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Enhancing E-commerce with Collaborative Filtering: Challenges and an Overview

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ABSTRACT
Digital marketing is experiencing a rapid growth in the present era, as we all are heading towards a digital world. People have started to become completely involved in digital things, which have slowly made them interact with digital marketing. So here arises a question: is it possible to do marketing in this digital world by knowing the user interest? Yes, if we get to know more about the user behavior towards digital marketing we can easily understand user interest and this is achieved with the help of "Recommendation Systems in machine learning". All of us are familiar with the term recommendation system. It is a system that filters information in order to predict the rating or interest we have in an item. In this paper, we are going to analyze how the machine learning algorithm helps in the implementation of recommendation systems and here we are choosing collaborative filtering (CF) as a type of recommendation system to study the working of ML algorithms. Also, here we will have an overview about the role of CF in E-commerce and the advantages provided by CF. Lastly in this paper we will be discussing the challenges faced by Collaborative Filtering (CF) and how we can solve these challenges.
Keywords—Recommendation Systems, Machine Learning (ML), Collaborative Filtering (CF)

1. Introduction

Recommendation systems play a crucial role in the field of E-commerce since the retailers use them on their websites in order to enhance their product sales. So what is actually a recommendation system? Recommendation systems are powerful machine learning systems used by companies to focus on improving their sales by making personalized offers on various products based on the user's interest. The speed of searching in recommendation systems makes it easier for the users to check on their favourite products, and it also provides the users with some surprise offers that they never thought about. When the company starts to gain the trust of the users and works by knowing exactly what the user want, it can increase the profit of the company.

Recommendation systems can be classified into different types based on the purpose of the user, like that one such recommendation system is collaborative filtering. CF is a technique in which items can be filtered based on the purposes and opinions of similar users. When we are taking the case of a group, different people in that group will have various opinions on the same matter; similarly, in the case of product recommendations many users may have similar interests in the same product. The opinion of other users is also considered while working on the product suggestion for primary users and before recommending a product to a user, there will be tracking of the entire user's behaviour. This way, it will be easier to understand which product is mostly liked by the users. It also relates similar users based on the preference and behaviour of other users towards a similar product while suggesting the product to a primary customer. Through the means of feedback, we can collect the likes and dislikes of the users and notice their actions like, listening to music tracks, searching histories, purchasing records etc. The main idea behind this approach is

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to suggest new products to similar users, and here we are using the ML algorithms to implement the CF.

2. Algorithm

Algorithms are finite set of instructions used to accomplish a particular task assigned by the user. So, here we are using machine learning algorithm that shows how the recommendation of movies to different users with similar interest is taking place with help of collaborative filtering.

Inputs:

a) Users as (u)
b) Movies as (m)
c) Rating as (r)
d) Number of Movies to be Recommended as (rec)

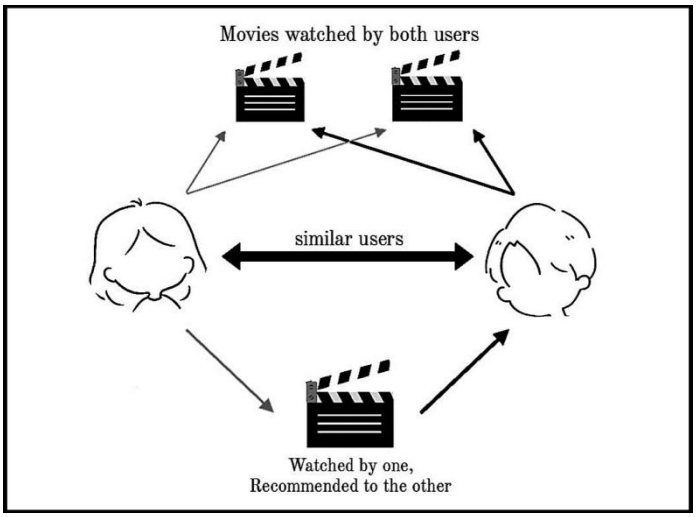
Other Notations Used:

a) (reli) is the common movies between user (i) and other users
b) max(me) is the rating of a particular movie

Output that must be obtained: Recommended Movies (R).

1. for all users (U) do
2. Select watched movies (w), unwatched movies (uw)
3. Find relatable movies (reli) with respect to (w), where i = 1 to n.
4. Select most relatable reli: user
5. Select m∈w of user obtained in step 4 and uw of ith user.
6. Calculate max rating 'max(me)' where e ∈ m
7. Return top 'rec' i.e. max rating recommendations.
8. end for

*With help of the above algorithm the users will get recommendations of movies / products based on the similar interests



Representation of Collaborative Filtering

3. Collaborative filtering in E-commerce

The term E-commerce means the buying and selling of products over the internet from businesses to consumers or from consumers to businesses. It involves online money transactions through the use of digital gadgets when a person purchases any product from the company. Nowadays, e-commerce is having a great impact on people's lifestyles as people slowly start to stop buying products from shops and begin to completely involve themselves in purchasing products from online shopping apps. The main reason behind the rapid growth in e-commerce is that here they will provide the products at cheap rates with good quality so that everyone can afford them. Also, digital marketing is a part of e-commerce, by promoting the brands of different products; the company can

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increase their product sales. So we are all familiar with online shopping apps like Amazon, Flipkart, etc. So have you ever thought about how these online shopping platforms are recommending the products that the consumer actually likes to have without telling them?

Here comes the role of collaborative filtering in e-commerce. Collaborative Filtering is a technique commonly used in the field of e-commerce to recommend the best products to different users based on their similar interest of them. So, collaborative filtering is not actually making recommendations based on the product details but by considering the users interest towards the same product. We can take Amazon as an example; they are using CF to recommend products to users. Earlier online shopping platforms used user based collaborative filtering, where the users interest where only considered, but in 1988 Amazon came with a new algorithm known as "Item Based collaborative filtering", where both the need of consumers and their product attributes are specifically recorded. CF is used nowadays more in online shopping platforms because when both the users A and B buys a product X and later on when user A buys another product Y then, using this collaborative filtering, the product Y will be recommended to the user B since they both shared similar interest while purchasing product X. So like that, the recommendation of products works in E-commerce. Since the products that are available in the online shopping apps are more affordable to the consumers, they started to get more interested in the recommendations of products provided when they browse their favourite product, which can increase the profit in e-commerce. So this is one of the ways to do marketing in E-commerce.

4. Advantages of Collaborative Filtering

Collaborative Filtering has more advantages than other types of Collaborative Filtering. Some of the advantages are mentioned below they are:

a) **Broader Exposure to products**: In Collaborative Filtering, consumers can get great exposure to various products. In this way it is possible to improve the chances of continual purchase of the products.

b) **No In- detailing of data**: Each and every details of a product and cataloguing of product data are not required.

c) **No cold- start problem**: There is no chance of having a cold- start problem; that is, even if no information regarding an item is available, we can still predict the rating of products without waiting for the user to purchase them.

d) **Capturing of data**: The change in the user's interest can be also be captured.

e) **Rounding off data**: Since CF provide an advantage like rounding off data .when we are assigning ratings of the products. If the products below rating 3 can be given as 0 and above 3 as 1.It will easier to compare the data.

5. Challenges faced by Collaborative filtering

A challenge means the call to justify something. So as we have discussed the advantages collaborative filtering provides to consumers, at the same rate it is facing some challenges such as:

1. **Data Sparsity**: The first challenge faced by CF is that when the user or the product is new, it is difficult to make recommendations because CF works based on the previous history of the user data, but in the case of new users and products they may not have enough history data, so due to this reason, CF might fail to provide new consumers with an affordable, personalized shopping experience and get a good impression from the user regarding that product brand. This problem is referred to as "Data Sparsity".
2. **Scalability**: Scalability is another challenge faced by CF, which means that when the numbers of users and the amount of data starts to expand, it will be difficult for the CF algorithms to work on that large dataset, which can reduce performance speed but with good accuracy when compared with a small dataset where performance is high with low accuracy.
3. **Synonyms**: The next challenge of CF we are going to discuss is "Synonyms"; it is defined as a state where CF is unable to identify synonyms; here synonyms refer to similar product labels. So

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here CF is unable to find out the similarity between the synonyms and even if the two items are similar, CF will consider them to be different items.

CONCLUSION

In this paper we have discussed an overview regarding recommendation systems and how they can be implemented using ML algorithms. For this purpose, we can choose Collaborative filtering (CF) as one type of recommendation system and what is the role of CF in E-commerce. Then, the challenges faced and advantages provided by CF are also discussed here. So from that, we can conclude that recommendation systems are a key to enhancing marketing in E-commerce since they can learn the user interest and act upon it, and the advantages provided by CF make it more user friendly .So, in this way it can increase sales in E-commerce. Even though it has many advantages, CF is also facing some challenges in its work on user data. In this case, we can't completely solve these challenges but for a limited time, they can be solved by improving algorithms and training the systems using large datasets .Finally, we can prove that "Collaborative filtering can enhance E-commerce".

References

1. Adomavicius, G., Tuzhilin A.: Toward the Next Generation of Recommender Systems: A Survey of the State-of-the-Art and Possible Extensions. IEEE Transactions on Knowledge and Data Engineering, (2005) 17(6): p. 734-749
2. Aggarwal, C.C., Wolf J., Wu K.L., Yu P.S.: Horting Hatches an Egg: A New Graph-Theoretic Approach to Collaborative Filtering. In Proceedings of the Fifth ACM SIGKDD International Conference on Knowledge discovery and data mining. (1999). San Diego, California. ACM Press p. 201-212
3. Avery, C., Resnick P., Zeckhauser, R.: The Market for Evaluations. American Economic Review, (1999) 89(3): p. 564-584
4. Balabanovíc, M., Shoham, Y.: Fab: Content-Based, Collaborative Recommendation. Communications of the ACM, (1997) 40(3): p. 66-72
5. Basu, C., Hirsh, H., Cohen, W.W.: Recommendation as Classification: Using Social and Content-Based Information in Recommendation. In Proceedings of the Fifteenth National Conference on Artificial Intelligence. (1998) Madison, Wisconsin. AAAI Press p. 714-720
6. P. Resnick, H. R. Varian, Communications of the ACM. 3, 40 (1997).
7. Y. R. Murti, Z. Baizal, Advanced Science Letters. 8, 22 (2016).
8. L. Sharma, A. Gera, International Journal of Engineering Trends and Technology (IJETT). 5, 4 (2013).
9. L. Chen, G. Chen, F. Wang, User Modeling and User-Adapted Interaction. 2, 25 (2015).
10. G. Linden, B. Smith, J. York, IEEE Internet computing. 1, 7 (2003).
11. Castellano G, Fanelli AM, Torsello MA. NEWER: A system for neuro-fuzzy web recommendation. Appl Soft Comput. 2011;11:793–806.
12. Crespo RG, Martínez OS, Lovelle JMC, García-Bustelo BCP, Gayo JEL, Pablos PO. Recommendation system based on user interaction data applied to intelligent electronic books. Computers Hum Behavior. 2011;27:1445–9.
13. Lin FC, Yu HW, Hsu CH, Weng TC. Recommendation system for localized products in vending machines. Expert Syst Appl. 2011;38:9129–38.
14. Wang SL, Wu CY. Application of context-aware and personalized recommendation to implement an adaptive ubiquitous learning system. Expert Syst Appl. 2011;38:10831–8.
15. García-Crespo Á, López-Cuadrado JL, Colomo-Palacios R, González-Carrasco I, Ruiz-Mezcua B. Sem-Fit: A semantic based expert system to provide recommendations in the tourism domain. Expert Syst Appl. 2011;38:13310–9.