

# A Survey on Various Techniques for Personal Movie Recommendation

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## ABSTRACT

Recommendation system plays an important role in helping users to find appropriate products and contents they usually want. There are various recommendation techniques for recommending items to users. These recommendations can be optimized to be more accurate by means of optimization algorithms. This paper focuses on survey of such recommendation techniques and optimization algorithms in the personalized movie recommendation domain. The comparative evaluation of recommendation techniques is also done. This paper gives an insight into recommendation system, various recommendation techniques and optimization algorithms. Collaborative filtering technique along with time varying multiarmed optimization algorithm will give most appropriate recommendations.

**Keywords :** Recommendation Techniques, Optimization Algorithms, Multiarmed Bandit Algorithm

## I. INTRODUCTION

Recommendation system is a type of information filtering system and makes suggestions to users based on past usage and preferences of users. Today importance of recommendation system is very high due to dependence of humans on social media and internet. Recommendation system has its applications on various domains. The main motivation behind using recommendation system is that, it is based on real activity. Any recommendation system consists of two basic entities. First one is user and second one is item. Based on the ranking on items by the users, the recommendations are made. The output of recommendation system is depending upon the type of input given to the system where input may be either rating or data in recommendation system. The rating is generally suggestions made by the users on an item. Data can be age, gender, education of users

and so on. Based on these inputs, the output of recommendation system will be predictions or recommendations. The technique used for recommendation is known as recommendation techniques.

Section II describe the different recommendation techniques. Section III describes related researches. Section IV describes the findings of related research and section V deals with the conclusion of this survey.

## II. RECOMMENDATION SYSTEM TECHNIQUES

A variety of approaches have been used to provide recommendation like collaborative filtering, content based and hybrid approach. Different Algorithms and approaches are there to provide recommendation that may use rating or content information; however collaborative filtering and content based method

suffer from same limitations. Several researchers have tried to overcome these limitations by integrating these techniques with some kind of optimization algorithms. Such a method is hybrid approach that combined ratings as well as content information. Recommendation system will always remain active search area for researchers. The recommendation techniques are majorly classified into three[4]. They are

- Content based filtering
- Collaborative filtering
- Hybrid filtering technique

#### A. Content based filtering

In content based approach, similar items to the ones the user preferred in past will be recommended to the user while in collaborative filtering, items that similar group people with similar tastes and preferences like will be recommended. In order to overcome the limitations of both approach hybrid systems are proposed that combines both approaches in some manner. This type of filtering techniques filtering built on the customer preferences and description about the item. Basically, these algorithms aim to suggest items or product which are alike to that items that user enjoyed in past or is looking at in the present-day[4]. The figure 1 shows the diagrammatic representation of content-based filtering technique.

Data sparsity as well as cold start problem are eliminated in content-based filtering. Data about users are not required for recommending items in content based based filtering. These are considered as the advantages of content-based filtering. Disadvantages of this type of filtering is that to define the item features, content analysis is essential.

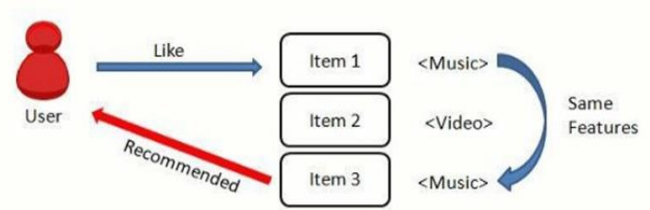


Fig. 1. Content based filtering[4]

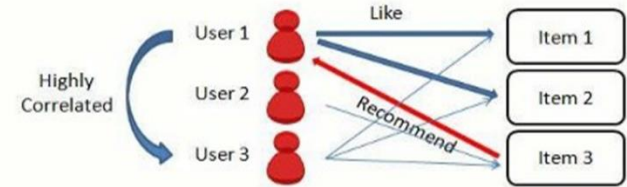


Fig. 2. user based filtering[4]

#### B. Collaborative filtering

Collaborating filtering approaches build the system by considering the user's past behavior viz rating given to those items previously purchased or chosen. The rating given by similar users will also be considered in this regard. then the system computes the items to be recommended from this. Collaborative filtering suffers from the ColdStart problems. This will be eliminated by using user demographics. Collaborative filtering are broadly classified as [4].

- Item based CF
- User based CF

A userbased CF algorithm makes suggestions by considering users having similar interests. It relates user as per the rating is assign to the product. In the Figure 2, in the 1st place user identified with the 3rd user rather second because the rating given by the third user is very alike to the 1st one. That is the reason item 3 is suggested to the user[4]. The pictorial representation of user-based CF is shown in figure 2. Itembased CF algorithms depend on the items as the user rated items comparably are probably similar. From Figure 3, user2 and user3 rated item1 and item3 so, it assumes that item 1 and 3 become similar. As user1 like item 1, item 3 is suggested.

The excellence of recommended items are estimated through user ratings. This is considered as an advantage of collaborative filtering. stability vs

plasticity issue and cold start problem is considered as disadvantage of this method.

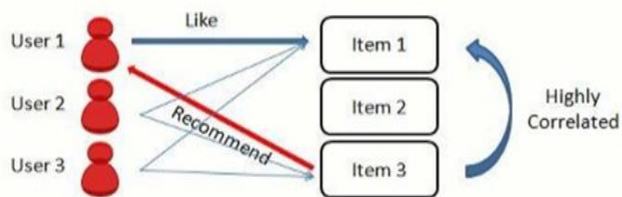


Fig. 3. item based filtering[4]

### C. Hybrid filtering

Hybrid method of recommendation is a recommendation technique which uses any of the recommendation techniques and an optimization algorithm or are built by joining different recommender system techniques to build a more robust framework. Hybrid recommendation system gives higher recommendation accuracy compared to content based and collaborative filtering methods in movie recommendation, the domain pertinent to the research[8][9].

## III. RELATED RESEARCH

### A. Recommendation System

Recommendation system is a model which predicts the user preferences and forms suggestions based on these predicted preferences. This section deals with the background study of recommendation system and recommendation techniques.

C Agarwal" Recommendation System" is a text book which gives the basic background study of recommendation system. This book includes the ideas about how recommendation system works and types of recommendation techniques [1].

Dolly Sigroha et, al. discussed the basic recommendation techniques for recommendation [2]. A comparative study on various recommendation

techniques are done. Study reveals that, among two techniques, content-based filtering has more accurate recommendation than traditional collaborative filtering technique [2].

Gourav Jain et, al discussed on implementation of recommendation in various domains. This study reveals about various domains where recommendations are applicable. The domains include movie recommendation, tag recommendation, venue recommendation and news recommendations and so on. This survey on recommendation domains gives us an insight about various areas where recommendations are applicable. [3] Bhumika Bhatt et, al. reviewed a paper on machine learning based approaches and techniques in recommendation. This paper represents the overview of Approaches and techniques generated in recommendation system. Recommendation system is categorized in three classes: Collaborative Filtering, Content based and hybrid based Approach. This paper classifies collaborative filtering in two types: Memory based and Model based Recommendation . The paper elaborates these approaches and their techniques with their limitations. This survey shows the road map for research in this area. The author substantiates the use of hybrid algorithm in recommendation context as the best. [4]

Yagnesh G. patel et, al. discussed a study on various techniques of recommendation system in web mining. This study shows the recommendation system related research and introduce various techniques and approaches used by the recommender system. Userbased approach, Itembased approach, Hybrid recommendation approaches. The study justifies that the hybrid method of recommendation is the best in web mining context. [5].

Priyanka et, al. introduces Various Algorithms on Recommender System[6]. This comparative study reveals the best recommendation technique. There are mainly three types of recommendation techniques.

They are classified as content-based filtering technique, collaborative filtering technique and hybrid filtering technique. In this particular study, the author concludes that hybrid recommendation techniques have a better recommendation performance. [6]

Dr. Shelbi Joseph et, al. introduced a comparative study on recommendation system types and its classifications. In this study, recommendation techniques are classified mainly into three. They are content based filtering technique, collaborative filtering technique and hybrid filtering technique. Comparing their recommendation performance, hybrid filtering technique of recommendation has better recommendation accuracy. This study is focused on reviewing some significant works in the three basic recommender system types. This survey brings out the major challenges faced by recommender systems. The main contribution of the study is in proposing a novel hybrid recommender system which addresses the sparsity of recommendation systems. [7]

Rui Chen et, al. discussed about the Collaborative Filtering Based Recommender Systems: from Traditional Methods to Hybrid Methods Based on Social Networks. In the era of big data, recommender system (RS) has become an effective information filtering tool that alleviates information overload for web users. Collaborative filtering (CF), as one of the most successful recommendation techniques, has been widely studied by various research institutions and industries, and has been applied in practice. CF makes recommendations for the current active user using lots of users historical rating information without analyzing the content of the information resource. However, in recent years, data sparsity and high dimensionality brought by big data have negatively affected efficiency of traditional CF based recommendation approaches. In CF, the context information such as time information and trust relationships among the friends is introduced into RS

to construct training model to further improve the recommendation accuracy and user's satisfaction, therefore, a variety of hybrid CFbased recommendation algorithms have emerged. In this study, we mainly review and summarize the traditional CFbased approaches and techniques used in RS, and study some recent hybrid CFbased recommendation approaches and techniques, including the latest hybrid memory based and model based CF recommendation algorithms. This study reveals the potential impact that may improve the RS and future direction. It introduces the recent hybrid CFbased recommendation techniques fusing social networks to solve data sparsity and high dimensionality, and provide a novel point of view to improve performance of RS, thereby present a useful resource in the state-of-the-art research result for future researchers. [8]

The overview of recommendation system and various techniques are understood from the above study. Among the various recommendation techniques, the hybrid filtering technique of recommendation has better recommendation performance compared to content based collaborative filtering and collaborative filtering technique. These survey papers give aninsight of background study of recommendation system and recommendation techniques.

## B. Optimization Algorithm in Recommendation

Recommendation system are popular and used in many fields for gathering the information based on the user require ments. It is mainly used to help the user for accessing the process based on the relevant information. Many framework for recommendation systems based on the different algorithms are revolve around the concept of accuracy only but other important feature such as diversity of the recommendations are unnoticed. To make the recommendations accurate, efficient optimization technique along with the recommendation technique is used for providing more diverse recommendations

by satisfying the requirements recommendation features. This section deals with the study of different optimizations techniques used in the field of movie recommendation.

D. K. Yadav et, al. proposed a paper named A Movie Recommender System: MOVREC. The most popular areas where recommender system is applied are books, news, articles, music, videos, movies etc. In this paper we have proposed a movie recommendation system named MOVREC. It is based on collaborative filtering approach that makes use of the information provided by users, analyzes them and then recommends the movies that is best suited to the user at that time. The recommended movie list is sorted according to the ratings given to these movies by previous users and it uses Kmeans algorithm for this purpose. MOVREC also help users to find the movies of their choices based on the movie experience of other users in efficient and effective manner without wasting much time in useless browsing. This system has been developed in PHP using Dreamweaver 6. 0 and Apache Server 2. 0. The presented recommender system generates recommendations using various types of knowledge and data about users, the available items, and previous transactions stored in customized databases. The user can then browse the recommendations easily and find a movie of their choice. The recommendation technique used here is collaborative filtering and optimization algorithm used is k means. So this collaborative filtering along with k means is a hybrid technique of recommendation. The only disadvantage of this system is to determine the value of K. [9]

Rahul Katarya et, al. proposed a recommendation system which uses collaborative filtering technique along with cuckoo search optimization technique. This article focuses on the movie recommendation systems whose primary objective is to suggest a recommender system through data clustering and computational intelligence. In this research article, a novel recommender system has been discussed which

makes use of cuckoo search optimization algorithm applied on the Movielens dataset. In this article hybrid technique with cuckoo search is applied to the Movielens dataset to achieve an improved movie recommendation system. They measured the performance of this approach regarding MAE, RMSE, SD, and tvalue. The experiment outcomes on the Movielens dataset discussed indicated that the approach that we discussed provide high performance regarding accuracy and were capable of providing reliable and personalized movie recommendation systems with the specific number of clusters. The disadvantage of this system is that the convergence of cuckoo search optimization takes time. [10].

Rahul Katarya et, al. proposed a hybrid movie recommendation system using collaborative filtering technique and particle swarm optimization technique (PSO). In this paper, we developed a novel hybrid model based on a collaborative filtering (CF) approach that produces movie recommendations in which we developed type division system for movies and adopted this with particle swarm optimization and clustering algorithms as fuzzy cmean and with Kmean algorithm application. The limitation of this work is PSO convergence take time, random initialization of particles position and velocity vector. [11]

Qing Wang et, al. discussed a hybrid movie recommendation system using collaborative filtering and multi armed bandit algorithm with arm dependencies. Online interactive recommender systems strive to promptly suggest users appropriate items (e. g. , movies, news articles) according to the current context including both user and item content information. Such contextual information is often unavailable in practice, where only the users interaction data on items can be utilized by recommender systems. The lack of interaction records, especially for new users and items, inflames the performance of recommendation further. To address these issues, both collaborative filtering, one of the

most popular recommendation techniques relying on the interaction data only, and bandit mechanisms, capable of achieving the balance between exploitation and exploration, are adopted into an online interactive recommendation setting assuming independent items (i. e. , arms). This assumption rarely holds in reality, since the real world items tend to be correlated with each other. In this paper, we study online interactive collaborative filtering problems by considering the dependencies among items. We explicitly formulate item dependencies as the clusters of arms in the bandit setting, where the arms within a single cluster share the similar latent topics. In light of topic modeling techniques, we come up with a novel generative model to generate the items from their underlying topics. Furthermore, an efficient particle learning based online algorithm is developed for inferring both latent parameters and states of our model by taking advantage of the fully adaptive inference strategy of particle learning techniques. Additionally, our inferred model can be naturally integrated with existing multiarmed selection strategies in an interactive collaborative filtering setting. Empirical studies on two real world applications, online recommendations of movies and news, demonstrate both the effectiveness and efficiency of this approach. [12]

Various optimization algorithms viz cuckoo search optimization, particle swarm optimization, multiarmed bandit algorithm etc were discussed in this section. These optimization algorithms are performed along with collaborative filtering technique for accurate recommendation. A comparative study on some of general optimization algorithm is done. The study justifies that, multi armed bandit optimization algorithm along with CF filtering are more efficient and gives better recommendation accuracy.

### C. Personal Movie Recommendation System

Personal movie recommendation system is a type of information filtering system which helps to recommend movies to individuals. This research domain consists of some of relevant works which are related to personal movie recommendations. Study on this domain brings out that the result that collaborative filtering along with an optimization gives better recommendation results.

D. K. Yadav et, al. describes a movie recommendation system called MOVREC. MOVREC uses the technique of collaborative filtering. These recommended movies are ranked on the means of k means clustering algorithm. Here k means clustering algorithm is used as an optimization algorithm. So this collaborative filtering along with k means optimization is a hybrid method of recommendation. The advantage of this MOVREC is that, collaborative filtering is a content independent technique. Real quality assessments of items are done in this paper. Since the system uses collaborative filtering technique, the recommendations are based on user similarity rather than item similarity. ie, user based collaborative filtering are used in this MOVREC system. [9]

Rahul Katarya et, al. proposed an effective collaborative movie recommendation system with cuckoo search optimization. Here, for the purpose of recommendation, collaborative filtering is used along with an optimization algorithm called cuckoo search. This recommendation system uses a hybrid recommendation technique. So this method has high recommendation accuracy. Major disadvantage of this paper is that it does not consider about the time varying preference of user and items. Limitation of this paper is that cuckoo search convergence takes more time. [10]

Shreya Agrawal et, al. introduced a personalized movie recommendation system which combines two

techniques of recommendation such as content based filtering and collaborative filtering. The advantage of this recommendation system is that it solves cold start problem and has improved recommendation accuracy. But the computational overhead and time of computation will be high. Because it combines two recommendation techniques. This recommendation system also does not considered about the time varying preference of users and items. [13]

Qing Wang et, al. proposed a personal movie recommendation system that uses collaborative filtering techniques and multi armed bandit algorithm. The output recommendations obtained as a result of collaborative filtering is formulated as multi armed bandit problem. The multi armed bandit algorithm is used as an optimization algorithm. So this system uses a hybrid approach of recommendation. The feedback is given to system for making the future recommendations better. The limitation of this system is that it does not consider about the time varying user preference and item preference. [12]

ChingSeh (Mike) Wu et, al. discussed a personal movie recommendation system using collaborative filtering technique. It compares the performance of item based collaborative filtering and user based collaborative filtering. By using the technique of collaborative filtering, cold start problem is avoided. The user based collaborative filtering has better recommendation performance compared with item based collaborative filtering. The limitation of this paper is that, it is not a hybrid recommendation technique. So it has less recommendation accuracy. Another limitation of this recommendation system is that, not considered about the time varying user and item preferences. [14]

#### IV. FINDINGS

Content based filtering and collaborative filtering are the commonly used two techniques for recommendation. Both the techniques have certain

disadvantages, that inhibits the performance of recommendation. To improve the recommendation accuracy, hybrid technique of recommendation was proposed. Personalized movie recommendation are not aware about the time varying preferences of users and movies, which inhibits the performance of system. Time varying property of user and item are considered by using time varying multi armed bandit optimization algorithm. So collaborative filtering along with time varying multi armed bandit algorithm gives better recommendation performance compared to other hybrid recommendation system.

#### V. CONCLUSION

Recommendation systems are considered as a wide area of research. But the challenges faced by recommender systems were not addressed completely and there is a lot of room for improvement. Study has attempted to list some of the significant works in three domains. ie, background study of recommendation system and techniques, recommendation algorithm optimization and personal movie recommendation system. In the era of big data, recommendation system helps users to spend less time finding their favourite items. This study shows the recent articles on solving data sparsity and high dimensionality, summarize the approaches and techniques of recommendation. This research in recommender system is directed on the right path of improving the relevance and accuracy of personalized recommendations.

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