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Design and implementation of an intelligent platform based on recommendation algorithm for college entrance examination volunteer application

Yu Jiang[1], Jinhao Li[1], Li Shi [2,*],Litao Fan[2]

[1] Department of Information Management and Engineering, School of Law and Business, Hubei University of Economics, Wuhan, China

[2] School of Information Engineering, Hubei University of Economics, Wuhan, China

* shily0118@163.com

Abstract

Every year after the college entrance examination, the filling of volunteer[1] ,the candidates fill in the wrong school and volunteer resulting in slippage happens frequently. The intelligent platform of college entrance examination volunteer filling based on collaborative filtering algorithm uses Spring Boot framework to realize the function, SQL Sever database for data storage, and WeChat applet to realize the interface, which uses hybrid recommendation combined with personalized test to recommend the most suitable colleges and majors for candidates according to their actual situation.

Keywords

Volunteering; collaborative filtering; personalized testing, hybrid recommendation.

1. Introduction

The number of applicants for the college entrance examination in 2022 is 11.93 million compared to 2021, an increase of 1.15 million. The increase in the number of candidates for the college entrance examination means that the competition for admission to the college entrance examination will be more intense. Nowadays, filling out the college entrance examination has become a major problem for candidates and parents. In recent years, some candidates have frequently filled out the wrong volunteer slip because they did not check the details of the institutions through the formal platform. In this regard, parents and students want to have a platform to guarantee candidates to fill in their volunteer applications quickly, efficiently and accurately. In this paper, the intelligent college entrance examination volunteer filling platform based on recommendation algorithm was born to provide college entrance examination candidates with a platform to search for college entrance examination volunteer information and intelligently select schools according to candidates' career interests, and to filter and recommend the most suitable colleges and universities for candidates according to their own actual situation.

2. Recommendation algorithms (The classification of recommendation algorithms)

Intelligent recommendation[2] does not need users to propose accurate and detailed information. It is possible to build a user interest preference model based on multi-dimensional information of the user, use machine learning to extract features from the user's historical behavior and build a user portrait to determine the user's needs, and finally provide more accurate recommendations for the user through recommendation algorithms and user portraits.

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2.1. Data set

The data used for the development of the intelligent platform for college entrance examination volunteer application are all crawlers written by our team using python [3] to crawl the information of major colleges and universities in central China on the Internet. The key data sets of this system are shown in Table 1 below.

Tab. 1 Key data set information

Dataset	Data volume	Remarks
User data set U	726 Articles	Includes personal information, MBTI test results, and Hollander Career Interest Test results
Institution data set S	4328 Articles	Institution views, favorite institutions, etc.
Institution data set S	4328 Articles	Institution name, institution code, major code, etc.
Professional Data Set Z	2176 Articles	Professional code, professional name, professional profile.
Professional Outlook Dataset J	8704 Articles	Examination rate, employment rate, salary level

Data set:contains user data, college data, professional information data, professional prospect data, college admission score data.

2.2. Professional recommendations based on Jitterbug-like overlay recommendation algorithm

The traditional user-based collaborative filtering algorithm and content-based recommendation algorithm have the problems of cold start and low recommendation accuracy, respectively. To address this drawback, this system uses a cascading mix of these two with a Jitterbug-like overlay recommendation algorithm to achieve more accurate recommendation results

The exact flow of the algorithm is as follows.

Candidates browse colleges and majors, collect, comment, and fill out the MBTI test questionnaire and the Hollander Career Interest Test questionnaire.

User-based collaborative filtering algorithm: using candidates' Hollander career interest test results as feature 1 and candidates' browsing colleges and majors as feature 2, the similarity between fresh candidates and previous candidates is calculated by cosine similarity, and the information of previous candidates with high similarity values and their application major data are extracted.

Content-based recommendation Recommendation algorithm: using professional outlook as a feature, string similarity between institutions and institutions to make reasonable recommendations for the candidates in (2)

Hybrid recommendation: the results in (2) (3) are aggregated, and the final professional recommendation is completed using the Jitterbug-like overlay recommendation algorithm.

2.3. Collaborative filtering algorithm

2.3.1. User-based collaborative filtering algorithm

The basic idea of the user-based collaborative filtering algorithm[4] is to build a feature vector table of candidates and calculate the similarity between fresh candidates and past candidates to find similar past candidates when the candidates' individual needs are not clear.

(1) Convert the Hollander Career Interest Test[5] and the MBTI Personality Test[6] into vectors as user attributes

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(2) The similarity between candidates and previous candidates is calculated by the cosine similarity formula, and the cosine formula [] is shown in the following formula, where X(u) and X(v) denote the eigenvalues possessed by candidate u and candidate v, respectively.

$$W_{uv} = \frac{|X(a) \cap X(b)|}{\sqrt{|X(a) \cup X(b)|}}$$

(3) The data of the previous candidates with the highest similarity and the majors they applied for are saved and used as input to the content-based recommendation algorithm.

2.3.2. Content-based recommendation algorithm

Content-based recommendation algorithm The specific process is as follows.

This system extracts the examination rate, public examination rate, employment rate, salary level and courses offered through data pre-processing.

The similarity between majors is calculated and results in similar majors for previous candidates to apply for, so that more majors can be recommended for fresh candidates.

2.4. Recommendation algorithm based on class Jitterbug overlay

Based on user and content overlay recommendation algorithm, the recommendation effect will be relatively concentrated in the case of cold start[7] . It is not possible to make recommendations based on the user as the core, but only based on the user's psychological test and high school ranking. In order to solve this problem, this system uses the mechanism of Jitterbug overlay recommendation to synthesize a variety of information for recommendation.

1. Coefficient setting

After logging into the applet, the user will be tagged by default after filling in the relevant information, and the system will generate default recommendation coefficients A, B and C based on this tag.

2. Data weighting

The system determines whether to give coefficients A, B, and C an increase based on the number of user visits to colleges and universities, the number of visits to professional information, and the number of questions asked in the college exchange area. It also obtains college tags and major tags. Users are reclassified according to these tags. The purpose is to make the recommendations more accurate.

3. Recommendation

The recommendation of colleges and majors is made directly to the user based on the derived coefficients A, B, C and the user label. Combining the schools and majors recommended by the collaborative recommendation algorithm, a similar interval is selected as the final recommendation result.

2.4.1. Algorithm flow

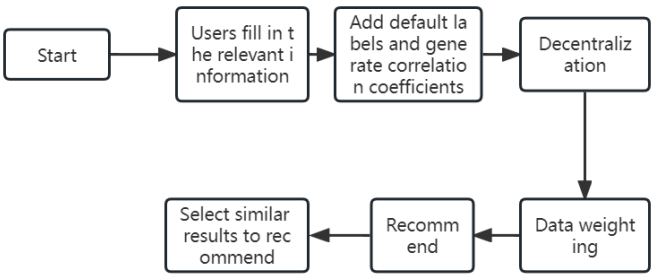

Figure 1 Douyin-like overlay algorithm flow

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3. System design

3.1. System structure functional module diagram

The system adopts the design of front and back-end separation, the back-end is sql server database and java Spring Boot framework[8] , which can greatly facilitate the data entry, modification and code improvement and modification. The front-end is wxml, wxss, js, colorui of WeChat applet used to beautify the interface. The system includes three general functional modules, which are divided into home page function, college communication, and evaluation test. The system structure functional module diagram is shown in Figure 2.

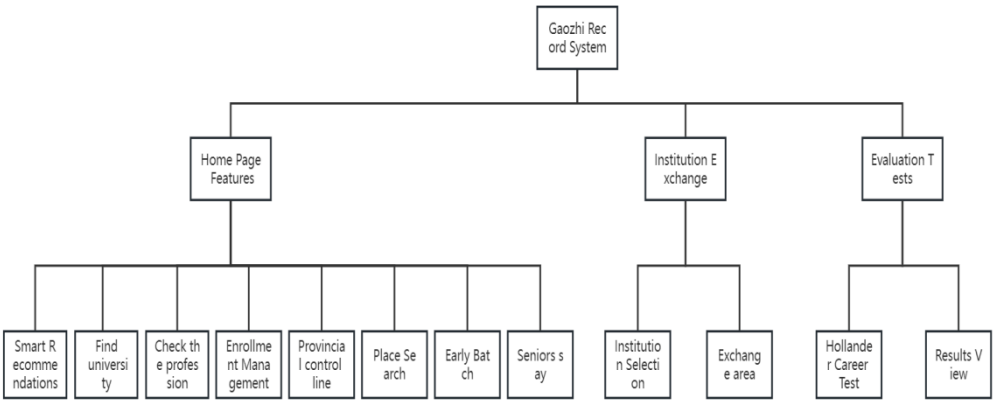

Figure 2 System Structure Function Module

3.2. General flow chart of the system

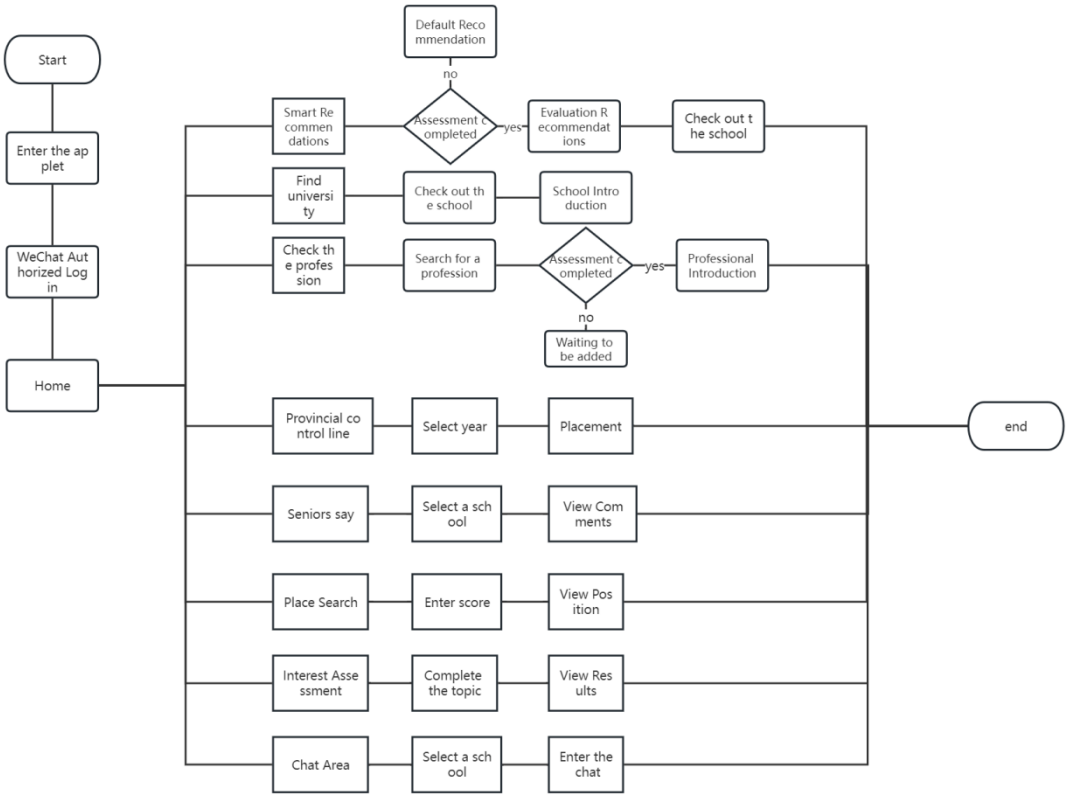

Figure 3 Overall system flowchart

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3.3. Database design

The system contains nine database forms: WC table to store the one-point, one-paragraph table of the college entrance examination, University to store the school's admission score line and the school's recommendation factor CH_UN database to store the chat records of the exchange group; Administrator to store the user name and password of the administrator of the relevant university; Speciality to store the major code, major name, and provincial control line code. The database is used to store the user name, password of the administrator of the university concerned. Due to the limitation of space, only the administrator table and university table are shown in Table 1 and Table 2 below.

Table 1 Administrator (Admin, Admin table)

Field Name	Type	Simple Notes
Admin_ID	VARCHAR2(32) not null	Administrator ID, primary key
Admin_PASSWORD	VARCHAR2(64) not null	Administrator password
Un_ID	VARCHAR2(32)	University Code

Table 2 University (UN, University Table)

Field Name	Type	Simple Notes
UN_ID	VARCHAR2(32)	University code, primary key
Sp_ID	VARCHAR2(32)	Professional Code
UN_WSCORE	CHAR(20)	Physics minimum score line
UN_LSCORE	CHAR(20)	The lowest score line in history
UN_Tjscore	Nachar	Recommendation factor 1
UN_Tjscore2	Nachar	Recommendation factor 2

The E-R diagram is shown in Figure 3, which includes 5 entities, namely Administrator, University, Major, Province, and User.

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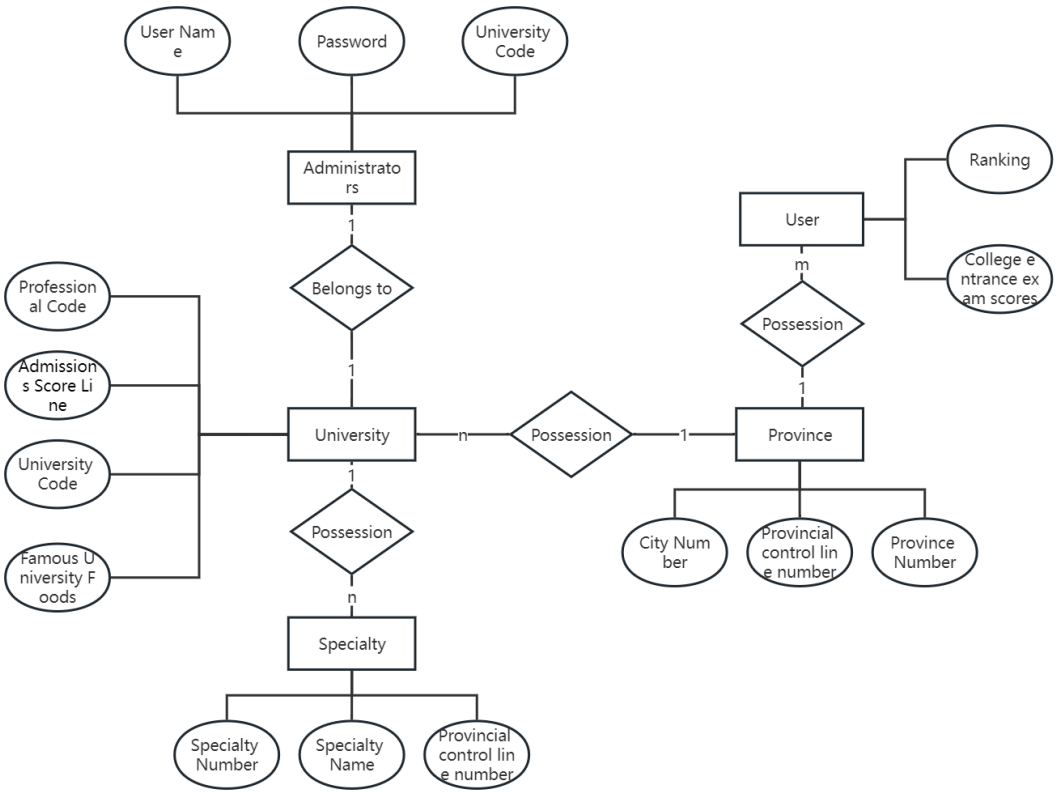

Figure 4 E-R diagram

4. System Implementation

Due to the limited space of this paper, the core functions of this system are introduced and demonstrated.

4.1. Intelligent recommendation

Candidates enter their college entrance exam scores, their ranking in the province, the subjects selected in the college entrance exam, fill in the college entrance exam information, and click the submit button to recommend admission schools for candidates in order of admission probability. If candidates complete the assessment test module of the applet, intelligent recommendations will be made according to the recommendation algorithm and the test results of the Hollander Career Interest Test.

1. First of all, the user is required to complete the evaluation of the system, and if not, the default coefficients are used for the recommendation.

2. The system gets the data selected by the user for a comprehensive evaluation and analysis, and then recommends the right school to the user.

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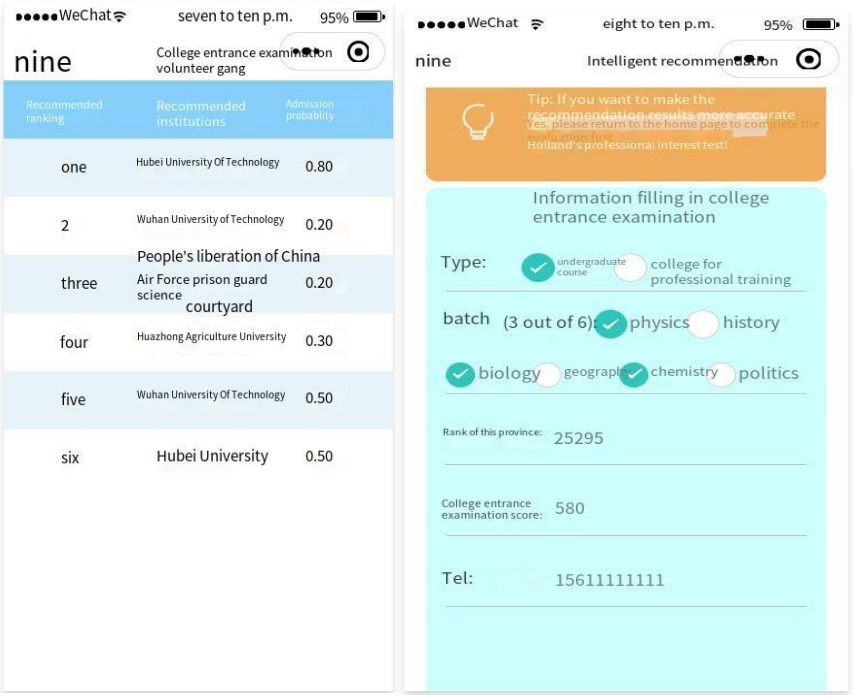

Figure 5 Intelligent recommendation

4.2. Finding a university

Popular university recommendations, you can view detailed information about the university's popular majors and the school's recommendation index, or you can manually search for your preferred university to view the details.

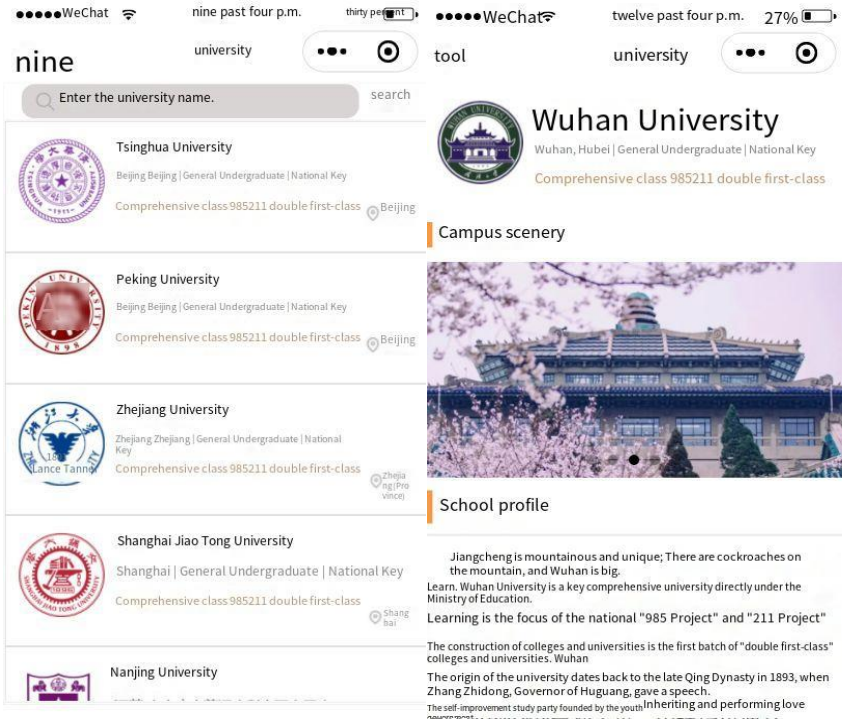

Figure 6 Finding a university

4.3. Hollander Career Interest Test

Through the Hollander Career Interest Test, we recommend suitable careers for candidates based on their interests and personality traits, and help them choose the right profession for themselves.

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The system will give users the test questions designed according to the Hollander Career Interest Test and get the results of these test questions on top of the backend. According to the recommendation algorithm, the user's interest model will be drawn according to the different test results of the user. The user's hobbies will be analyzed and suitable schools will be recommended for the user.

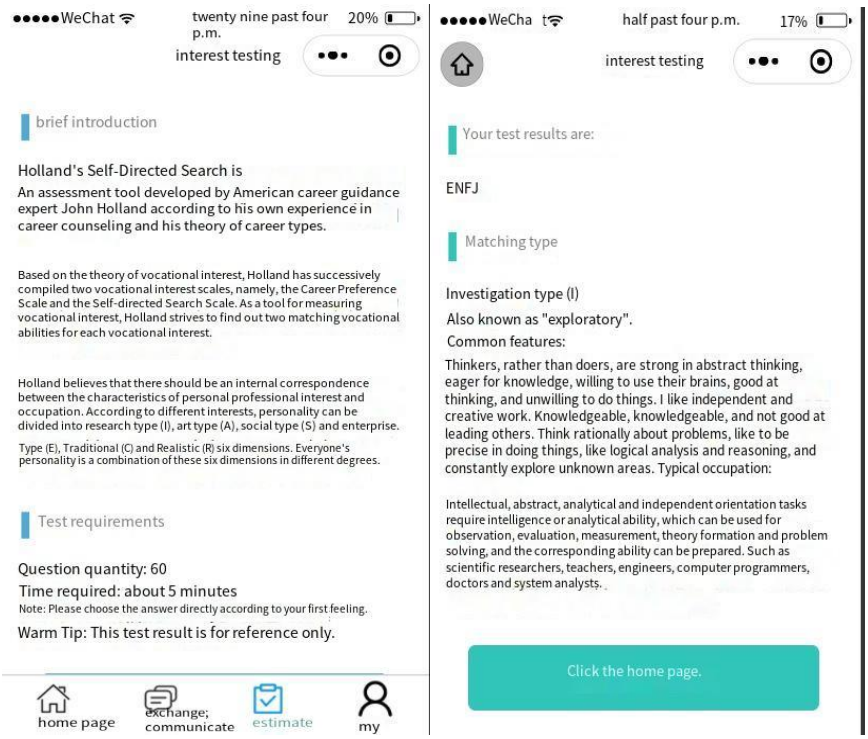

Figure 7 Hollander Career Interest Test

5. Conclusion

With the increase in the number of college entrance examination candidates, it means that the competition for admission to the college entrance examination will be more intense. Nowadays, it has become a big problem for candidates and parents to fill in the college entrance examination. In recent years, how to quickly and efficiently provide comprehensive volunteer application services for college entrance examination candidates has become a major difficulty. The system helps candidates understand the skills related to college entrance exam preparation before the exam, the admission scores of their favorite colleges and universities in recent years, to the volunteer simulation application after the exam. Candidates complete our assessment test, fill in their college entrance exam information, and recommend colleges and majors that meet their interests through a comprehensive Hollander career interest test and recommendation algorithm. In the future development work, we will further refine and improve the recommendation algorithm, improve the algorithm performance and reduce the impact of errors.

Acknowledgments

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References

[1] YAN F L, ZHANG X. Research on the Volunteer Filling in College Entrance Examination Driven by Information Technology[J]. Journal of Educational Research and Policies,2020,2(6).

ISSN: 2664-9640

[2] Bai, J. J.. Design and implementation of a hybrid recommendation-based volunteer recommendation system for college entrance examinations [D]. Inner Mongolia University, 2022. DOI:10.27224/d.cnki.gnmdu.2022.001490.
[3] Gao, Lili, Fan, Rainbow. The design of recommendation system for college entrance examination volunteer application based on big data[J]. Electronic Technology and Software Engineering, 2021(22):213-215.
[4] Xiang Meng. A review of the research on volunteering algorithm for college entrance examination[J]. Changjiang Information and Communication,2022,35(07):50-52.
[5] Zhang Lu. Analysis of volunteering behavior in college entrance examination based on the perspective of limited rational decision making[J]. Journal of Wuhan University of Technology (Social Science Edition),2022,35(03):158-164.
[6] Liu M. Q., Cheng J. K., Chen X. L.. The design and implementation of an auxiliary decision-making system for college entrance examination volunteer application[J]. Modern Information Science and Technology,2022,6(17):38-40+44.DOI:10.19850/j.cnki.2096-4706.2022.17.00 9.
[7] Luo Wei,Yin Hongtao,Tao Chen. Design and implementation of a recommendation system for university clubs based on collaborative filtering algorithm[J]. Software Engineering,2022,25 (02):42-45.DOI:10.19644/j.cnki.issn2096-1472.2022.002.010.
[8] Huang, Chuan-Lin, Lu, Yan-Xia. Research on hybrid music recommendation algorithm based on collaborative filtering and tagging[J]. Software Engineering,2021,24(04):10-14.DOI:10.19644/j.cnki.issn2096-1472.2021.04.003.