

Ecological Construction of Distance Education Learning Behavior Analysis Model Based on MOOC Data

Muyang Wu^{1,*}

¹Jingchu University of Technology, Jingmen, Hubei, 448000, China

*Corresponding author: yywmy@163.com

Keywords: MOOC Data, Behavior Analysis, Ecological Construction of Distance

Abstract: In recent years, the continuous improvement of the MOOC curriculum system and the continuous improvement of the teaching platform technology have made MOOC accepted by more and more universities and students. At the same time, because of the foundation of its curriculum, there is no threshold, so the number of social learners is also increasing. In this case, the ecological construction of the distance education learning behavior analysis model based on MOOC will become very important. In this paper, the explicit information and implicit information of each user are analyzed and statistically analyzed by principal component analysis. Then, the analysis results are fed back to learners, supervisors, educators, backstage personnel, etc. in different forms through the learning behavior analysis model. Learners can learn to reflect through feedback data. The supervisor can have a clear understanding of the learner's recent learning status and help him make adjustments. The teacher can carry out teaching reflection and continuously improve his teaching skills. Backstage personnel can make technical adjustments to make the teaching platform more humane.

1. Introduction

With the continuous development of network technology, the convenience it brings us has spread across various fields [1]. The use of Internet technology for distance education has become more and more important in the entire teaching system[2]. The effective analysis of the behaviors exhibited by learners in distance education is of great benefit to the reform of the system of distance education[3]. The specific behavior of the learner in the education process affects the final learning effect [4]. The main learning behaviors of learners in the distance education process include the learner's learning attitude, the control of learning time and the way of learning. Therefore, as long as the appropriate analytical models are processed for these data, the data can be used to improve the teaching methods and improve the teaching quality[5]. Under the distance education system, the process of teacher-teaching and the process of student learning are completely separated, both in terms of time and space. Therefore, the control of students' learning quality can only be provided directly or indirectly through the behavioral monitoring of learners and a series of teaching feedback information during the learning process[6]. Then, how to effectively process these

¹Author profile: Wu Muyang, female, Nanjing, Jiangsu, master, associate professor, main research direction: financial investment and risk management; research on education and teaching.

monitoring data and feedback information, and help the distance education learning behavior analysis model, has become the primary work under the distance education system.

One of the original intentions of implementing distance education is to be able to successfully realize the individualized differences of learners in the learning process, so as to teach students in accordance with their aptitude. For the learner's differences, the ultimate goal of distance education is to provide one-to-one personalized service for each user [7]. Therefore, for this targeted teaching behavior, it is necessary to have a large amount of historical information about each user in order to effectively analyze its behavior, so as to carry out the next personalized service[8]. Therefore, from this perspective, it is also essential to construct an ecological analysis model of distance education learning behavior[9].

The ecological classroom refers to a classroom where teachers and students are harmonious, equal, and interactive. Its sustainable development makes the ecological classroom have higher room for improvement and innovation[10]. The ecological construction of the classroom makes the learner the main body of the whole learning process, and the teacher and the distance education system are the assistants in this process. Only by ecologically constructing this environment, learners will significantly improve their technical skills in this naturally relaxed and enjoyable learning environment[11].

2. MOOC teaching platform

The more successful platform for the distance education platform is the MOOC system[12]. MOOC is a large open online course. It is an online teaching class for the masses in the society. In this teaching class, the time for students to attend classes is flexible enough, and the number of classes can be adjusted by themselves, so that the quality of the class is greatly guaranteed. At the same time, this online course is different from other traditional video lessons. The traditional video lesson is just a recorded video taught by the teacher, and the student can only passively learn the relevant knowledge by watching the video, and does not fully exert the learning subjectivity of the student. But the MOOC is different. It not only contains all the advantages of traditional video courses, but also fully absorbs all the advantages of the offline classroom. In view of the interaction between teachers and students in the offline classroom, the cooperation between students, and the communication atmosphere of the whole classroom atmosphere, they have done enough learning and absorption[13]. In the MOOC classroom, several modules such as teaching, learning, evaluation, testing, training, certification, group, and social are introduced, which fully cover all the advantages in the real teaching classroom[14].

Through the information compilation of the university in Figure 1, it can be seen that many famous universities in China have participated in the teaching process of the MOOC platform, and the number of courses started is about 40. It can be seen that the form of MOOC has gradually been accepted by major universities under the leadership of prestigious schools [15].

At the same time, it can be seen from Figure 2 that the courses taught by major universities are related from human geography to natural science. Faced with the rapid development of artificial intelligence, the proportion of computer courses is also large. Therefore, in the face of the continuous development of the society, the module is appropriately adjusted, the MOOC is also very good.

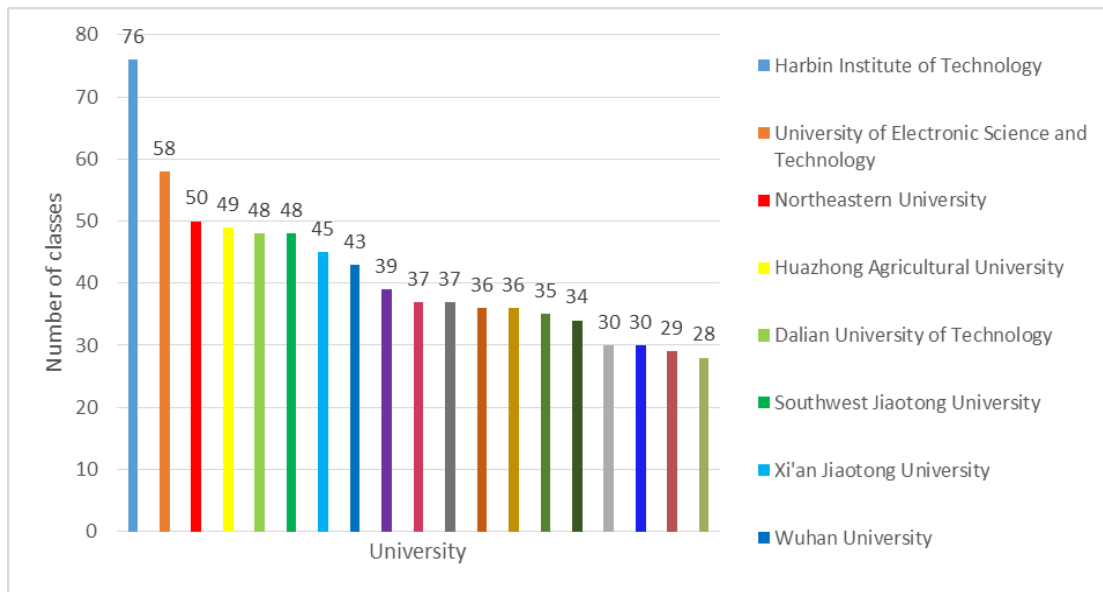


Figure 1: Statistics on the opening of public schools in MOOC

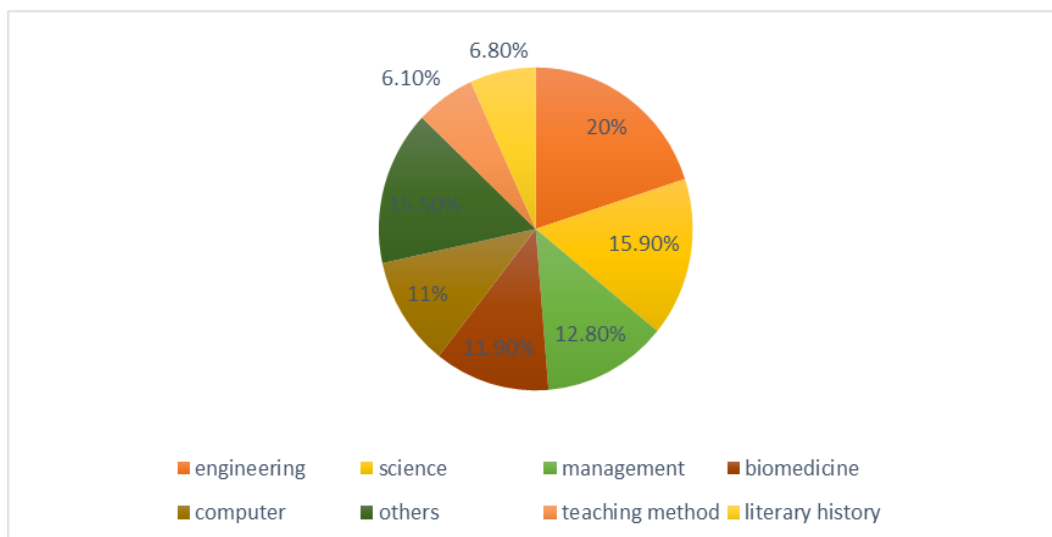


Figure 2: Statistics of open class types on MOOC

3. Learning behavior analysis model

3.1 Source and processing of data

The data types of users on the MOOC platform can be mainly divided into two categories, one is the information submitted by the learners themselves, and the other is the invisible feedback information obtained according to the learning behavior of the user [16]. Among them, the former mainly includes basic information automatically submitted by the user in the early stage (for example, basic conditions such as age and school), and the user's elective situation. The latter mainly includes the progress of the user during the class, the completion of the assignment, the withdrawal of the class, and the browsing of the search records.

For collecting information, it is first necessary to perform data cleaning to remove invalid information. Then you need to classify different types of information, and distinguish textual text information from numerical information. For text information, it may be necessary to perform

corresponding operations through natural language processing, while for numerical information, it can be directly processed[17]. In the process of model processing, it is necessary to comprehensively consider the data of these two aspects.

3.2 Establish an analytical model

For the establishment of the learning behavior model, the clustering method is usually adopted. Among the many influencing factors of learners, clustering the same or similar factors can truly find the factors that affect the learners, so as to effectively guide the learning strategies. In the learning behavior analysis model, we use principal component analysis [18]. Principal component analysis can effectively obtain representative main information from a large amount of relevant data, thereby greatly improving the rate of problem solving[19].

To find out the main problems that learners have in the learning process through the model, it is necessary to have a large amount of historical data about the learners. However, the rich historical data has provided us with sufficient information and brought us a lot of work. Data is not all messy and unconnected. There is often a large correlation between data. It is a good solution to represent the population through principal component elements [20]. Principal component analysis can greatly reduce the amount of data while maintaining the adequacy of data information.

The algorithm flow of Principal Component Analysis is shown in Figure 3:

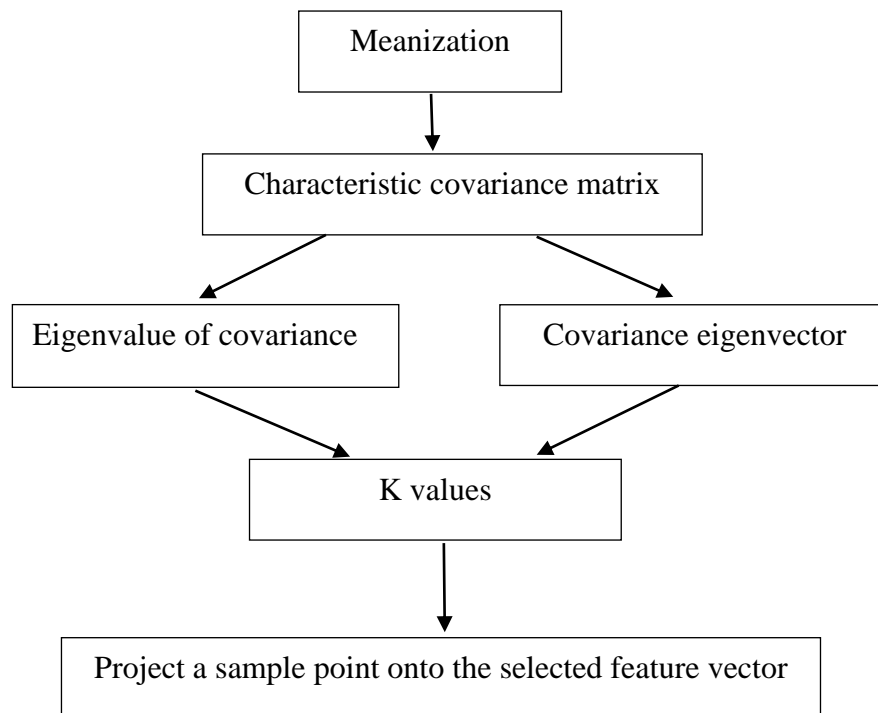


Figure 3: Algorithm flow chart of principal component analysis

(1) Meanization: Firstly, the collected data samples need to be averaged, that is, the averaged data is subtracted from all the data values to obtain the processed data samples.

(2) Find the feature covariance matrix: For the data after the averaging process, solve its covariance matrix according to its dimension. If the value of dimension k is 3, then its covariance matrix is as follows:

$$\begin{matrix} cov(x,x) & cov(x,y) & cov(x,z) \end{matrix} \quad (1)$$

$$\begin{matrix} cov(y,x) & cov(y,y) & cov(y,z) \end{matrix} \quad (2)$$

$$\begin{matrix} cov(z,x) & cov(z,y) & cov(z,z) \end{matrix} \quad (3)$$

(3) Find the eigenvalues and eigenvectors of the covariance: Solve the eigenvalues and eigenvectors of the obtained covariance matrix.

(4) Selecting the feature value: Sorting the plurality of feature values obtained in the previous step in descending order, and then sequentially selecting the top k values, that is, the maximum k values.

(5) The sample point is projected onto the selected feature vector: The obtained feature vector corresponding to the feature value of k is the final vector value to be selected. Projecting a plurality of sample values onto the k feature vectors yields the results of the final principal component analysis.

3.3 Learning behavior analysis model

The data information processed by the principal component analysis method needs to be fed back not only to the relevant personnel of the learner but also to the personnel at the back end of the distance education platform. For the learner's own person and supervisors, the feedback data can be visually processed, so that it can intuitively discover the learning effect of the MOOC and the existing learning problems from the chart. At the same time, these feedbacks can help the staff at the back end of the distance education platform to analyze the teaching methods and the innovation of technical means. The model of the overall learning behavior analysis system is shown in Figure 4:

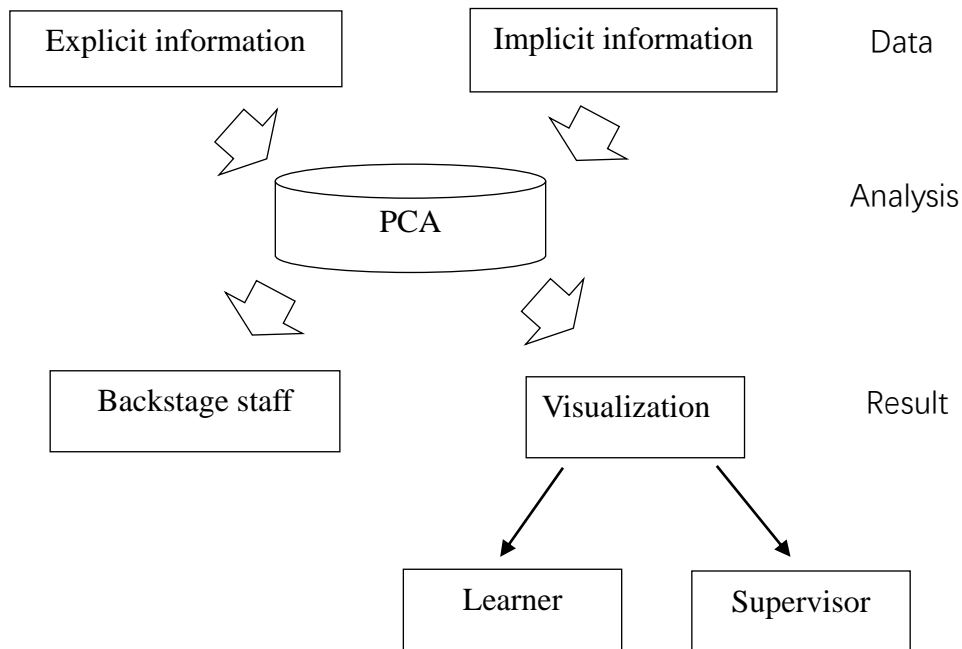


Figure 4: Model of the learning behavior analysis system

As can be seen in Figure 4, both the explicit data value and the implicit data about the user belong to the data module. The data module provides sufficient raw data for the next model analysis, which is an important guarantee for this learning behavior analysis system. The next analysis model will analyze the relevant data of each user to get the most significant and richest dimension information. The final analysis results are provided to the learners and supervisors in a visual form

on the one hand, so that they have a detailed understanding of the past learning situation and future learning trends. At the same time, the final analysis data will be provided to the back-office personnel for reference, including the developers provided to the distance education platform, so as to effectively improve the form of platform learning resource construction. It is also provided to the key components of the teaching process, teachers. The final analysis data can help teachers to reflect on teaching and make continuous improvements to their teaching content and teaching methods.

Through the above model of the learning behavior analysis system, each user can make their own personalized analysis results, and the learner's subjectivity and difference in the learning process are better guaranteed, and the construction ecology is truly achieved. The purpose of the classroom. In addition, the classroom operation module and communication cooperation module of MOOC itself make the drawbacks of the traditional video course effectively solved. The equal and harmonious classroom atmosphere in the ecological classroom is effectively guaranteed without reducing the quality of teaching. At the same time, the platform should also focus on enhancing online teacher-student exchanges, group cooperation and other aspects of interaction, so that its effect is close to the real classroom teaching atmosphere.

Through the analysis of the data, the learner's future learning situation can also be predicted initially. This prediction can help learners to develop future learning plans to a certain extent. At the same time, the prediction results of a large number of students will also have an impact on the development of the teaching content of the instructors.

4. Conclusion

Under the wave of rapid development of network technology, distance education platform has increasingly become an important educational model. An analytical model that uses distance learning learning behavior can effectively help learners' personalized services. Analyzing the specific situation of each learner and improving and innovating from many aspects can greatly improve the teaching effect of the distance education platform. At the same time, for educators and back-end technicians to improve the teaching content and platform technology, it is necessary to follow the standards of curriculum ecological construction, not only to ensure the learner's learning content, but also to ensure the learner's learning environment and learning atmosphere.

Acknowledgement

This study is supported by the Education and Teaching Research Project of Jingchu University of Technology "Innovation and Practice of Securities Investment Virtual Simulation Training Teaching Mode under the Background of First-class Undergraduate Education (JX2022-041).

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