A Survey of Online Book Recommendation System in Social Network

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Abstract- *The impending growth of the internet results the people to use of social networks such as Facebook, Twitter, linked-in etc., and started sharing of their likes and dislikes. A large amount of heterogeneous study materials is generated on the internet every day and it is rapidly increasing. Though the resources are budding infinitely every day, it is difficult to choose appropriate resource for their learning. Book Recommendation System (RS) is the tool (subset of information filtering), which helps the users to find their interesting and relevant products from huge amount of information by suggesting them based on preference given and rating given by other users with a similar interests. In this paper, we highlighted the importance of Recommendation Systems, different methodologies and general architecture of Book Recommendation System.*

Keywords- Social Network, Book Recommendation System, Cold start, Sparsity.

I. INTRODUCTION

The people uses internet to communicate with each other. Nowadays, there are lot of sources deliver content in a variety of forms and lot of content is generated from users through blogs, comments and reviews than through professional writers. Users frequently faced with an information surplus (extra data). Even before the Internet days, it is difficult to find desired book to read. The people were regularly guided with others opinions and recommend the same to their friends. In some situations, the users don't know exactly what they want or they may not even be actively looking for contents.

Library is a vital learning and research location and also an key channel that learners can admire knowledge. Now libraries have been recognized at all levels of web-based information service system, but most of the library service provides only some plain queries, which still cannot successfully supply adaptable information to readers who are attracted in some specific types of books. With libraries becoming more and more gigantic and sparse, often readers need to obtain timely information on latest book. So, to satisfy readers' personal demands, it is important to consider a new book recommendation to provide better service through social networks.

Generally, some users prefer news articles, blogs and events, which are related to their interest can be delivered to them. But, right now they are enforced to visit various sources and go through inappropriate content prior to judge helpful information. For such type of information need, one of the finest ways to help users is to advise information intended to them. There are many social websites like Orkut, Facebook, Tweeter and LinkedIn the place where people often share their likes/dislikes. For web sites like these, it is important to build recommendation system that could incorporate information from various sources to offer customized information to the user. Book recommendation systems can gain to social networks, commercial sites, social and digital libraries by alleviating the awareness acquisition process of users who look for books that are interesting to them. The survey made my amazon shows that more than 25% of sales generated through recommendation. Survey also shows that over 90% peoples believe that book recommended by friend are of useful and 50% people buy the recommended books. Online social network information promises to boost recommendation accuracy ahead of the capabilities of purely rating or feedback driven recommender systems as to better serve users' behaviour across various domains, many online social media now support a new attribute of "Buddy Circle" or "Friends Circles".

II. RESEARCH CHALLENGES

a. Cold Start problem

This problem refers to the situation when a new user or items newly added to the system [6]. With swift increasing of registered users diverse products, the problem of cold start occur. Three kinds of cold start problems are: new user, new item and new system. In such cases, it is too difficult to provide recommendation, as in case of new user, there will be very less information available about the user. For a new item, no ratings are usually available and thus recommendations cannot make useful in case of new user as well as new item. For the new system, it is difficult to find the pattern as

information about user and newly updated product or items is very less. Crucial factor in social network is each individual preferences and interpersonal relations namely "friend circle" or "buddy circle" helps to solve the cold start problem.

b. Sparsity Problem

This is one of the key problems encountered by recommender system. The data sparsity which has great influence on the class or quality of recommendation. One of the key reason behind data sparsity is that only a few users rate and many other users do not rate most of the items and the ratings available are usually less and sparse. In collaborative filtering technique it is very important that the more users are expected to be rated the item. Though high rating [6] provided by very few users leads to problem of sparsity. To overcome the sparsity problem, one can use user profile information [6] to calculate user likeness or similarity item with others. Similarity or likeness in users can be identified with the help of gender, age, area code, demographic segment etc. Associative retrieval algorithms will aid to solve problem of sparsity[3]. To resolve the sparsity problem one can use Sparse rating matrix. Item based mining and Associative retrieval technique [5] are also used to overcome the problem of sparsity.

c. Scalability

It is the property of system which indicates its ability to handle emergent amount of information [6] in a smart manner. With enormous growth in information over internet, it is evident that the recommender systems are having an outburst of data and thus it is a big clash to handle with constantly growing demand. Few algorithms of the recommender system deal with computations, which increase proportionally with growing number of users and items. Technique projected for treatment of scalability problems are based on approximation mechanism [2]. Scalability problem can be overcome by '**Clustering**' which helps to group the similar items with inter cluster distance as big as possible, '**Pre-processing**' in which noisy data is cleaned and transformed over to the recommendation system and '**User based collaborative filtering**' [5] uses the person's profile.

d. Overspecialization

It prevents user from discovering new items and other available options [6]. However, diversity of recommendations is a desirable feature of all recommendation system. Overspecialization occurs if system recommends only items which having high rating against the user profile. For example if a person has no experience with Indian foods will never receive recommendation though the Indian restaurant are available in the city. Probabilistic fusion and similarity fusion are used to solve the problem of overspecialization. Out-of-Box method can be used to resolve the overspecialization problem. Similarity measures, sampling and dimension reduction in collaborative filtering helps to overcome the overspecialization problem.

e. Synonyms

The different names given to very similar items are known as synonymy. Present recommended systems are incapable to determine this latent feature and thus delight these items differently. For example, the apparently diverse items "children movie" and "children film" are really referring to the same product, but recommendation systems refer these as different items. Indeed, the level of unpredictability in descriptive term usage is superior than commonly assumed. The frequency of synonyms reduces the recommendation performance. This problem could solve by grouping different words belonging to the similar topic.

f. Gray Sheep

It refers to the users whose opinions always disagree with any other group of people. Hence, it makes difficult to recommend the desired items to the users. On the other hand, Black sheep are the conflicting group whose characteristic make recommendations almost unfeasible. Although black sheep is a failure of the online recommendation system, non-electronic recommendations also have huge troubles in these cases, so black sheep is a manageable failure.

g. Shilling attacks

In a recommendation system people give the ratings to their interested items, but there is chance that most of the people may give plenty of positive ratings for their own products and negative ratings for their competitors products. This leads to manipulation of the recommendations. It is important to initiate safety measures to discourage such kind of manipulations.

h. Diversity

Collaborative filters help us determine fresh products among multiple choices. So, it is estimated to increase diversity. However, some algorithms may unintentionally do the reverse. In some of recommendation systems, items are recommended based on other users rating only. These systems usually cannot use historical data, which leads to rich-get-richer effect for well-liked items, leading to less diversity. It is

important consider the diversity effect in recommendation system to identify the desired products based on user preference and rating given by other users.

III. BOOK RECOMMENDATION SYSTEM APPROACH'S IN SOCIAL NETWORK

Content-based and collaborative filtering are two important and popular recommendation methods. Both of these methods lead to cold start and sparcity problem. Personal filtering and hybrid filtering are used in book recommendation system to provide accurate and timely recommendation. The following diagram shows the different methodologies used in book recommendation system.

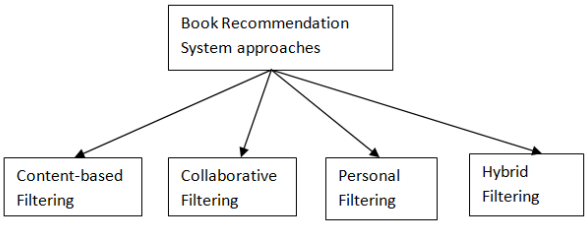

Fig. 1: Classification of Book Recommendation Strategies

A. content-based Filtering

Recommender systems have the result of guiding users in a adapted way to attractive products in a huge space of probable options. The content-based method to recommendation has its major roots in the information retrieval [6] and information filtering research. For the reason that of the important and before time advancements completed by the information retrieval and filtering communities and because of the consequence of several text-based applications and many current content-based systems concentrates on recommending items which contain textual information, such as documents, Web sites (URLs), and Usenet news messages.

In Content-based filtering method try to recommend items most alike to those a given user has liked in the earliest times. Indeed, the basic progression performed by the content-based recommender consists in matching up the attributes of a user chart (outline) in which preferences and interests are being stored, with the attributes of a content object (item), in organization to recommend to the user fresh interesting products. Let the utility u(I, P) of item 'I' for user 'P' is estimated based on the utilities u(I, P_k) assigned by user P to items I_k € I that are "similar" to item I. For example, consider a movie recommendation application, in order to recommend movies to user P, the content-based recommender system tries to understand the similarities or commonalities among the movies user P has rated highly in the past (specific actors, directors, genres, subject matter, etc). Then recommendation will be based only on the movies that have a elevated level of likeness to whatsoever the user's preferences.

The advancement over the usual information retrieval approaches that comes by the use of user profiles which contain information about users' needs, preferences, and tastes. The profiling information can be extracted from users explicitly, for e.g., through questionnaires, or implicitly learned from their transactional behaviour over time.

B. Collaborative Filtering

Collaborative Filtering has proved one of the most effective methods used for recommendation. Collaborative recommender (filtering) systems try to guess the utility of items for an intended user based on the items formerly rated by other users. More officially, the utility u (I, P) of item 'I' for user 'P' is estimated based on the utilities u (I, P_k) assigned by user P to items Ik € I that are "similar" to item I. For example, consider a movie recommendation application, in which in order to recommend movies to user P, the collaborative recommender system helps to find the "peers" of user P, i.e., other users who have similar interest in movies (rate the same movies in common(similarly)). Then, only the movies that are most liked by the "peers" of user P would be recommended.

C. Personal Filtering

Personalized Filtering systems can aid users to discover attractive things and they are generally used with the development of web commerce. With the regular boost of customers and products in web commerce systems, collaborative filtering and content-based filtering hunt of the target customer in the entire customer space resulted in the breakdown of ensuring the real time requirement of recommender system.

The personalized recommendation model consists of the following three [21] aspects:

1. Interpersonal influence (whom you would trust).
2. Interest circle inference (others interest is most similar to yours).
3. User private (personal) interest (effect on what items you would interest more).

Personalised Filtering aims at recommending user attracted products based on their past behavior and interpersonal relationship. However, we calculate the ratings of user 'u' on an unknown item 'i' to assess how much user u fascinated in item i. In Recommendation System, we have a

set of users U = {u1, . . . , u_M} and a set of items P = {i1, . . . , i_N}. The ratings expressed by users on items are given in a rating matrix R = $[R_{u,i}]M \times N$. In this rating matrix R, $R_{u,i}$ denotes the rating of user 'u' on item 'i'. It may be any real number, but a lot of times ratings are positive integers in the range of 1 to 5. In a social network, each user 'u' has a number of friends, and Su,v ∈ [0, 1] denotes the value of user 'u' trust on user 'v' or the influence of user 'v' to user 'u'. The trust values are specified in a matrix S = [Su,v]M × M. Note that S is usually asymmetric, because the influence of user 'v' to user 'u' can be diverse from the influence of user 'u' to user 'v'. for the time being, Wu,v ∈ [0, 1] denotes the interest in common of user 'u' to user 'v' and such values are given in a matrix W = [Wu,v]M × M, which is symmetric in general. And Qu,i ∈ [0, 1] denotes the relevance of user u's interest to the matter of item i. The significance values are given in a matrix Q = [Qu,i]M × N, which represents users' personal interests.

Thus the mission of our personalized recommender is: Given a user u ∈ U and an item i ∈ P for which Ru,i is unknown, forecast the rating for u on item i by using R, S, W and Q matrices.

D. Hybrid Filtering

Many recommendation systems make use of hybrid approach by combining different filtering methods, which helps to evade certain limitations [8] of particular system.

Different ways to unite and content-based collaborative methods into a hybrid (combiner) recommender system can be classified as follows:

1. Implementing collaborative and content-based methods separately and combining their predictions.
2. Incorporating few content-based characteristics into a collaborative approach.
3. Incorporating few collaborative characteristics into a content-based approach.
4. Building a general unifying model which incorporates both content-based and collaborative characteristics.

All these approaches have been used by recommender systems researchers, as said below.

To build a hybrid recommender systems by Combining Separate Recommenders One way is to implement separate collaborative and content-based systems.

In that case, we can have two different scenarios. One, we can merge the ratings(outputs) that are obtained from individual recommender systems into a final recommendation by using either a linear combination of ratings [2] or by a voting scheme [6]. Two, we can use any one of the individual recommenders, at any given moment selecting to use the one that is "better" than others based on some recommendation "quality" metric. For example, the Daily Learner system [13] choose the recommender system that gives the recommendation with much higher level of confidence, while [4] selects the one whose recommendation is more reliable with past ratings of the user.

IV. GENERAL ARCHITECTURE OF BOOK RECOMMENDATION SYSTEM

The following figure describes the general architecture used in book recommendation system.

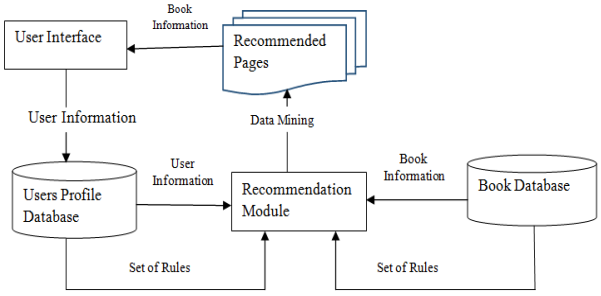

Fig. 2: General Architecture of Book Recommendation System

The general model of book recommendation system is made up of book database, user interface, rule matching, and user profile. Firstly, the user gives input to the book recommendation system which is in the form of either user details or the name of the book with or without author name. The input given by the user is then processed by the book recommendation system module and the desired books are fetched from the database and displayed to the user. Now the user can download the book of their choice after rating the book. Once the user gives his star rating, then the set association rules are implemented based on the user rating to display him other related books of the same author or other user with similar rating patterns. The association rules produced by recommendation module are used to analyze user's interest. The data mining technology is applied on the profiles database where the star rating and downloading patterns of all the users are stored.

Recommendation module finds the appropriate match from the books database based on the analysis of the profile database according to user's information, and then output some book recommendation information by searching in book database according to the subsequent of selective rule, which

may of user interest. Recommendations are also made on the basis of the same author and same domain of the book selected by the user.

At the backend the user's data in the database is analyzed in order have better understanding of the user's interests. Every time when the new user rates a particular book, its average rating is calculated and stored in the database. So the book recommendation system can uses the combination of both content base and collaborative filtering to have better understanding of user's interest.

V. CONCLUSION

This paper surveys the different methodologies used to recommend books in social network. We introduced the challenges faced in recommendation system. We also discussed general architecture of book recommendation system. The books can be recommended to the users more accurately with the help of personalized filtering and hybrid filtering methods.

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