

## Survey Paper on Recommendation Systems

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**Abstract** - In this 21<sup>st</sup> century online shopping is a common trend. With increase in number of users day by day, there was a need to improve the buying experience of the users. Hence recommendation systems were developed. The aim of the recommendation system is to suggest things that the user might order or like. This survey paper describes various recommendation techniques used in various systems. Generally recommendation system is used to benefit the users as well as the Business(merchants), by recommending the user items related to his/her previous searches or buying patterns. This helps to increase the sales of the company. In this survey paper, various recommendation techniques used previously are compared.

**Key Words:** Recommender System, Content Based Algorithms, Collaborative Filtering Algorithm, Hybrid Approach.

### INTRODUCTION

A recommender system uses information provided by the user and some filtering system techniques to recommend/suggest items such as TV shows, Web Pages, Music, Books, Toys, Electronics etc.

The system seeks preference or ratings from the user and depending upon the rating it tries to rate the unlabelled or unknown data.

Recommender system uses data mining algorithms to predict the user's interest.

Recommender system uses data mining steps such as pre-processing, analysis and result interpretation. Today recommendation systems are used by almost every website.

For example-Amazon, Flipkart, Swiggy, Uber Eats etc.

### BACKGROUND

A Recommender system or Recommendation system is a sub-class of information or content based filtering system that seeks to predict the rating the user would give to them. A recommender system can be built using a collaborative filtering algorithm.

The recommendation system[6][9] can be built based on the inputs taken from the users. The input can be taken implicitly or explicitly. The implicit input can be

obtained based on the past product transactions made by the user or based on the similar profile of another user. Explicit input can be taken by asking the user to rate the product based on his personal experience.

The recommendation system[6][9] can be of various types it can be Push, Pull, Passive.

**Push:-** This is a direct method of giving recommendations or sending recommendations to the users through notifications or emails.

**Pull:-** This is recommendation system where the recommendations are given to the user only when users asks for it.

**Passive:-** In this recommendation system the related products are displayed which have resemblance to the product currently being viewed.

A personalized recommendation system[7] can be determined as of three modules which are:

(i)Behaviour record module:-This module saves the user behaviours such as product browsing history and user ratings[7]

(ii)Model analysis module:-This module analyses the potential user's interest in products and its degree based on the ratings given by the user.

(iii)Recommendation analysis module:-Based on the above two modules a personalized recommendation system can be built which recommends products to the target user.

### RELATED RESEARCH

Many concepts and ideas have been published and semi-implemented for a better and accurate recommender system.

Peng-Yu lu[1] described in his paper, the hybrid recommendation methods can avoid defects of single algorithm & it is more suitable for recommendation application of e-commerce. It significantly improves the recommendation quality & efficiency provides great user experiences. It overcomes various problems such as data sparsity, cold start & inefficiency. This hybrid algorithm is based on improved collaborative filtering of user context fuzzy clustering & content based. Also Various approaches

(CB,CF & NB) [2] are used to recommend products by system, but no single algorithm can satisfy the personalized needs of users. Sparsity is one of the main problems to almost all recommendation system. The proposed algorithm combines user based approach, item - based approach & Bhattacharyya approach [2] together by a competition mechanism. This proposed algorithm was able to find more reliable items to recommend to the user.

Ms Shakila Shaikh, Dr Sheetal Rathi [3] proposed the need for semantics in current recommendation system. To predict or suggest efficiently, the authors performed survey on various websites by rating them on various parameters. They suggested that graph algorithm [3] can be used to improve recommendation of the system. If semantic factors are integrated in the system the recommendation can be improved.

Also there is a need of improving the efficiency and accuracy of filtering algorithms. Using the root mean square error [7], it facilitates evaluations of the accuracy of various algorithms. In this paper, a fast Collaborative Filtering algorithm using a k-nearest neighbor graph is proposed that will increase the accuracy as well as the efficiency. Not only does this [7] algorithm predict the preferences of only the k-nearest neighbor items, but it also shortens the execution time by calculating a k-nearest neighbor item graph in less time based on greedy filtering.

#### CHALLENGES AND ISSUES

- A. Cold-start [4]: It's hard to give suggestions to the new user as the system is unaware of his/her shopping patterns. This is known as the Cold-start problem. In some recommender systems this problem is solved by performing a survey while user creates his/her profile. Some questions are asked and the responses is recorded. Based on these responses, recommendations are made.
- B. Scalability [4]: When the number of users increases, the system needs more resources for processing information and forming recommendations. Most of resources are consumed with the purpose of determining users with similar purchasing patterns. This problem is solved by the combination of various types of filters.
- C. Scarcity [4]: Today online shopping websites have huge amount of users and items. Using collaborative and other approaches recommender systems creates neighborhoods of users using their profiles. If a user has rated only few items then it is difficult to determine his taste and he/she could be mapped to the wrong neighborhood. Sparsity is defined as the problem of lack of information.
- D. Privacy: Privacy can be considered as the most important challenge that the systems can face. For

performing recommendations the system asks for information such as user location, bank data etc. This type of information needs to be protected for unauthorized users. Almost all online websites today use algorithms and programs specially developed for privacy protection.

To overcome the challenges like scalability [10] and to improve scalability of Collaborative filtering algorithms and reduce data sets sparse of the recommended system, Against these issues an collaborative filtering approach - Cluster based collaborative filtering recommendation [10] algorithms has been proposed.

#### CONCLUSION

This paper has presented the various techniques to build the recommender system and to advice the performance and accuracy of the system. We have also discovered areas that are open to many additional improvements, and where there is still much exciting and relevant research to be done.

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