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ONLINE COURSE RECOMMENDATION SYSTEMS

Abstract. Today in our world exists many online courses, so today it is hard to students to choose the courses they like. This paper work is about recommendation system based on user`s interests in his profile, this technique called Content Based, and on similarity with other users, this technique called Collaborative filtering, and hybrid method. My aim is to make such system, which will recommend courses that will be interesting to users. By using these techniques it can be improved efficiency of the recommendation system and make the life of the users more easier. Because in the process of study, the user will not be difficult to receive information and he will not be border.

Keywords: recommendation systems, content based, collaborative filtering.

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Аннотация. Сегодня в нашем мире существует множество онлайн-курсов, поэтому сегодня студентам сложно выбрать те курсы, которые им нравятся. Эта работа посвящена системе рекомендаций, основанной на интересах пользователя в его профиле, методике, называемой на основе контента, и на основе сходства с другими пользователями, это методика называется совместная фильтрация и еще один метод гибрид . Моя цель - сделать такую систему, которая будет рекомендовать курсы, которые будут интересны пользователям. Используя эти методы, можно повысить эффективность системы рекомендаций и облегчить жизнь пользователям, потому что в процессе обучения пользователю не составит труда получить информацию и ему не будет скучно.

Ключевые слова: системы рекомендаций, контентная, совместная фильтрация.

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Аңдатпа. Бүгінгі күні біздің әлемде көптеген онлайн курстар бар, сондықтан бүгінгі таңда адмадарға өздеріне ұнайтын курстарды таңдау қиын. Бұл жұмыста пайдаланушының өз профиліндегі қызығушылығына ұқсас ұсыныстар арқылы кеңес беріледі. Бұны мазмұнға негізделген деп атаймыз және басқа қолданушылармен ұқсастығына негізделген, бұл бірлескен фильтр деп аталады және де гибрид методын қолданамыз. Менің мақсатым - қолданушыларға қызықты болатын курстарға кеңес беретін осындай жүйені жасау. Осы әдістерді қолдану арқылы ұсыныстар

жүйесінің тиімділігін көтеріп, пайдаланушылардың өмірін жеңілдету. Бұл кеңестерді қолданған кезде оқу барысында пайдаланушыға ақпарат алу қиын болмайды және пайдаланушы жалықпайды.

Түйін сөздер: ұсыныс системалары, контентік, бірлескен фильтр.

1. Introduction

Recommendation systems works in many spheres in our world. For example in social networks, in Youtube, Instagram, Facebook and so on. Instagram will recommend accounts based on mutual accounts, Youtube recommends videos based on your previous watched videos and so on.

People needs recommendation every day. You may ask your friends to recommend the films, restaurants, games and so on [1]. It shows that we need some recommendations, and Internet has so many information, you just drowned in data and you could not be sure in your decision. And we need filter this data. But how? The solution can be user`s interests, user`s experience history, user`s previous behaviors. By this filters you can filter the data efficiently, and user will not see the information that not interesting to him. And we can compare the users and get the similarity between them by their likes and dislikes. In this work we tried to make recommendation system to online courses for users. The recommendation system recommends courses based on user's interests, and based on similarity with other users. We have dataset with 575 users with their interest categories, 10 courses with categories. And we have 2 cases to use recommendation system. First case is which recommendation will be effective if dataset is small. For example users count and courses count are very little. Second case which recommendation will be effective if we do not have user`s interest.

2.1. Online learning

As we mentioned before now recommendation system is using in many spheres in our life, and in this research we made it for online courses. During the pandemic demand to the online courses have grown exponentially and the count of online courses also grew up very quickly. This research paper aim is to ensure that the student does not get lost in the information and help him find what he is interested in.

In 2002 year, were created techniques which learns the behavior of the user in online by Osmar R. Zaíane [4]. With the help of that they could you can recommend to the user what is most interesting and relevant to him.

Jiahui et al. [5] created a large-scale recommender scheme to provide customized news based on users' previous click actions. To find the most interesting news posts, they use a combination of content-based recommendation and shared filtering methods.

2.2 Content Based

Content based recommendation system recommends the similar items which user likes [1, 2]. For our work we compared user`s profile categories and the courses categories, and get the categories which are in common.

This algorithm is very simple, because we should compare two list of items, and check the similarity of the lists. In our research case we have the user`s interests with categories and we have courses which also has their categories. In the figure 1, the web development course has categories like informatics, software engineering, programming and in the case if user has in his profile also informatics, software engineering, programming it will be recommended Web development course.

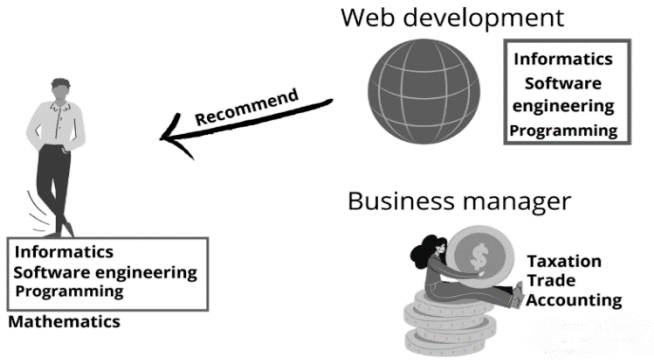

Figure 1. Content based recommendation system

The formula of the content based recommendation system is

$$P(U, C) = \frac{(UserCategories \cap CourseCategories)}{\sum CourseCategories}$$

- P (U,C) the probability that user U likes the Course C;
- User Categories= the categories that have the User;
- Course Categories= the categories that has the Course.

Firstly, we should get the number of common categories of course and the user, and divide it to the number of courses. The result will be between 0 and 1. The closer the result to 1, the better the result.

2.3. *Collaborative filtering*

Collaborative filtering recommends the item based on the opinions of the users, which have similar preferences with the user [3]. Collaborative filtering divides in two parts. First is user based and second is item based [1].

The user based collaborative filtering recommends the items that similar users like. The item based collaborative filtering recommends the items similar to the user likes.

In the figure 2, we can use collaborative filtering recommendation, because user A and user B have similar subjects. Sometimes collaborative filtering can not perfectly recommend items because it is user for small data sample. Because collaborative filtering looks like: you asking your friend which have similar tastes, to give you recommendation. But his recommendation will be what he knows, no more than his knowledge. If you compare the more different people, respectively the result will be better.

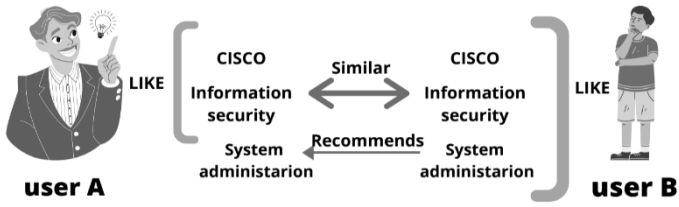

Figure 2.Collaborative filtering

Before the calculating the probability of the liking the course, we must calculate the similarity of the user. We have 2 steps: the first is we should calculate the similarity between two users, and secondly we should calculate the probability of the user likes the certain course.

1) To check the similarity level of the 2 users we should consider the situation if they like the same course and if they do not like the same course. The system also check opposite preferences, if user likes a course but another user do not like. The formula is

$$S(U_1, U_2) = \frac{(|L_1 \cap L_2| + |D_1 \cap D_2| - |L_1 \cap D_2| - |L_2 \cap D_1|)}{|L_1 \cup L_2 \cup D_1 \cup D_2|}$$

- *S(U1,U2)* similarity between 2 users;
- *L1* = Preferences of the *user1;*
- *L2*= Preferences of the *user2;*
- *D1*= Dislikes of the *user1;*
- *D2*=Dislikes of the *user2.*

Firstly we should get the number of items that both users likes and dislikes. After that we should get the number of items that first user likes but another user dislike. And first user dislikes but the second is likes. The last step is to get the number of courses that both users likes or dislikes.

2) Probability of a user liking a certain course

And here we should calculate that user`s liking probability of the course based on similarity of the other users.

$$P(U,C) = \frac{(Z_L - Z_D)}{(M_L + M_D)}$$

-*p(u,c)* it shows the probability that user U likes course C;
- *ZL* = sum of the similarity with all the user that like this course;
- *ZD* = sum of the similarity with all the users that dislike this course;
- *ZD* = sum of the similarity with all the users that dislike this course;
- *MD* = number of user which dislike this course.

Firstly we should find the similarity of our user from all users who prefer this course, subtract from the similarity of our user from all users who do not like this course and divide it to the number of users who liked and disliked it.

2.4 Hybrid

Hybrid is the intersection of the Content based and collaborative filtering.

$$P(U,C) = Content\ based \cap Collaborative\ filtering$$

3.1 *First case problem*

First problem, which recommendation will be effective if dataset is small (pupil count, courses count).

In my dataset we have 575 users and 30 course. But for this experiment we will take only 100 users and 10 courses.Users and courses have their own categories. By using this categories we can get the common categories, which user likes and also exist in my dataset.

According to the content based formula we can get the probability of the user liking course.

$$P(U,C) = \frac{(UserCategories \cap CourseCategories)}{\sum CourseCategories}$$

For this experiment we will get the common categories of each user from each category, and get the best probability. The result of the experiment is 75%. It shows that we can find for each user the interesting course. The result if experiment when using Content based is 75%.

Now we can look at collaborative filtering. For that we will get the similarity of each user from each user. And get the best similarities of that. After we should calculate the probability of users liking courses ang get the best result for each user. The result of the experiment shows 60%.

The last method is hybrid method. It is the common of the Content based and Collaborative filtering. And it shows 67 %.

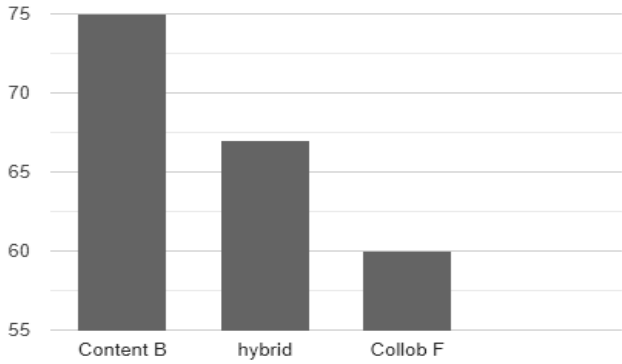

Figure 3. The result of the first case

First case problem shows that Content based solves successfully this problem 75%, Collaborative filtering solves 60% and hybrid shows 67%. And best recommendation system for the first case is Content Based. Because despite the small number of students and courses, we can determine the interests of the user by profile.

3.2 *Second case problem*

The second problem is, which recommendation will be effective if there will be not clear data, for example there will not exist user`s categories.

First method we will use Content based. Content Based uses user's interests categories and courses categories. And it shows only 30%. The result is bad because if most of the user's interest will be null, the result also will not be so good and Content based makes recommendations based on user`s interests. Our second method is collaborative filtering. First step we will get the similarity of each user from each user. And get the best similarities of that. After we should calculate the probability of users liking courses and get the best result for each user. The result of the experiment shows 80%.

And the last method is hybrid method. It takes the common of Content based and Collaborative filtering. It shows 50%.

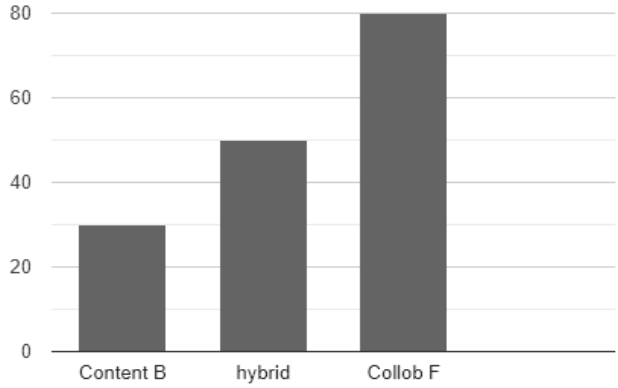

Figure 4. The result of the second case

For the second case Content Based shows 30%, Collaborative filtering shows 80%, and hybrid shows 50%. The second case shows that when our dataset is not so clear it is good to use collaborative filtering technique. In our experiment it showed 80%. It is very good result.

4. Conclusion

Recommender systems in today's world are useful. Because they filter information from uninteresting things. In the internet we have so many information, and it's difficult to find what we're searching for without filtering or recommendations. However, suggestion services do more than only assist the customer in finding what he is searching for; they also have the best potential user interface such that he continues to visit the website or even shows him new data that he may not be aware of but is still interested in.

In this research my aim is to show that it is exists many ways to make recommendation system that makes students life easier and recommends to students that courses which they interested. And formulas and algorithms is very simple and it is possible to make implementation of this methods in any programming languages.

References

1 Lu, J., Wu, D., Mao, M., et al.: Recommender system application developments: a survey. *Decis. Support Syst.* 74 (2015): pp. 12–32.

2 Pazzani, Michael J., Billsus, D.: Content-Based Recommendation Systems. In: Brusilovsky, P., Kobsa, A., Nejdl, W. (eds.) *The Adaptive Web. LNCS,* vol. 4321, (2007): pp. 325–341.

3 Deshpande, M., Karypis, G. Item-based top-N recommendation algorithms. *ACM Trans. Inf.Syst.* 22, (2004): pp.143–177.

4 Zaíane, O.: Building a recommender agent for e-learning systems. In: 2002 Proceedings of Computers in Education (2002): pp. 1-5.

5 Liu, J., Dolan, P., Pedersen, E.R. Personalized news recommendation based on click behavior. *In: Proceedings of the 15th international conference on intelligent user interfaces—IUI'10. Hong Kong: ACM Press;* 2010. P. 1-10.