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A Clustering Based System for Diversifying WSRec Results

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Abstract: The use of Web services for various applications has led to the growth of web services on a large scale. Due to the increase in usage of web services, it has become of prime importance to design systems for effective web service recommendation. In our project, we propose a system for effective web service recommendations incorporating users' preferences regarding quality and diversities amongst web services. Users' requirements are considered and mined from his usage history. Then we find functional similarities using clustering techniques followed by applying a ranking algorithm to list top-k services. To discover high quality Web services, a number of QoS models for Web services and QoS-driven service selection approaches have been proposed in the service computing field. In this system user explicitly specifies his/her interests and QoS requirements, and submits them to the service discovery system. Then the service discovery system matches the user's interests and QoS requirements with corresponding attributes of Web services, and returns those with the best matching degrees to the user.

Keywords: Web Service Recommendation, ANN, feature evaluation, ranking, top-services.

I. INTRODUCTION

There has been a rapid growth on web technologies which has increased the growth of web services rapidly. Discovering and suggesting relevant web technologies is a critical issue to be addressed. Since there are a large number of services having similar functions, recommending appropriate services to the user is an important aspect. Web services recommendation is the process of recommending web services to the user depending on various aspects such as QoS, user history, requirements, service parameters, etc. There are various web services recommendation systems developed, but the lack of accuracy make them incapable for recommending the required web service to the user. Here we are using ANN (Artificial-Neural network) which is a machine learning technique which will enhance the results over period of time. The recommendation system should be self-sustaining and proactive. As data evolves over time, predictors need to have opportunities to update or retrain themselves; otherwise they will become less accurate. The solution for this issue is the use of machine learning techniques (A-NN) which learns from previously existing data as well as the new updating inputs to the system. The system itself stays updated and even if there is a major change in the service usage trend of the user, it can adapt efficiently by keeping the recommendations accurate.

Hence the proposed web services recommendation service help generate accurate suggestion proactively for the following reasons:

1. The user's interests and quality of services are taken into the consideration for giving the suggestions. The quality of services and user interests are used for measuring functional relevance and QoS utility of the web services.
2. The score of each web service is calculated through the functional requirements and QoS. Also a web service graph is constructed based on functional similarities with a certain level of user interest relevance.
3. Then a diversity-aware service ranking algorithm calculates the optimal web services based on the proposed system.

Hence the proposed system provides better and accurate web service recommendation than the existing methods.

II. RELATED WORK

In this paper the issue of diversity was addressed and solutions were provided. When individual recommendations are taken into consideration, a key challenge arises that most objects are recommended based on user or object similarity. Hence a new algorithm is specified to address the problem of diversity in combination with an accuracy focused algorithm Recommender systems use data on past user preferences to predict possible future likes and interests. The previously defined diversity recommendation techniques have similarity as the basis for recommendation. The risk of an overlap approach for recommendation rather than difference would expose users to a narrow band of services while the relevant niche items would be unnoticed. The algorithm proposed in the system focuses more on diversity factor rather than similarity. However this may pose a risk to accuracy. So a combination of accuracy and diversity focused method is used to solve this problem. A heat-spreading algorithm is designed to address the issue of diversity. A combination of accuracy and diversity related metrics are employed to evaluate performance using three different datasets. The hybrid algorithm does better as compared to other recommendation approaches in enhancing personalization of the results of individual user recommendations.[2]

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The Quality of Service (QoS) is an important factor being considered these days by the users for finding appropriate web services amongst the wide range of services available. Most of the QoS-aware recommendation systems use a rating-oriented prediction approach for the services 3intending at predicting the potential ratings that an active user may assign to the unrated services as accurately as possible which may not be beneficial in some of the application scenarios. In order to overcome this problem a ranking-oriented hybrid approach was proposed by combining item-based collaborative filtering and latent factor models. Similarity computation between web services is done in terms of correlation coefficient between their rankings rather than that in between the traditional QoS parameters. Moreover improvement in this measure is done using NDCG (Normal Discounted Cumulative Gain) for computing accuracy of top-k recommendation results. The paper aimed at issue of ranking in predicting missing QoS values in a given data set. [3]

It is not sufficient only using QoS properties as the recommendation standard due to following mentioned reasons. First of all, QoS properties just reflect the attribute relationship, rather than mine the user's potential needs. Then, it requires service invocations and imposes costs for the service users. At the same time, it consumes resources of service providers. Finally, if the user's intention to choose services is not clear, QoS properties could not be employed to make appropriate recommendations. So it is more appropriate to employ the user-independent ones to estimate whether the Web service could satisfy the users expected demands .Therefore an algorithm named as URPC-Rec, was proposed to fulfil the task of reducing the dimensionality of sparse matrix and solving cold-start problem of recommendation systems. Furthermore, social network and recommendation systems are combined so as to employ user relationships and references to make personalized recommendations for them. And the target of this paper is: according to user feedback, transforming the user-service matrix into the user-service category one and reducing the matrix dimensionality at first then, making sufficient use of the user and service labels; at last, excavating wide range interest of users rather than the single one. [4]

Missing QoS values are predicted using CF algorithms. QoS values include performance parameters like response time, availability, throughput etc. The values of these QoS parameters are highly dependent on network distances between the services and the user's i.e their locations. This factor is taken into consideration and thus a location-aware CF approach is proposed for web services recommendation.At first location of users as well as services are considered and a hybrid location-aware QoS prediction method is given. User location and service location are used for improving accuracy and performance of QoS prediction. Thereafter large scale datasets are used to demonstrate a relationship exists between Qos similarity and user (service) location. Considering the above two factors a hybrid method of CF is proposed.[5]

III. PROPOSE WORK

This paper targets to develop a system which implements Web service recommendation approach with clustering to find desired Web services for user. Hence we are proposing an efficient system which will work on A-NN algorithm to cluster the data and then rank the services by using suitable ranking algorithm. The system overcomes the problem and limitation of the existing system. The main objective of our system is to recommend top-k services to the user according to the user preferences which are mined from the user history. The proposed system helps generate a far better web services recommendation than the existing systems. It used the functional and non-functional requirements of the user; service usage history.The system will provide the suggestions from dataset which is provided from the admin. If new services are available, then they are to be updated by the admin in the dataset.
The architecture of our system is as follows:

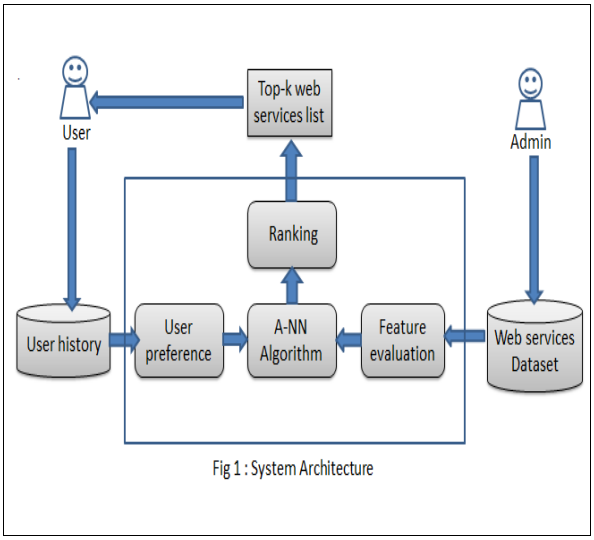

Fig 1 : System Architecture

The functional modules of system are:

ANN Algorithm: This is the main functional block of our system. Artificial Neural Network will learn from the user history and accordingly the top-k list of services to be recommended to the user will be updated,
User Preference : The preference value for the service will be updated once that service is consumed or used by the user .So its basically a numeric value to be fed to the ANN back for re-ranking of services.
Ranking: This block deals with the deciding the order of top-k services to be recommended to the user i.e. it returns the list of services by reordering it.
Feature Evaluation: This block deals with the similarity checking of the user query on the basis of type or name of the services from the services dataset.

Hence other than the functional modules of the system user history and web service dataset are the storage systems. User and admin are two roles of a person where user can input a query and get the output whereas admin can add new services to the web services dataset.

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IV. COMPUTATIONAL MODEL

Various computational formulas used in ANN are mentioned below:

The network error is the sum of the squared errors of the output neurons:

$$E(n) = \sum e_k^2 (n)$$

The total mean squared error is the average of the network errors of the training examples.

$$E_{AV} = \frac{1}{N} \sum_{n=1}^{N} E(n)$$

The Backprop weight update rule is based on the gradient descent method:

It takes a step in the direction yielding the maximum decrease of the network error E.

This direction is the opposite of the gradient of E.

Iteration of the Backprop algorithm is usually terminated when the sum of squares of errors of the output values for all training data in an epoch is less than some threshold such as 0.01.

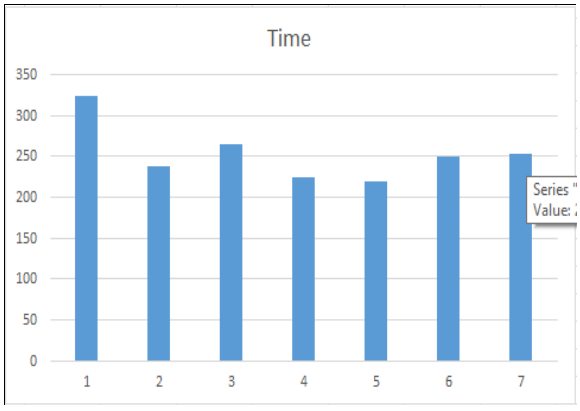
$$w_{ij} = w_{ij} + \Delta w_{ij}$$

$$\Delta w_{ij} = -\eta \frac{\partial E}{\partial w_{ij}}$$

V. RESULTS DETECTED

The following are some random values given input to ANN algorithm and the output is plotted as the bar diagram shown next to the table:

Index	Time
1	323
2	238
3	264
4	225
5	219
6	250
7	253



Hence we can see the better recommendation results of the system than the previous WSRec systems as we have used a machine learning algorithm such as ANN to evolve the results over time. The ranking of services is done on the basis of the user preference form user history.

VI. CONCLUSION AND FUTURE WORK

In this system we presented a Web service recommendation approach with diversity to find desired Web services for users. We incorporate ANN algorithm for functional interest, feature evaluation, and diversity feature for recommending top-k diversified web services. A diversified Web service ranking algorithm is proposed to find the top-k diversified web service ranked list based on their functional relevance including historical user interest relevance and potential user interest relevance such as QoS utility, and diversity feature.

In future work, we will study Web service clustering methods to improve the similarity computation and conduct real user survey to evaluate the usefulness of our method further. In addition, our proposed diversified ranking system performs the mining task on the structured dataset so in future we can try for any non-structured database as an option such as MongoDB,etc. As well as we can opt for a better algorithm such as Naive Bayes classifier which will take into account the textual comments of user for a web service and choose most appropriate service for user.

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