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# A Survey on Online Social Voting Based on Recommended Systems

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**Abstract: Recommended system which predicts or recommend the content to the user based on the past searches and based on the other user's behavior. With the popularity of the social network, the social recommender system has gained the momentum of research among the researchers and political scientist. Social voting is one of the new emerging features. Social voting is used by both e-commerce and political organizations. Political organizations use it to analyze the outcome of the election result. E-commerce uses it to boost their services and business. The paper basically talk more about collaborative filtering in specific and in general about the social recommender systems. The paper discusses the approaches which are taken for the social voting recommendation. And it discusses the social voting recommendation system in MF and NN based approaches. The paper provides a summarize context of the techniques and challenges in the collaborating filtering.**

**Index Terms— Collaborative filtering,social voting,similarities,recommender systems.**

## 1. INTRODUCTION

With the advancement of technology, social networks are getting better day by day and it has become a crucial part of our life. Some of the examples of some famous social network are twitter , facebook ,weibo and wechat. On the daily basis lot of data is being generated by the users. A user not only can share textual updates but also, picture, and video, or any other form of data with his/her friends and can also share with a large targeted audience by quickly disseminate those updates to a much larger audience [1]. These services help users to share the information among themselves inefficient manner.

In today's world, the consumption of data is more compared to the past. And due to the digitalization and introduction of mobile devices, it has become much easier to people to consume a lot of data from any part of the world. So one or another way each and everyone are connected to the social world. It has become a platform for many organizations. It may be marketing or political campaign it is the perfect platform for them to connect with a mixed group of audience. Some of the functions of the social network providers such as like or dislike, short text link update, sharing of hyperlinks or any media content from the internet. One of the popular functions of social networks is social voting which offers the user to share his/her opinions

Each and every day the web generates a huge amount of data. And it is important to show and deliver accurate information to the user. So, to tackle this in an efficient way the social network provider adopted the recommended system concept. This recommended system makes the whole process easy by analyzing the user data and the activities. Its job is to find the relevant information and predict the user behaviour by mining the data and using the recommendation approaches and methods [2]. The current research is mainly focused on the collaborative filtering recommender system. The collaborative filtering algorithm is widely used in the social network recommendation [3] [4] [5] [6].

The rest of the paper is organized as follows: Section II presents the related work. Section III provides literature survey which provides brief overview of the basic collaborative filtering algorithms and the challenges faced in CF recommender systems. Section IV is the conclusion.

## II. RELATED WORK

### *A. Mining Social Networks*

Because of the popularity of the social network many research community has shown keen interest. ArnetMiner is the most popular research journal repository. It is the popular publication and search engine to search for research papers. In [7] [8] the authors present a software name LikeMiner which is used to capture and represent the objects. The software works by mining the "like" graph by taking the facebook data. Another research work on the same topic is presented in [9] where the authors utilize what they define as social endorsements networks in order to assign tags to entities existing in social systems like Twitter.

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***B. Voting Advice Applications***

Voting advice application is used for the electronic political campaign. Research on VAA was mostly taken by the political scientist [10]. The VAA help the users to decide to whom to vote. The user's analysis the policy which are relevant to them. But research has taken up so as to improve the design of the VAA. The VAA work with the mathematic algorithms. In [11], Mendez compares four models for calculating the user-party congruence and argues that algorithms based on a directional logic perform best. In [12] the authors share that the output of voting assistance tools might be manipulated by political entities. The drawback of the VAAs is that most it is dominated by the political science approach and a little has been done towards the voter community by enabling the collaborative vote suggestions and voters interactions through the comments.

The best example of the VAAs is the Choose4Greece [8]. Choose4Greece Voting advice application was developed by Preference Matcher team. Some of the features of Choose4Greece [8] are

- In Choose4Greece blog, user has the option to comment or leave a feedback. Through mean of this blog, the user can communicate with the research team.
- By taking into the consideration of voter-party similarity, the application is able to provide with community-based recommendations.
- Another feature of Choose4Greece in which the users can compare the political views with each other by using a public PIN that can be sent to other users for comparison. Here the Users can get similarities and dissimilarities of the political views with each other. Each user is assigned a unique private Personal Identification Number to save the results.

***C. Recommendation Systems***

As Recommended system is the system which suggests item like movies, books etc to the users. The two methods which are categorized are:

1) Collaborative-filtering: Users are recommended with the items that people with similar preferences liked in the past [13] [14].
2) Content-based: Users are recommended with the identical type of items which they preferred in the past [15] [16].
3) User based collaborative filtering- User based collaborative filtering (UBCF) present the rating for an item by taking the rating of the other users which are similar to the chosen user.
4) Item-based Collaborative Filtering- Similar to UBCF, IBCF is for producing the predictions to the users. In IBCF the prediction of the rating for an target item is computed by combining the rating of user for the set of items which are similar to the target item.

In the next section, we broadly discuss the most popular recommended system method i.e. collaborative filtering in detail including the models, techniques and challenges faced by it.

## III. LITERATURE REVIEW

Collaborative filtering is implemented by using them in the form of algorithms and models. And further research is going on and new methods are being introduced and also the known methods are being carried forward with improvement into it,
Below are some of them:

***1.Model Based algorithm***

The model-based algorithm also known as the item-based algorithm is used for recommendations. It provides item recommendation by building a dataset of ratings. This is done in probabilistic approach by computing the similarity values by getting the expected value by predicting It is based on the rating on other items [17].

Model-based algorithm works with the similarities of the items. The similarities between the items are analyzed by taking the rating of the users who have rated on the two or more items which are common in between them.
There are many formulations for measuring the similarities between the two entities are more. Most common methods are used in model-based are Cosine based and Pearson based similarity.

***a) Cosine Based Similarity***

Here in the below formula, the two items are taken as the two vectors. And the similarity between these vectors is measured by the angle of cosine. Here the similarity between the two items i and j is denoted by sim($i$,$j$) and the vectors are denoted by cos($\vec{i}$,$\vec{j}$) .

$$sim(i,j) = \cos(\vec{i},\vec{j}) = \frac{\vec{i}\cdot\vec{j}}{||\vec{i}||_2 * ||\vec{j}||_2}$$

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***b) Pearson Based similarity***

This similarity is measured on the set of data. The pearson based similarity shows the linear relationship between two set of data:

Recommender systems (RSs) for voting online social networks have two main concepts.

Matrix factorization (MF)

Nearest neighbor (NN)

Notations:

| | |
|---|---|
| U, u | User |
| V | Voting |
| G | Group |
| V | Target User |
| Qu | User Latent Feature |
| Pi | Voting Latent Feature |
| Ř u , i | User-voting interaction |
| Gu,n | User-group interaction |
| Su,v | User-user interaction |

***Matrix factorization (MF)***

This concept will help to non-social people. The Voting system requires social relationship in *Nearest-neighbor (NN)* (u → v). Here *Matrix factorization (MF)* doesn't require any social relationships. Finding hot voting is main motive of this concept without social relationship [18] .

In MF we rank the voting's according to user-voting interaction Ř u , i .

**Ř**u,i = **r**m + **QuPi**T [Ref algorithm. 1]

*Here:* Ř u ,i → User-Voting Interaction. (Find the Hot Voting Based On User and Vote Latent Features)

rm → User voting interaction of target vote latent feature.

QuPiT → Score of the voting interaction.

*Nearest-Neighbor (NN)*

In this paper, the idea of meta path is to construct nearest neighborhoods for target users with four formats [18].

1. U-G-U-V metapath
2. U-U-V metapath
3. U-V-U-V metapath.
4. UNN

***1.U-G-U-V metapath***

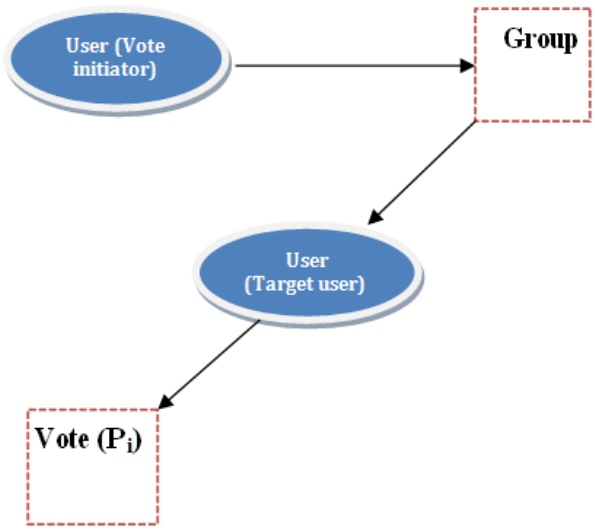


***Fig: U-G-U-V metapath (Xiwang Yang et al, 2017)***

***2.U-U-V metapath***

Voting count of U's followers/friends with in m-hops with same latent features. (1-hop Direct friend, 2- hop Indirect friend).

1-hop Direct friend w=1

2-hop Indirect friend w=0.1

Ex:

Rahul (Vote Initiator), Vote LF: Books  Swamy (1-hop) Pi of books is 2

1*2=2;

Rahul(Vote Initiator), Vote LF: Books  Ali (2-hop) Pi of books is 2

0.1*2=0.2;

***3.U-V-U-V metapath***

Find the set of users who have participated, take count of the voting's participated vote initiator's previous votings.

4.User Nearest Neighbor (UNN)

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A set of NNs of user u and user v are weighted according to their similarity sim(u, v) with user u. Simply take User's Latent features and count the voting participated of Latent Feature.

Combined Neighborhoods:
Hybrid approach is attained with the combination of UUV (m-hop), UVUV, UGUV and UNN approaches.
Score u, i = U-G-U-V Score +U-U-V score + U-V-U-V Score +UNN Score; Based on score we forward the vote to users.
In [18] the authors presented an MF- based and NN-based recommender systems through some experiments they have found that social network and group affiliation can improve the accuracy of the voting recommendation system, especially for the cold users. The authors in [18] present that social network information overtop the group affiliation information in Nearest Neighbor. But both the social network and group affiliation information does improve the accuracy of the recommendation but it tends to work well with the cold users than to heavy users. This is in favor of cold users because they tend to participate in the trending well-liked voting.
And to know more about some other collaborative filtering techniques and their advantages and its outcomes refer to Table 1.
Some of the challenges faced by collaborative filtering
Researchers are researching on the collaborative filtering for several years. And we have seen some serious improvements it may be in the form of some new techniques or putting forward the same algorithm in a new way by collaborating with the other streams. For example, Sparsity problem, cold start problem.

***1. Scalability Problem***
According to [17] NN based algorithms requires the calculation which increases with both the number of users and the items. Recommended system algorithms have to run over lakhs of user data and items which lead to scalability problems.

***2. Sparsity Problem***
This problem mostly occurs in the commercial recommendation systems dataset are in large quantity. The recommendation gets improve when the rating of the item is done by the user. So the more the rating the better performance of the recommendation. But in reality, the user cannot rate 1% of the total items. So this leads to the system unable to make the item recommendation properly. As a result, the accuracy of the recommendation gets poor.

| CF categories | Representative techniques | Main advantages | Main shortcomings |
|---|---|---|---|
| Memory-based CF | *Neighbor-based CF (item-based/user-based CF algorithms with Pearson/vector cosine correlation)<br>*Item-based user-based top-N recommendations | *easy implementation<br>*new data can be added easily and incrementally<br>*need not consider the content of the items being recommended<br>*scale well with co-rated items | *are dependent on human ratings<br>*performance decrease when data are sparse<br>*performance decrease when data are sparse<br>*limited scalability for large datasets |
| Model-based CF | *Bayesian belief nets CF<br>*clustering CF<br>*MDP-based CF<br>*latent semantic CF<br>*sparse factor analysis | *better address the sparsity, scalability and other problems<br>*improve prediction performance<br>*give an intuitive rationale for recommendations | *expensive model-building<br>*have trade-off between prediction performance and scalability<br>*lose useful information for dimensionality reduction techniques |

*improve prediction performance
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***Table 1: Overview of collaborative filtering techniques [19]***

## CONCLUSION

Recommendation systems are new generation technology. This technology is in use by the political parties so as to predict the elections outcomes. And for business

organization it is generating more business. These system helps the user to find the relevant or similar item which are recommended by the system according to the rating which the user made in past. It is being carried forward to study the user behaviour over the internet. The paper represents some of the approaches which are used to improve the voting procedure over the social networks. The MF and NN based approaches seen to be present models which are tends to be work on the social network and group affiliation information. In coming years, advancement in the field of artificial intelligence make the recommendation procedure more transparent and improve the accuracy of the recommendation. But still the information overload problem is an issue in social voting and research is going on to overcome this issue so as to present the right voting to the right users so as to improve user experience.

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