A Review on Different Techniques to Implement Service Recommendation System

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Abstract: In recent years, there is growth in number of customer; different types of services and online service application are increasing rapidly. Nowadays users use the internet information for taking decision. The users enter the query and get the relevant information. So for this recommendation systems are used to give appropriate service to user. In this paper, we are going review the different techniques used to implement service recommendation system. Also we are going to review some machine learning algorithms.

IndexTerms – **service recommendation system, collaborative filtering, content-based filtering, hybrid recommender system, machine learning, supervised learning, unsupervised learning, preferences.**

I. INTRODUCTION

Due the development of technology of Internet, web programming and web applications in recent years, the huge amount of data increases extremely, then information overload problem occur. So new technology are developed and made to solve these problems and to provide user wanted information quickly and accurately. Many e-commerce sites mostly use recommender system to suggest product items, videos and music. So increase growth in data and variety of information available on the internet and rapid introduction of new e-business service like item buying, item comparing etc, its leading user to make inappropriate decisions. So users were finding it very difficult to make correct and appropriate choices.

So the service recommender system plays an important role in discovering valuable and interesting information for users searching among large dataset.

Service recommender system is technique which providing suggestions for items or services which are useful for user to take decision which service or item to select. The suggestion and recommendation related to various decision making processes. Some decision making processes such as which hotel to select for stay, where to go for trip, which books to buy or what music to listen. In recommendation system service or item word is used to show what the system suggests to user. [1]There are different types of technique which are used by recommender system that are content based filtering, collaborative filtering and hybrid filtering. Content based approaches recommend service similar to those the user preferred in the past. Collaborative filtering approach recommends services to the user that users with similar or same taste preferred in the past. Hybrid approaches combine content based and collaborative filtering in different ways. In this paper also we are going to review on some machine learning algorithms which are used for implementing recommendation system. Recommendation system tries to improve accuracy of given suggestions.

II. DIFFERENT TECHNIQUES USED FOR IMPLEMENTING SERVICE RECOMMENDER SYSTEM

To implement recommender system, it requires some techniques and algorithms. There are different approaches such as collaborative filtering; content based filtering and hybrid recommender system. These approaches will be explained in following section.

2.1 Collaborative Filtering Techniques and Application:

[2]Collaborative filtering is based on idea that it recommends items by identifying other users with similar taste, it uses their opinion to recommend items to the active user. Collaborative filtering is categorized into two categories one is memory based and other is model based. In memory based approach it has two ways one is item-based or other is user-based. In user-based approach the user interest in item i is considered, ratings for this item i by other users are considered who have similar ratings patterns. The item-based approach in these the rating for an item i of a user u based on the ratings of user u for items similar to i will use for recommendation. The advantage of this technique is its simplicity, justifiability and efficiency.

Memory based systems use the stored information about ratings for prediction where as model based approach use these rating information to acquire knowledge and learn a predictive model. In these it focuses on preference of users. This available information is used to train the model and this trained model is used for recommendation. For model based approach it uses technique such as Bayesian model, clustering, support vector machine and singular value decomposition.

2.2 Content Based Filtering:

[3]The content based filtering approach derives from the concept of information retrieval and filtering research. In these the items are recommended using its past liking information. In these it checks which type of items users like, then similar taste items are recommended to users this is called content based filtering system. Many content based filtering systems build two profiles one for user and other profile for item. In user profile it stores the information about user preference and user needs. In item profile it stores description about item. The content of every item is defined as group of detail attributes. Using this information it checks the similarities between user interest and all items profile. Then it recommends items list which satisfy user taste or needs. As the user gives more input or ratings or gives response to users questionnaires then the service recommendation system becomes more effective and accurate.

[4] The reason to select this approach to implement any recommender system is because it doesn't have the cold start problem. Its recommendation only depends on the active user information such as user preference, user needs and user taste. For eg. Content based filtering algorithm used for implementing mobile recipe application [4]. The content based filtering algorithm is applied to get recipes which will have high possibility for user to like. The inter-dependencies is limitation of content based system.

2.3 Hybrid Recommender System:

Different techniques are proposed for implementing service recommendation system which includes content-based filtering and collaborative filtering. These techniques are mixed or combined in hybrid recommender to improve performance of system. Collaborative and content –based filtering has mostly used in information filtering system.

[1] Hybrid recommender system can be used in following different ways:

- By separately implementing collaborative and content-based methods and then combine their predictions to generate recommendation.
- By integration of some capabilities of content-based filtering into a collaborative filtering method.
- By integration of some capabilities of collaborative filtering into content-based filtering method.
- Merging the capabilities of both content-based method and collaborative filtering method into one single model.

These are ways used for implementing hybrid recommender system. Also there are some other hybridization techniques such as weighted, switching, mixed, feature combination and feature augmentation. In weighted technique score or weight of an item is calculated from all available recommendation techniques which are implemented in the system. In switching the system has the function to switch between recommendation techniques. Mixed hybrid system based on combining and presenting multiple rated list into a single rated list. This approach avoids the start-up problem of new item. Feature combination technique in which the main recommender system is depends on the output of contributing recommender system. In feature augmentation the contributing recommender gives more interesting information and characteristics to actual recommenders.

Some studies demonstrate that the hybrid methods can provide more perfect recommendation than pure technique. In recommendation systems the cold start and sparsity problem arrives [5]. To solve these problems in recommender system hybrid filtering approaches are used. The disadvantage of an individual method is overcome by using multiple recommender technique in a combined model. The combined model overcome sparsity and cold start problem. Netflix movie recommender is an example of hybrid recommender system.

III. MACHINE LEARNING ALGORITHMS

Recommender system uses the algorithms to provide user with appropriate service recommendation. Various recommender systems use the machine learning algorithms. For example in content-based recommendation provides recommendation by matching users interests with description and attributes of items. For content-based recommender system we can use standard machine learning techniques like logistic regression, SVM, Decision tree etc. based on user and item features for making predictions.

Machine learning uses computer to understand human learning and allows computer to acquire and identify knowledge from the real world and improve the performance of the task using this knowledge. The computers learn with help of machine learning algorithms. [6]Machine learning deals with problem such as classification, regression, ranking, and clustering and dimensionality reduction. There are large numbers of machine learning algorithms; they can be classified based on approach used for the learning process. They are classified into four categories: supervised, unsupervised, semi-supervised and reinforcement learning.

[6]Supervised learning means when we have training data and correct answers. In these algorithm receives a training data in which the output value and input value are known. Unsupervised learning means it doesn't have training data and correct answers. Some data is providing from the real world then systems have to learn from than data on their own. This technique is focused on finding hidden patterns in data or information. In semi-supervised technique system gives training data set with missing information and still need learn from it. A semi-supervised learning algorithm is capable of learning and giving conclusion even with incomplete data. Reinforcement learning algorithms work on external feedback or information given by the users or the environment. The positive feedback is learned and repeated, whereas negative feedbacks are avoided.

Now we review some supervised and unsupervised learning algorithms.

Some supervised learning algorithms are as follows:

- Decision tree algorithm is called as decision support tool which uses decision tree like structure.
- [7]Naïve Bayes classification it is probabilistic model which is used for classification of items according to their features. Applying Bayes theorem based on strong independence assumption between the features. For example to mark an email as spam or not spam.

- Logistic regression algorithm measures the relationship between the categorical dependent items and one or more independent items by estimating probabilistic using a logistic function.
- [7]Support vector (SVM) is a binary classification algorithm.

   Some unsupervised learning algorithms are as follows:
- Clustering algorithm is used to do clustering. Clustering is the task of grouping a set of objects. The objects in one group are more similar to each other than to those in other group.
- Independent component analysis algorithm is used as statistical technique which is use for revealing hidden factors from data.

IV. CONCLUSION

   In this paper, we discussed different techniques used for implementation of service recommendation system. The techniques like collaborative filtering, content-based filtering and hybrid recommender system are discussed. We also concerns about how this can be achieved in recommendation system. We also discuss what is machine learning and its different algorithms. We had seen how these machine learning algorithms are used in recommender system to improve performance.

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