College Students' Innovation and Entrepreneurship Resources Recommendation Based on Collaborative Filtering and Recommendation Technology

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Abstract. The 21st century is the era of big data. With the soaring of user data index, information data will be more diversified and complex. This is an era full of a lot of information data. Therefore, when we want to get valuable information, we have to spend a lot of time and energy to filter the accuracy and adaptability of information, which can be improved by personalized recommendation algorithm, such as collaborative filtering recommendation technology. Innovation and entrepreneurship is a project to train students' ability to think and solve problems independently, which is the frontier of innovation in Colleges and universities. Through continuous improvement and improvement, we can form a college students' innovation and entrepreneurship resource recommendation scheme, which can help college students choose more suitable projects. First of all, this paper analyzes the current situation of College Students' innovation and entrepreneurship resources recommendation. Then, this paper proposes an algorithm of collaborative filtering recommendation technology.

Keywords: Collaborative Filtering Recommendation Technology, Innovation and Entrepreneurship, Resource Recommendation

1. Introduction
In recent years, with the rapid development of Internet technology, the network is also full of a large number of data resources[1]. With the innovation and entrepreneurship becoming the talent training mechanism in Colleges and universities, the innovation and entrepreneurship resources have flooded the whole network, which has a lot of bad projects and unsuitable information[2]. Therefore, we need to reduce the workload of college students through personalized recommendation technology. Most of the personalized recommendation systems of network resources are only the arrangement of a large number of innovation and entrepreneurship project resources, which is a very primitive arrangement method[3]. Therefore, students will search keywords according to their own needs, which is a very difficult choice[4]. At present, personalized recommendation algorithm has many forms, such as collaborative filtering recommendation algorithm, content-based recommendation algorithm, hybrid recommendation algorithm, association rule recommendation algorithm, recommendation algorithm based on network structure, etc., which has become the main technology of filtering a large number of...
data resources. Among them, collaborative filtering recommendation algorithm is the most widely used, which has relatively efficient and stable characteristics[5]. The interests of college students are widely diverse, which requires us to complete the selection of interest resources based on collaborative filtering and recommendation technology, which will show the personalized needs of college students.

2. Collaborative filtering recommendation algorithm

2.1 obtaining user data
According to users' evaluation of innovation and entrepreneurship projects, we can establish a user project resource rating matrix, as shown in Table 1[6]. Among them, the row represents the user from user 1 to user n, n users in total, and the column represents the resource from source1 to source m, m resources in total, where R_{ij} represents the interest rating of the i user for the j-Class project, as shown in the table 1.

| User1 | Project1 | … | Projecti | Projectj | … | Projectn |
|-------|----------|---|----------|----------|---|----------|
| User1 | R11      |   | R1i      | R1j      |   | R1n      |
| User2 | R21      |   | R2i      | R2j      |   | R2n      |
| …     | …        |   | …        | …        |   | …        |
| Useri | R1i      |   | Rii      | Rij      |   | Rin      |
| Userj | R1j      |   | Rji      | Rjj      |   | Rjn      |
| …     | …        |   | …        | …        |   | …        |
| Userm | Rn1      |   | Rni      | Rnj      |   | Rmn      |

2.2. generate neighbors
The core of collaborative filtering algorithm is to find out groups or target projects with similar interests to users, which will form a target set. Among them, the process of finding target set is to form similar neighbors.

Cosine similarity in the recommended algorithm is shown in Formula 1.

\[
sim(m,n) = \frac{m \times n}{\|M\| \times \|N\|} = \frac{\sum_{i=1}^{n} R_{i,s} R_{i,t}}{\sqrt{\sum_{i=1}^{n} R_{i,s}^2 \sum_{i=1}^{n} R_{i,t}^2}}.
\]  

Among them, \( R_{i,s} \) is the rating of item s by user i.

The improved cosine similarity in the recommended algorithm is shown in formula 2.

\[
sim(m,n) = \frac{\sum_{i=1}^{n} (R_{i,s} - \bar{R})(R_{i,t} - \bar{R})}{\sqrt{\sum_{i=1}^{n} (R_{i,s} - \bar{R})^2 \sum_{i=1}^{n} (R_{i,t} - \bar{R})^2}}
\]

According to Pearson correlation coefficient, the calculation formula is shown in Formula 3.

\[
sim(m,n) = \frac{\sum_{i=1}^{n} (R_{i,s} - \bar{R})(R_{i,t} - \bar{R})}{\sqrt{\sum_{i=1}^{n} (R_{i,s} - \bar{R})^2 \sum_{i=1}^{n} (R_{i,t} - \bar{R})^2}}
\]

2.3. Generate recommendations
After obtaining the similar user group of the target user, we can predict the project by the similar neighbor’s score, and the method of predicting the score is shown in formula 4.
4.4. Interfaces, which will modify, reduce and change the website's recommendation performance

3. Workflow of innovation and entrepreneurship Resource Recommendation System

Through collaborative filtering and recommendation algorithm, we can analyze the age, specialty, gender and interest of learners. According to the user feature vector, we can generate similar user groups, which can easily solve the cold start problem of collaborative filtering recommendation algorithm. The workflow of the innovation and entrepreneurship resource recommendation system is shown in Figure 1.

4. System performance requirements

4.1. High concurrency

We need to recommend innovation and entrepreneurship projects based on the personality of each college student, which is a multi-user concurrent access system. Therefore, the system should be able to bear the simultaneous access of multiple users, which can effectively support concurrent access.

4.2. Low response time

The response time of Web site is an important index to measure the performance of a website, and a website with slow response cannot be tolerated by users. According to the research, the maximum response time that users can tolerate is 3 seconds, so the response time of the system's add, delete, modify, search cannot exceed 3 seconds.

4.3. Good scalability

Based on collaborative filtering and recommendation technology, University Students' innovation and entrepreneurship resource base is an important system of university students' entrepreneurship project development. But with the development of time, college students' innovation and entrepreneurship projects will meet new needs and changes. Therefore, we should improve the scalability of the system, which will better respond to the changing needs. At the same time, the system must reserve certain interfaces, which will reduce the coupling.

4.4. Safety performance

The innovation and entrepreneurship resource base of college students based on collaborative filtering and recommendation technology is accessed through the Internet or campus intranet, which inevitably leads to data and information leakage. Therefore, we must take measures to perfect the system as much as possible. By reducing the loopholes, we can improve the security performance of the system.

Among them, KNB is the nearest neighbor of the target user.

\[
p_{uv} = \frac{\sum_{v \in KNB} \text{sim}(u,v) \times R_{uv}}{\sum_{v \in KNB} \text{sim}(u,v)}
\]

\[
p_{uv} = \frac{\sum_{v \in KNB} \text{sim}(u,v) \times (R_{uv} - \bar{R}_v)}{\sum_{v \in KNB} \text{sim}(u,v)}
\]
Figure 1. The workflow of the innovation and entrepreneurship resource recommendation system

5. Conclusions
Collaborative filtering and recommendation technology of network resources is based on the common evaluation project of users. In the era of big data, innovation and entrepreneurship project resources are very rich, which will lead to a very sparse data set. Through collaborative filtering recommendation technology, we can ensure the accuracy of the project, which improves the accuracy of prediction and calculation. Therefore, the quality of collaborative filtering and recommendation of College Students' innovation and entrepreneurship resources has been greatly improved.

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