

Analyses of Collaborative Filtering Using Item Clustering and Hybrid Clustering

Ankita P. Patel
P.G.Student(G.T.U.)

Prof. Indra Jeet Rajput
Hasmukh Goswami College of Engg, Vahelal

Mehul C Parikh
Asso. Prof. (IT)
Government Engineering College, Modasa.

Abstract

Personalized recommendation systems are producing recommendation and widely used in today's world. Collaborative filtering technique is most successful technique for recommendation.. Collaborative filtering is a method of making prediction about interest of user by collecting preferences from many users. The growth of users and products are increase very quickly and its challenge for nearest-neighbor filtering algorithm. Many algorithms proposed so far, where the principal concern is collaborative filtering challenges. This paper analyses the collaborative filtering challenges using clustering technology. This approach can be implemented based on user clustering, item clustering and another method is hybrid method which use user and item clustering.

Key words – Collaborative filtering; user clustering; item clustering

1. Introduction

Web personalization recommendation is an important task from the user point of view as well as application point of view^[1]. Personalization recommendation used organization to make customer centric website. Personalized recommendation

systems helps organization to enable loyal and lasting relationship to customer by providing individualized information. Collaborative filtering technique is most effective personalized recommendation technique.

Many researchers have proposed various kind of collaborative filtering (CF) technique. Collaborative filtering technique use customer ratings on items. There are two method in CF as first is user based collaborative filtering and second is item based collaborative filtering^[2,3]. In user based CF we first find user's interesting items and then find other user who have similar interest. So , as first it find user user's neighbor based on similar interest and then combine neighbor users' ratings. Item based CF is same as User based CF. It consider a set of items, the target user already rated and compute how similar they are to the target item under recommendation. The challenges of this two CF is following^[4,5]:

Sparsity: Even as users are very active, there are a some rating of the total number of items available in a user item ratings database. As the main of the collaborative filtering algorithms are based on similarity measures computed over the co-rated set of items, large levels of sparsity can lead to less accuracy.

Scalability: Collaborative filtering algorithms seem to be efficient in filtering in items that are interesting to

users. However, they require computations that are very expensive and grow non-linearly with the number of users and items in a database.

Cold-start: An item cannot be recommended unless it has been rated by a number of users. This problem applies to new items and is particularly detrimental to users with eclectic interest. Likewise, a new user has to rate a sufficient number of items before the CF algorithm be able to provide accurate recommendations.

Collaborative filtering algorithm is very efficient when no of customer and items are less. If no of customer and items are increase its gives poor result. There is a scalability problem. There is another problem in collaborative filtering technique, an item cannot be recommended until it has been rated by a minimum number of users. New items introduce it undergoes phase this problem as it has not sufficient ratings from users. Many algorithms are proposed to solve these problems. A

traditional Clustering approach has been also used to increase the performance of recommendation process. Collaborative filtering is based either on similarities between users or Items, to form a cluster of users or items respectively. Current research combines two approaches to improve effectiveness.

In this paper we analyses collaborative filtering using clustering techniques. These techniques consist user clustering, item clustering and hybrid clustering which based on user and item clustering.

II. RELATED WORKS

YiBo Huang Zhejiang^[6] Proposed an item based collaborative filtering using item clustering prediction. The methodology consist five step of clustering the item based on k means algorithm, predicting the vacant ratings where necessary, selecting the item clustering centers, forming neighbors from the selected item centers, and producing recommendations. The item based collaborative filtering utilizing the item clustering prediction is more scalable than the traditional collaborative filtering.

Ming-Jai Wang, Jin-ti Han^[7] present algorithm to solve Sparsity and expansibility is Problem in

traditional Collaborative Filtering algorithm. To deal with this Problem a Collaborative Filtering algorithm based on item rating was proposed. Ming-Jai Wang, Jin-ti Han puts new formula to compute the rating values of the item that user have not rated. The new algorithm could improve the accuracy of recommendation under the condition of the extreme sparsity of user rating data.

Qingcheng Li, Zhenhua^[8] Dong introduces a novel approach based on the probabilistic clustering model to solve the problems of traditional collaborative filtering algorithm. This approach can improve the efficiency of recommendation, and compute the recommending value of all the items to all the users.

SongJie Gong, HongWu Ye, XiaoMing Zhu^[9] develop an algorithm to solve problem of about prediction accuracy, response time, data sparsity and scalability. they presented an item-based collaborative filtering recommendation algorithm using self-organizing map. The item-based collaborative filtering recommendation algorithm using self-organizing map can efficiently improve the scalability and promise to make recommendations more accurately than conventional collaborative filtering.

Hideyuki Mase, Hayato Ohwada^[10] presents a novel approach that incorporates hybrid-clustering technology after introducing a smooth-based method in the entire database. They use hybrid clustering. hybrid clustering combine item clustering and user clustering. The proposed collaborative filtering provides predictions of high precision.

SongJie Gong^[11] proposed a personalized recommendation approach joins the user clustering technology and item clustering technology. The recommendation joining user clustering and item clustering collaborative filtering is more scalable and more accurate than the traditional one.

III. ANALYSES OF COLLABORATIVE FILTERING USING ITEM CLUSTERING AND HYBRID CLUSTERING

A. Clustering Algorithm

Many clustering algorithm can be used in collaborative filtering. Most popular algorithm is K

means. Many researcher use k-means algorithm for collaborative filtering.

Specific algorithm as follows^[12] :

Input: clustering number k, user-item rating matrix

Output: smoothing rating matrix

Begin

 Select user set $U = \{U_1, U_2, \dots, U_m\}$;

 Select item set $I = \{I_1, I_2, \dots, I_n\}$;

 Choose the top k rating users as the clustering

$CU = \{CU_1, CU_2, \dots, CU_k\}$;

 The k clustering center is null as $c = \{c_1, c_2, \dots, c_k\}$;

do

 for each user $U_i \in U$

 for each cluster centre $CU_j \in CU$

 calculate the $\text{sim}(U_i, CU_j)$;

 end for

$\text{sim}(U_i, CU_m) = \max\{\text{sim}(U_i, CU_1),$

$\text{sim}(U_i, CU_2), \dots, \text{sim}(U_i, CU_k)\}$;

$cm = cm \cup U_i$

end for

for each cluster $c_i \in c$

 for each user $U_j \in U$

$CU_i = \text{average}(c_i, U_j)$;

 end for

end for

while(C is not change)

End

B. Item clustering

Item based clustering algorithm for collaborative filtering algorithm is follow :

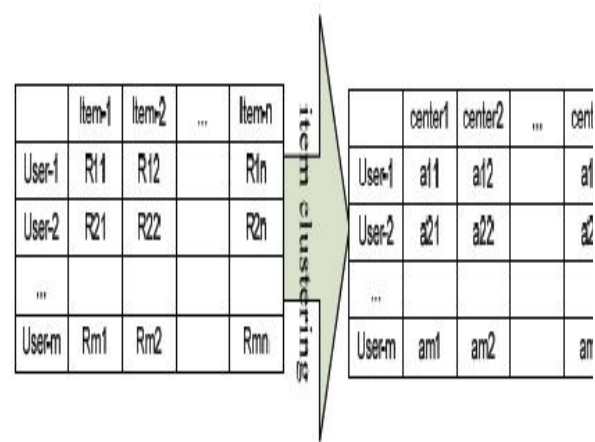


Figure 1: Collaborative filtering based on item clustering^[12]

Where R_{ij} is the rating of the user i to the item i , a_{ij} the average rating of the user i to the item center i , m is the number of all users, n is the number of all items, and c is the number of item centers.

C. Hybrid clustering

In collaborative filtering, each user gives rating to an item. In hybrid algorithm first create cluster using user clustering algorithm and then use item clustering algorithm.

IV. CONCLUSION

Personalized recommendation systems are producing recommendation and widely used in today's world. Collaborative filtering technique has been proved to be one of the most successful techniques. Collaborative filtering is a method of making prediction about interest of user by collecting preferences from many users. This approach can implement with two ways. First is using item clustering and second is using hybrid clustering. Hybrid clustering use item clustering and user clustering.

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