

Location-aware and Personalized Collaborative Filtering for Web Service Recommendation

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Abstract: As the number of web services with similar functionality increases, the service users usually depend on web recommendation systems. Now a days the service users pay more importance on nonfunctional properties which are also known as Quality of Service (QoS) while finding and selecting appropriate web services. Collaborative filtering[3] approach predicts the QoS values of the web services effectively. Existing recommendation systems rarely consider the personalized influence of the users and services in determining the similarity between users and services. The proposed system is a ranking oriented hybrid approach which integrates user-based and item-based QoS predictions. Many of the non-functional properties depend on the user and the service location. The system thus employs the location information of users and services in selecting similar neighbors for the target user and service and thereby making personalized service recommendation for service users. General Terms Service computing, Recommendation

Keywords: Web services, Collaborative filtering, Location-aware, QoS prediction, Service recommendation

1. INTRODUCTION

Web service has been emerged as a promising technique to support inter-operable machine-to-machine interaction which provides a method of communication between electronic devices over a network. As the number of web services with similar functionality has increased rapidly over the internet the web service discovery is not a challenging task but selection and recommendation are becoming more important. Optimality of a web service depends on its performance and performance is measured through Quality of Service i.e. QoS. QoS is the set of nonfunctional properties[7] of a web service

which includes response time, price, failure rate and so on. Recommendation system initially searches for the list of web services those having similar functionality, which the user requested and finally the optimal web services are recommended to users. Collaborative filtering is widely employed in web service recommendation. Existing QoS prediction[7],[10] methods rarely finds the similarity of users, services and location of users into consideration. The proposed method uses both the location of users and web services on selecting similar neighbors [8] for the target user or service.

2. RECOMMENDATION SYSTEM

2.1 QoS based service ranking QoS based service ranking and their selection for a best web service are initially based on the calculation of satisfaction scores [1] of each web service. Basic steps includes: the registration of web services in a service directory (SD)[1], users specifying the QoS requirements to the service directory. The SD initially matches user's functional requirements followed by the calculation of satisfaction scores for each service. The SD lists out the services based on the satisfaction scores [1]. QoS-based service ranking and selection method helps users to select the services that best satisfy their QoS requirements. The top ranked service with the largest satisfaction score is the service that best satisfy user's QoS requirements.

2.2 Collaborative filtering Collaborative filtering [3] is most commonly used in present web service recommendation systems. The basic idea in CF is to make automatic predictions about the interests of a user by gathering preferences or taste information from many users. The processing in CF algorithms are based on user-item matrix. CF techniques are generally divided into two broad categories- model based[6],[2] and memory based[3][2].

2.2.1 Model based collaborative filtering. This method first develops a model of user ratings and provides item recommendation. Probabilistic approaches are being used in this method and model building process is done with the machine learning algorithms like Bayesian network, rule based and clustering approaches.

2.2.2 Memory based collaborative filtering. Memory based collaborative filtering is also known as neighborhood-based CF and it makes use of the entire user-item database to generate a prediction. Based on the user neighborhood or item neighborhood neighborhood-based CF can be further classified into: (1) User-based CF (2) Item-based CF

	Tom	Nick	Harry	Jane
Item A	😊		😊	😊
Item B	😊	😊		😞
Item C	😞	😞		
Item D		😊	😊	😊

Fig. 1. Compare user-based and item-based filtering

User Based filtering can be explained as: In fig 1, it is found that users Tom and Nick seem to have similar interests as they both liked item B and both dislikes item C. So the item A will be recommended to Nick. Similarly item-based filtering[2] can be explained as : Considering an item D, two users who liked item D Harry and Jane also liked another item A. From this observation we can conclude that people who liked item D will also like item A. So item A will be recommended to Dick. User-based CF provides a subset of appropriate users as neighbors based on their similarities to the active user and the Item-based CF will retrieve those items similar to the ones the active user preferred in the past.

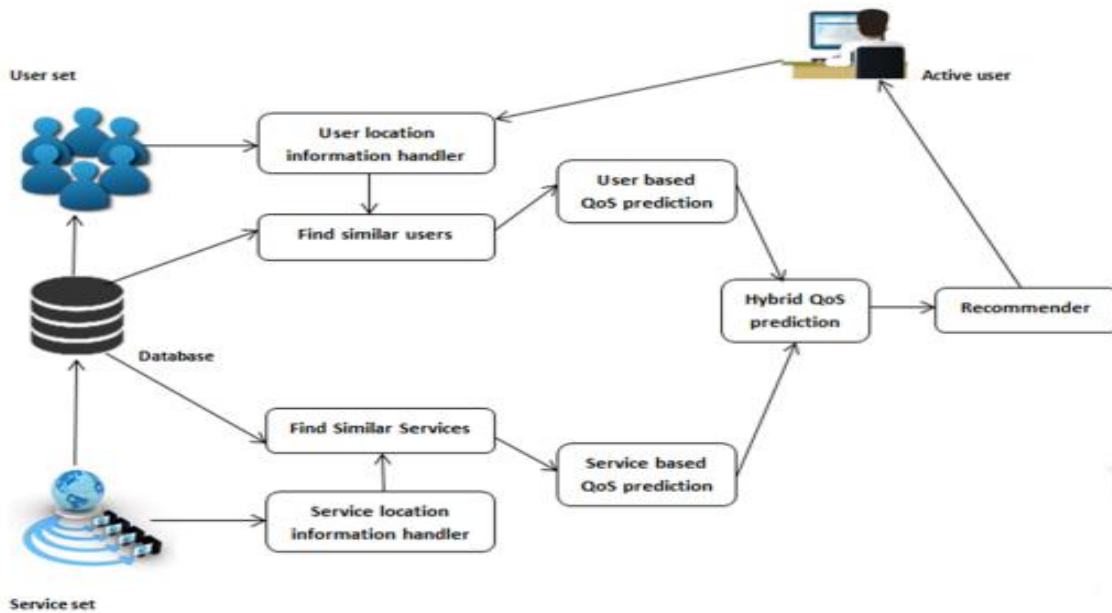


Fig 2. Recommendation System

The recommendation system can be explained when an active service user searches for high-quality Web services in a Web service discovery system or the system is recommending high-quality Web services to an active user. The process is done by predicting the QoS values for the web services. The recommendation system as a whole can be explained using the Fig 2.

The system consists of : (1) User location information handler : This is used to find the location information of a user which includes the AS number and the country name according to the user's IP address. (2) Service location information handler: This is used to find the location information of Web services that includes the AS number and the country in which the Web Services are located. (3) Find similar users : This module finds similar service users who are similar to the active user by considering both the user's QoS values and their corresponding locations. Similarity computation is done with a weighted Pearson Correlation Coefficient. (4) Find similar services: This module

finds similar web services for a target web service by considering both the users QoS values and their corresponding locations. Similarity computation is done with a weighted Pearson Correlation Coefficient. (5) User-based QoS prediction: After finding similar users from the above step, QoS values are predicted accordingly for an active user. (6) Service-based QoS prediction: After finding similar services from the above methods, QoS values are predicted. (7) Hybrid QoS prediction: The final QoS predictions are obtained by combining the user based QoS prediction and the servicebased QoS prediction. (8) Recommender: After predicting QoS values, recommendation of Web services are given to the active user.

3. SYSTEM STUDY

3.1. Existing System

Location-Aware and Personalized Collaborative Filtering for Web Service Recommendation existing Quos prediction

methods seldom consider personalized influence of users and services when measuring the similarity between users and between services. However, existing Web service QoS prediction methods seldom took this observation into consideration. We conducted an experiment to evaluate the prediction time of our method, and compare it with some existing

Existing System Algorithms

Collaborative filtering is one of the most popular recommendation techniques, which has been widely used in many recommender systems. In this section, we give a brief survey of CF algorithms, and summarize recent work on CF-based Web service recommendation.

3.2. Proposed System

- We proposed an enhanced measurement for computing QoS similarity between different users and between different services. The measurement takes into account the personalized deviation of Web services' QoS and users' QoS experiences, in order to improve the accuracy of similarity computation.
- Although several CF-based Web service QoS prediction methods have been proposed in recent years, the performance still needs significant improvement

- We propose a location-aware personalized CF method for Web service recommendation.
- The proposed method leverages both locations of users and Web services when selecting similar neighbors for the target user or service
- To evaluate the performance of our proposed method, we conduct a set of comprehensive experiments using a real-world Web service dataset.
- Based on the above enhanced similarity measurement, we proposed a location-aware CF-based Web service QoS prediction method for service recommendation.
- We conducted a set of comprehensive experiments employing a real-world Web service dataset, which demonstrated that the proposed Web service QoS prediction method significantly outperforms previous well-known methods.

Proposed System Algorithms

- We first formally define notations for the convenience of describing our method and algorithms.
- The Top-K similar neighbor selection algorithm is often employed
- The Top-K similar neighbor selection algorithm can be employed to select K

Web services that are most similar to the target Web service

- We can see that the algorithm first searches local users for similar users.
- This algorithm has a high probability of finding users similar to the active user in his/her local region.
- Prediction coverage is also an important metric for evaluating a QoS prediction algorithm

Advantages

In addition to the prediction accuracy, another advantage of our method is its high efficiency of QoS prediction. This indicates that our method is more scalable than traditional CF methods when applied to large-scale service recommender systems. This indicates that our method is more scalable than traditional CF methods when applied to large-scale service recommender systems. The reason is that, in most cases we can limit similar neighbor searching to a small subset of users (or Web services), especially when K is small.

4. COMPARISON WITH THE OTHER RECOMMENDATION SYSTEMS

(1) Existing approaches fail to recognize the QoS variation with change in the physical locations of users and services [5].

(2) Current web service recommendation systems provide a recommendation result with no

transparency into the reason behind the recommendation results.

(3) Model based methods cannot successfully handle the dynamic user-service matrix. Matrix factorization (MF)[6],[9] is used in this method for QoS prediction. MF model has to be recomputed when there is a change in the matrix.

(4) The recommendation systems are generally based on User-based QoS prediction or item-based QoS prediction. Integrating both the methods for QoS predictions will provide a better recommendation than the individual predictions.

5. CONCLUSION

Collaborative filtering techniques presents a QoS based recommendation system. Basically the system will predict the QoS value of a web service and will recommend the best for an active user. This can be integrated with the location information of both users and the services on finding the similar neighborhood results in better QoS predictions. As the IP address of the user is known it is much easier to locate AS number and the country where he is located. Similarly the locations of web services are also found. The location information is then processed to produce a set of similar users and similar services that are close to each other. Comparing with other recommendation systems and the existing methods rarely consider the user and service location in determining QoS values. The existing recommendation systems are either based on

user-based or item-based QoS prediction. Integrating both the methods for QoS predictions along with the location information will provide a better recommendation than the individual predictions. The system can be improved by integrating different nonfunctional properties into consideration which helps in providing better results. 27

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