang Nejdl [4] proposed a hybrid solution that combines global optimization with local selection techniques to benefit from the advantages of both worlds. The proposed solution consists of two steps: first, we use mixed integer programming (MIP) to find the optimal decomposition of global QoS constraints into local constraints. Second, they used distributed local selection to find the best Web services that satisfy these local constraints.

QoS Prediction Approach-User Clustering and Regression Algorithm [5] [x3] Yuliang Shi, Jinan, Kun Zhang, Bing Liu, Lizhen Cui [5] present an approach which can provide the approximate QoS value for users, and support finding the optimal Web service. Firstly, it clusters the users based on location and network condition, then according to the QoS historical statistics of users in the same cluster, uses the linear regression algorithm to predict the QoS value based on invocation time and workload.

J.S. Breese, D. Heckerman, and C. Kadie propose recommender systems usage a database about user given ratings to calculate subjects or goods a new user might similar. They have described another task which depends on correlation coefficients, vector-based same calculations, and arithmetical Bayesian methods. Collaborative filtering algorithm is used two classes:

III. PROPOSED SYSTEM

They proposed a Web service QoS value prediction approach by combining the traditional user-based and item-based collaborative filtering methods. Their approach requires no Web service invocations and can help service users discover suitable Web services by analyzing QoS information from similar users. In their Web service evaluations reported in paper, to reduce the effect of the Web service invocations to the real-world Web services, they only selected one operation from a Web service for making evaluations and employ the performance of this operation to present the performance of the Web service.
After the phase of region aggregation, thousands of users are clustered into a certain number of regions based on their physical locations and historical QoS similarities. The service experience of users in a region is represented by the region center. With the compressed QoS data, searching neighbors and making predictions for an active user can be computed quickly. Traditionally, the QoS prediction methods need to search the entire data set, which is rather inefficient. In our approach, similarity between the active user and users of a region is computed by the similarity between the active user and the region center. Moreover, it is more 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.

The basic idea of our approach is that users closely located with each other are more likely to have similar service experience than those who live far away from each other.

Top-K algorithms rank the neighbors based on their PCC similarities and select the top k most similar neighbors for making missing value prediction.

IV. PROPOSED ALGORITHM

- **Top-k Algorithm**
  Top-K algorithms rank the neighbors based on their PCC similarities and select the top k most similar neighbors for making missing value prediction. In practice, some entries in the user-item matrix have limited similar neighbors or even do not have any neighbors. Traditional Top-K algorithms ignore this problem and still include dissimilar neighbors to predict the missing value, which will greatly reduce the prediction accuracy. To attack this problem, we propose an enhanced Top-K algorithm, where neighbors with PCC similarities smaller or equal to 0 will be excluded.

- **Cosine Similarity Algorithm:**
  Cosine similarity can be expressed mathematically as,

  \[
  \text{similarity}(\vec{a}, \vec{b}) = \cos \theta = \frac{\vec{a} \cdot \vec{b}}{||\vec{a}|| ||\vec{b}||}
  \]

  Expanding it a little further,

  \[
  \frac{\vec{a} \cdot \vec{b}}{||\vec{a}|| ||\vec{b}||} = \frac{\sum_{i=1}^{n} a_i b_i}{\sqrt{\sum_{i=1}^{n} (a_i)^2} \times \sqrt{\sum_{i=1}^{n} (b_i)^2}}
  \]

  This basically means,

  1. Get the dot product of vectors a and b
  2. Multiply magnitude a and magnitude b
  3. Divide the dot product of vectors a and b by the product of magnitude a and magnitude b.

- **Clustering Algorithm**
  The clustering method has two parts: initialization and aggregation. In the initialization part, we select non-sensitive user regions for aggregation, and compute the similarity between each region pair with . To aggregate regions,

  1. Select the most similar region pair (region I, region j) merge the regions to region i if their similarity exceeds the similarity threshold -u, otherwise stop this region aggregation process. To merge the two regions
    a. Compute the sensitivity and region center of this newly merged region i. remove this region from aggregation process if it becomes a sensitive one.
    b. Remove similarities between region j and other existing regions.
    c. Update similarities between regions i and other existing regions.
  2. Repeat the above step.

V. CONCLUSIONS AND FUTURE WORK

The physical locations are indeed an important factor when making QoS prediction for web services. However, there are still some other factors, such as the conditions of the servers, network workload that may also have influences on the QoS results. Hence, more experiments on the above issues will be conduct in our future work. We have used CF to anticipate obscure QoS values. Entirely talking, our methodology is basically distinctive from conventional CF which is not appropriate to objective information expectation. QoS data relates to a variety of factors. It is difficult to divide
all QoS data observed by different users into groups on some exact constraints. In our approach, we improve the clustering process based on the FCM algorithm by combining PCC calculation. It can also be useful for user in security point of view. The physical locations are indeed an important factor when making QoS prediction for web services. However, there are still some other factors, such as the conditions of the servers, network workload that may also have influences on the QoS results. Hence, more experiments on the above issues will be conduct in our future work.

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