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A Survey on Different Features and Techniques for Web Service Prediction

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Abstract – **Quality of Service (QoS) assurance is an important factor of service recommendation. The web services which are never been used before by users have some indefinite QoS values for that service, and hence the accurate prediction of indefinite QoS values is important for the successful consumption of Web service-dependent applications. Collaborative filtering is the technique which is broadly accepted in the prediction of indefinite QoS values as it is significant for predicting missing values. Though, collaborative filtering derived from the processing of subjective data. In this paper, we describe various collaborative filtering by QoS rating techniques applied to web service mining and addresses various collaborative filtering problems.**

Keywords – **Information Extraction, Service prediction, Social Features, web mining.**

I. INTRODUCTION

Web services are mainly designed for interaction between computers over a network. The web services publication over network is increasing speedily. The users need to select web services from a huge set of applicant services. Most of the users target on evaluating the differences of non-functional properties between web services with related features, and hence useful and competent service suggestion is necessary to determining the most appropriate service element. For that reason, Quality of Service (QoS), which characterizes the non-functional properties of services, is applied as a base to evaluate whether a service is appropriate to recommend. 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. So, predicting the indefinite QoS values is very essential to find out whether this service is a suitable to recommend or not. Collaborative Filtering (CF) is a widely used approach to build many popular commercial recommender systems. In order to make prediction of unknown QoS values, numerous approaches are proposed based on CF and accuracy of the predicted values is achieved by making several attempts [8]. Existing quality of web service predicting approaches or web service recommendation methods merely focus on modeling the response time or the throughput of web services. Therefore, these quality attributes cannot comprehensively characterize the performance of a specific service. There is a need of providing web service users with an efficient and effective approach to generate multi-dimensional QoS recommendations and to establish a score function to represent the overall performance of services.

II. TECHNIQUES OF WEB SERVICE PREDICTION

CF methods

Content-based methods and hybrid methods are three kinds of methods that are widely used in Web service recommendation. A. CF Methods The memory-based and model-based methods are two kinds of CF techniques that are widely used in recommendation systems. Well-known memory-based methods include user-based approaches and item-based approaches. Memory-based CF techniques have been recently adopted to provide QoS-aware recommendations. Shao et al. [9] propose a typical user-based CF method to predict QoS values which supposes that similar users tend to receive similar QoS from similar services, and they use Pearson Correlation Coefficient (PCC) to compute similarity between users. Zheng et al. develop a model which enhances the user-based CF by fusing item-based CF [10]. The model-based method allows the system to make intelligent predictions for the collaborative filtering tasks based on some learned models [5, 6]. Matrix factorization (MF) is one of the representative works. In MF is used to construct a global model for predicting Qos data, which can achieve higher prediction accuracy. Yu et al. [13] propose a matrix completing approach using an effective iterative algorithm. The method takes into account both the

lowrank structure and the clustered representation of QoS data.

Content Based Methods
The content based methods mainly focused on providing a mechanis m to formalize users' preference, resource, and the description of Web services, and recommendations are generated based on the predefined semantic models. Zhao et al. provide a way to model services and their linkages by semantic algorithm. Based on the input keywords, users can get a set of recommendations with linkages to the query. Blake and Nowlan compute a recommendation score by matching strings collected from the user's operational sessions and the description of the Web services. Based on this score, they judge whether a user is interested in the service. Pattern to the service description to provide more information to discover a service that meets user requirements. in. [6] propose a model for the context of Web service interactions and highlighted the resource on which the Web service performed.

Hybrid Method
Since hybrid methods which often combine CF with other techniques can provide more accurate predictions, they are widely used. Numerous hybrid models have been presented that involve other related factors to improve service recommendation quality, such as users' locations social network information and temporal effects. Chen et al. propose a CF algorithm which takes into account of users' physical locations and design a region model for large-scale Web service recommendation. Tang et al. demonstrate a location aware CF model by incorporating locations of both users and services. Tang et al. propose a trustaware recommendation method with social network which integrates some social relation.

Demographic recommendation approach
In this approach, recommendations are generated on the basis of user demographic profile [1]. Demographic profile contains the demographic information about the user. The information is about user's age, gender, job area, nationalities, language, region etc. It is assumed that different demographic niches would obtain different recommendations [1]. For example many website provide customized suggestions according to a user's age.

Popularity-bias
One more limitation of collaborative filtering approach based recommendation systems is "popularitybias". [8, 11] This problem arose from the Long Tail phenomenon, which states that maximum number of the users consume very few but famous items while few number of users consume less famous items. Since collaborative filtering depends on the preferences of the people to generate recommendations, it leads to poor diversity of recommended items (as mostly people prefer to consume only famous items). [11] E.g. Celma showed that the music industry follows the long tail phenomenon.

III. Basic Issues in Web Service Prediction

Cold-start
Its difficult to give recommendations to new users as his taste is unknown to the system because his profile is almost empty and he has not rated any items. This is called the cold start problem. In some recommender systems this problem is has been solved by survey when creating a profile. Items can also have a cold-start when they are new in the system and there is no rating for them. Both of these problems can be also solved with hybrid approaches.

Scalability
In the entire environment where recommendation plays a important role, involves various products or services. Hence computational complexity of recommending product or service is proportional to the number of products or services and number of active users". However this problem can be solved by employing effective recommender algorithm.

Trust
The voices of people with a short history may not be considered as relevant as the voices of those who have large history in their profiles. The issue of trust is evaluating a certain customer. The problem could be solved by distribution of priorities to the users.

Sparsity In online shops that have a huge amount of users and items. there are few users that have not rated much items. Using collaborative and other techniques recommender systems generally create neighborhoods of users using their profiles. If a user has evaluated just few items then its pretty difficult to determine his taste and user could be related to the inappropriate neighborhood. Sparsity is the problem of lack of information.

Privacy
Privacy has been the most important problem. In order to receive the most accurate and correct recommendation, the system must consider the large amount of information about the user, including data about the location of a particular user and demographic data. the question of security, reliability and confidentiality of the given information arises. Many systems offer effective protection of privacy of the users by utilizing specialized algorithms.

Gray-sheep problem
Competitive service provider might provide poor ratings to its competitive services thereby decreasing its chance of being recommended. Similarly, competitive service provider might provide good ratings to its own services thereby increasing its chance of being recommended. Even some users" acting as malicious users" might provide

inappropriate ratings to products or services. For new users‟, user profile will be initially created with no rating of targeted users‟ by other users‟. This approach is similar for items or services too.

Synonym problem
Most product or service either similar or same available seems to have different entries as services. The problem of Collaborative Filtering is that it doesn‟t handle this type of association.

Shilling attack
Competitive service provider might provide poor ratings to targeted services or good ratings to its own services, similar to gray sheep problem.

IV. RELATED WORK

Lin, S-Y et al, ―Web service discovery Trustworthy QoS-based collaborative filtering approach‖ [1], deals with a trustworthy two phase web service discovery mechanism based on collaborative filtering and QoS. In the first phase, the observer agents will collect records of user behavior, including querying and invoking web services and monitor actual QoS, and then store the profile information in the public cloud database. This phase involves 3 sub-phases namely establishing query and web services matrices, finding query similarity and calculating the relevance between query and web services. This phase mainly establishes item based (memory based) collaborative filtering.

Chen et al, ―Similarity-Aware Slope One Collaborative Filtering- QoS Prediction for Web Services‖ [3], employs similarity-aware slope one algorithm for QoS ratings prediction. The proposed work combines both Pearson similarity and slope one measurement for QoS ratings prediction. Weight adjustment and SPC (Statistical Process Control) based smoothing is also utilized for abnormal data smoothing. The proposed work shows better precision result compared with slope-one and famous WSRec system. The work has the capacity to reduce noise in QoS ratings data.

In [4] present a highly credible approach, called reputation-based Matrix Factorization (RMF), for predicting the nknown Web service QoS values. RMF first calculates the reputation of each user based on their contributed QoS values to quantify the credibility of users, and then takes the users' reputation into consideration for achieving more accurate QoS prediction. Reputation-based matrix factorization is applicable to the prediction of QoS data in the presence of unreliable user-provided QoS values. Extensive experiments are conducted with real-world Web service QoS data sets, and the experimental results show that our proposed approach outperforms other existing approaches.

In [5] paper, we propose a novel collaborative filtering-based Web service recommender system to help users select services with optimal Quality-of-Service (QoS) performance. Compared with existing service recommendation methods, our approach achieves considerable improvement on the recommendation accuracy. Comprehensive experiments are conducted involving more than 1.5 million QoS records of real-world Web services to demonstrate the effectiveness of our approach

In [6] paper, we propose a method of location- aware collaborative filtering to recommend Web services to users by incorporating locations of both users and services. Different from existing user-based collaborative filtering for finding similar users for a target user, instead of searching entire set of users, we concentrate on users physically near to the target user. Similarly, we also modify existing service similarity measurement of Collaborative filtering by employing service location information. After finding similar users and services, we use the similarity measurement to predict missing QoS values based on a hybrid collaborative filtering technique. Web service candidates with the top QoS values are recommended to users. To validate our method, we conduct series of large-scale experiments based on a real-world Web service QoS dataset. Experimental results show that the location-aware method improves performance of recommendation significantly.

X. Chen et al. [7] describes in their paper that effective QoS based recommendation is becoming more important and previous could not consider QoS variance according to the user‟s location and provided just the limited information on the performance of service candidates. Their paper proposes a collaborative filtering algorithm designed for large scale Web Services. The recommendation approach makes use of region-based Collaborative Filtering algorithm and consists of two phase process. In first phase, users are divided into different regions based on their physical location and previous QoS experience on Web Services. In the second phase, when a user is requesting Web Services, it finds similar users for the current user and makes predictions for Web Services which have the best predicted QoS values for the unused services.

J. Yin et al. [8] says that QoS values are very important and propose a novel collaborative QoS prediction framework. Suppose there are i users and j Web Services, and they contribute to an i x j web service QoS matrix R, and each entry of rating r represents a QoS value recording the specific usage information of web service k executed by user a and predicts missing QoS values of Web Services by using the concept of localization and matrix factorization. This approach assumes that users nearby

share similar web service invocation experience and makes of matrix factorization framework for predicting missing QoS values.

J. Zhu et al. [9] propose a novel clustering-based QoS prediction framework, in which various Landmarks (computers) are deployed in the internet to monitor QoS information of the available Web Services by invoking these services at regular intervals and then cluster the computers based on the QoS information that has been obtained. It then clusters these small groups into a large existing cluster, and try to form hierarchy of clusters, this is done by measuring the latency between the landmark and the cluster, from this QoS predictions are made from the QoS information that has been gained from the landmarks.

G. Kang et al. [10] propose a Web Services recommendation approach which recommends Web Services to a user based on the user's history. The system measures the similarity between the user's functional interests and web services and based on the similarity in the functional and non functional characteristics Active Web Service Recommendation System, ranks the services so that a list is generated which has top recommendations for the user.

V.Conclusion

Due to the marvelous growth and usage of mobiles and internets, recommender system affected by many problems like data overloading, appropriate service recommendation and mapping etc. Recommendation systems proved themselves to be a best solution for addressing problem of the information overload. They help in making decisions by preserving time and energy. Future work will focus on enhancement of the existing methods and algorithms used so that the recommendation systems predictions and recommendations quality can be improved.

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