# Personalized Recommendation Method of College Art Education Resources Based on Deep Learning

Sen Li[1(✉)] and Xiaoli Duan[2,3]

[1] School of Fine Arts, Fuyang Normal University, Fuyang 236037, China
shengsheng234987@163.com
[2] China Academy of Art, Hangzhou 310009, China
[3] Haikou University of Economics, Haikou 571132, China

**Absrtact.** In order to solve the problem of uneven distribution of educational resources and enable the campus network host to complete the recommendation of art education resources according to students' learning interests, the personalized recommendation method of art education resources in colleges and universities based on in-depth learning is studied. Design the deep learning architecture of art education in colleges and universities, and determine the basic architecture, upgrade architecture and complete architecture layout of the campus network learning algorithm. According to the principle of educational weight distribution, the similarity degree of educational resource information is calculated; Based on the in-depth learning algorithm and the resource vector to be allocated, the solution expression of the recommendation table is derived, the personalized recommendation list of college art education resources is formulated, and the design of personalized recommendation method of college art education resources based on in-depth learning is completed. The implementation results show that under the effect of the deep learning recommendation method, the proportion of learning allocation of the selected art education resources exceeds 90%, and the uneven distribution of education resources has been well solved.

**Keywords:** Deep Learning · Art Education Resources · Personalized Recommendation · Education Weight · Similarity · Recommendation List

## 1 Introduction

Deep learning is a meaningful learning based on understanding and the pursuit of transfer application. It promotes the development of higher-order knowledge and realizes the application of these knowledge in new situations or the generation of new higher-order knowledge by encouraging students to participate in learning deeply and adopt advanced learning strategies appropriately. "Learning based on understanding for transfer" focuses on multi angle deep reflection, application of knowledge and energy in new situations or generation of new high-level knowledge and energy, which is the purpose


B. Wang et al. (Eds.): ICMTEL 2023, LNICST 534, pp. 184–199, 2024.
https://doi.org/10.1007/978-3-031-50577-5_14

of deep learning; Under this purpose, deep learning "focuses on the development of high-level knowledge and ability", which is the result of deep learning, focusing on the development of knowledge and ability such as implementation (i.e. application in new situations), analysis, evaluation and creation; In order to achieve this result, in-depth learning focuses on guiding students to "adopt the in-depth learning strategy appropriately". As a way to achieve the results of in-depth learning, it can be determined by three criteria: "whether it is based on understanding", "whether it pursues transfer application", and "whether it is active"; As the premise of realizing this approach, "deep participation in learning" focuses on the degree of students' learning engagement and their flow state after engagement [1].

At present, the traditional art education resources are mainly textbooks and textbooks, and the form is relatively simple, which can not fully reflect the characteristics of the visual art of art. Fine arts can be called plastic arts or visual arts. It is the art of creating visual images with certain space and aesthetic value by using certain material materials (such as paper, cloth, wood, clay, marble, plastic, etc.) through plastic means. However, the rapid development of network information technology has provided a new opportunity for online art education resources. We can fully use this platform to establish a network art education resource library, integrating text, graphics, images, audio, video, etc. The network art education resources use the open and equal network environment with no center that is unique to the modern information network tools to communicate across time and space, interact and share information to develop the students' personality, which can not only fully reflect the special attribute of art as a visual art, but also give full play to the subjective and interactive advantages of teaching and learning. In recent years, the construction of educational online courses has been constantly carried out. With the implementation of "distance education" in some schools, the research on the use of online art education resources has been greatly promoted. Therefore, the strategies and methods of using network art education resources are very meaningful research work.

The recommendation technology of educational resources is the combination of the relevant research of educational resource platform and the research of recommendation algorithm. The user behavior data in the educational resource platform is an important basis for the recommendation algorithm. At the same time, reasonable design and application of the recommendation algorithm can help users to conduct efficient resource screening and independent learning in the Internet education platform. Literature [2] proposes a personalized teaching resource recommendation method based on learner portrait. Firstly, the data of learners are obtained by using crawler technology, and then the learning data of learners are analyzed quantitatively; The two-way long-term and short-term memory network based on attention mechanism is used for emotional analysis, and a learner portrait feature model including three dimensions of learner's basic information, behavior and bullet screen text is constructed. On this basis, the relationship model between teaching resources and learner portraits is established by using deep neural network; The model is used to predict learners' new learning needs and provide personalized course recommendation services. Literature [3] studies and constructs a learner model suitable for personalized recommendation of online learning resources based on education and teaching theory and relevant data of learners in online education

platform. Taking the collaborative filtering recommendation method as the starting point, the collaborative filtering method is improved by integrating the static and dynamic features of the learner model, and the collaborative filtering recommendation method of online learning resources is established by integrating the learner model.

However, there are still some shortcomings in the existing research results: the main purpose of user behavior analysis in education resource related research is to design reasonable courses, and the data analysis at home and abroad is aimed at obtaining the characteristics and laws of universal users' learning behaviors. There is a lack of analysis of user interaction data, and it is impossible to establish personalized interest models for users. In the context of the Internet, the education resource platform reflects the collective wisdom of users, such as the user-defined tags that users add to education resources. However, the current research lacks semantic analysis of user tags and does not make full use of the collective wisdom. Therefore, this paper puts forward the personalized recommendation method of college art education resources based on deep learning.

## 2 Definition of Deep Learning Framework of Art Education in Colleges and Universities

The improvement of the deep learning algorithm of art education in colleges and universities requires the construction of a basic learning architecture, an upgrading architecture and a complete learning architecture. This chapter will focus on the above contents.

### 2.1 Basic Learning Architecture

Architecture refers to the frame structure formed by combining things that play a supporting role. This is consistent with the definition of architecture: architecture is the process and product of planning, designing and building buildings or any other structure. By analogy, it is proposed that learning architecture refers to the process and product of learning design. However, the scope of this definition is too broad and too vague to present the learning architecture for students and teachers.

In the field of computer science, learning architecture refers specifically to software architecture. As a metaphor, it is also similar to architecture in the field of architecture, but more operational than the above definition of learning architecture. Specifically, the software architecture is a top-level design structure, which involves the description of the constituent elements of the software system, the interaction between the elements, the element grouping mode and the constraint conditions of the mode. As the blueprint of software system and its development, it makes a plan for the tasks that the design team needs to perform.

Learning, as a complex system, has been recognized by the education community. For example, the popular view of learning ecosystem based on ecological theory in recent years, based on which, learning architecture can also be compared to software architecture and positioned as the top-level design structure of the learning system [4]. Similar to software architecture, learning architecture is also just a framework structure, which provides a blueprint for teaching design. It does not impose specific restrictions

on the "bricks and tiles" filled in the framework, such as the gender of students, the presentation form of learning materials, the shape and placement of desks, etc.

Similar to software architecture, learning architecture also focuses on and is based on learning elements. In the teaching structure, the stability of the teaching process structure is usually characterized by the interaction of the four elements of teachers, students, content (or textbooks) and media. Considering that the learning architecture is a representation of the flexibility of teaching and learning, when recommending college art education resources, the learning architecture should be defined and constructed from the interaction of learning tasks, activities, processes, decisions and other influencing factors. The advantage of this is that the teaching structure and learning structure, as a dual feature of teaching and learning, can work in harmony with each other like the left and right channels in stereo, rather than either one or the other. This is of practical significance in classroom teaching: stability is conducive to teachers organizing teaching and improving teaching efficiency; Flexibility helps students participate in learning and improve learning depth. The recommended basic learning architecture of art education resources in colleges and universities is shown in Fig. 1.

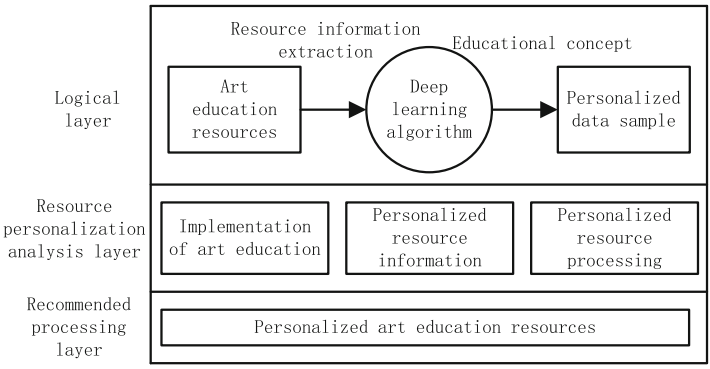


**Fig. 1.** Basic Learning architecture

The direct reason why the learning architecture highlights the flexibility is to more fully meet the different needs of students, and let learners have greater control, that is, to reflect the personality and initiative of students. In the teaching mode formed based on the learning architecture, students can learn by any path according to their own preferences, and can also decide which learning tasks to choose and how to learn by themselves. This is consistent with the concept of learning structure.

Learning task is the main learning content of deep learning, and students' ability to decide learning content independently according to needs is an important dimension of flexibility. In deep learning, the effectiveness and interest of learning tasks are two attributes that teachers should focus on when providing optional content. The former ensures the efficiency of the classroom, while the latter helps students to participate deeply.

### 2.2 Learning Architecture Model Upgrade

For college art education, the significance of learning events can be demonstrated through the interaction of participation and materialization; Time can be designed, but learning events emerge; The space for students to participate in activities is local, but affected by the overall situation; Power (such as discourse power) is embodied through personal identification and discussion of such identification. From this perspective, these elements define the possible method space for solving design problems: learning design is completed by solving the problems concerned by the four pairs of binary elements. In deep learning algorithm cognition, the two dimensions of each pair of dual elements (such as participation and materialization) are not mutually exclusive, and they can be balanced and coordinated to jointly affect the learning quality [5]. As the upgraded deep learning architecture is oriented to the construction of the learning space for Unicom learning, the architecture mainly considers the learning environment, learning tools and content, enterprise level background systems, other traditional related applications and other elements, as shown in Fig. 2.

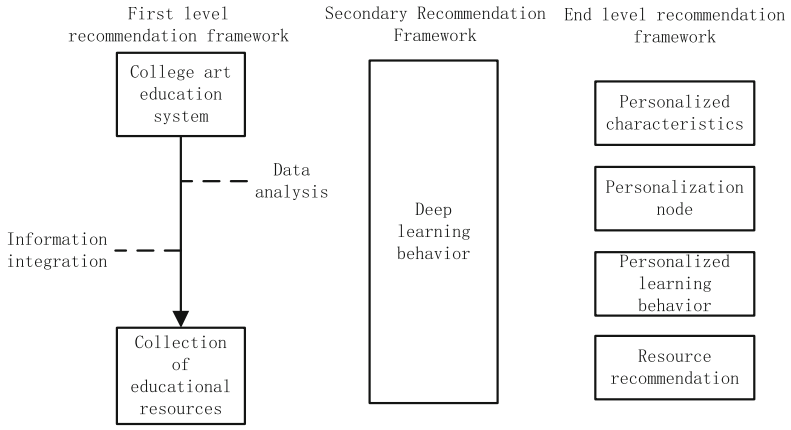


**Fig. 2.** Upgrade model of deep learning architecture

It can be seen from Fig. 2 that learning environment mainly refers to online environment enabled by technology, such as learning management system, portal, MOOCs, simulation environment, etc. Learning tools and content are mainly tools and content embedded in the learning environment, in which tools are subdivided into general tools and specific tools. Enterprise level background systems refer to enterprise level systems that conduct data mining and learning analysis in the background. They provide data information about students' learning conditions. Other traditional related applications mainly refer to the applications that are currently used and can provide specific services. They are usually isolated and cannot exchange data between systems.

Since this architecture is based on open standards and services, it is also called "open architecture". It can not only realize the "plug and play" integration of various software, but also realize the sharing of applications or data between different learning

spaces. In order to realize the openness and fairness of contemporary art education, it is mainly reflected in the access to educational resources and information. Based on this understanding, the establishment of online art education resource library and its application strategies and methods are particularly important.

Let $\alpha$, $\delta$ represents two unequal learning behavior vector, $I_\alpha$ is based on coefficient $\alpha$ student learning characteristics, $I_\delta$ represents students learning characteristics based on coefficient $\delta$, $\beta$ depth value measurement coefficient, $O$ represents core marker coefficient, $\Delta I$ represents the unit of student learning characteristics, establish the above physical quantity, can be the depth of college art education algorithm expression is defined as:

$$P = \frac{\beta \cdot (I_\alpha - I_\delta)^2}{\left(O^2 - 1\right)\sqrt{|\Delta I|}} \tag{1}$$

Educational resources are defined by educational elements. Educational resources refer to various resources supporting teaching activities. Network education resources are the virtualization of physical resources. A more interesting transformation way is to transform the connotation of physical resources and their electronic and virtual forms into network resources. Of course, online education resources are not passive transformation of physical resources, but also innovative. In the description of recommendation algorithms, items are often used to describe things to be recommended. In different application backgrounds, items can represent different entities.

### 2.3 Improvement of Learning Architecture Model

The complete deep learning architecture includes six dimensions to promote the structure of learning experience, namely, students' independence level, students' initiative, extended school year/study day, mixed age/peer learning, community learning, and learning space, as shown in Fig. 3.

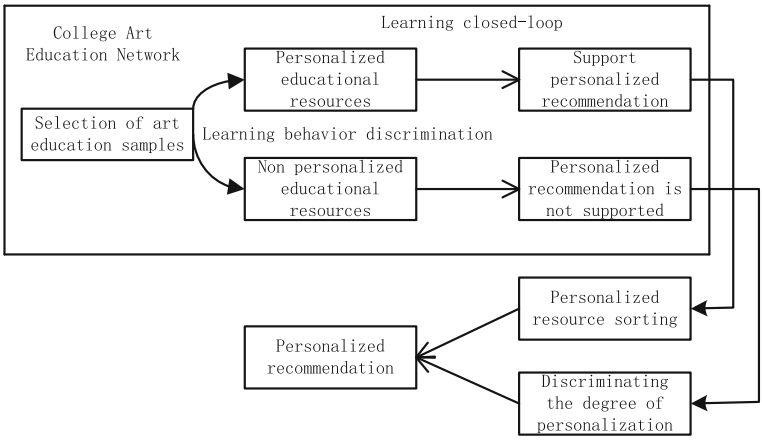


**Fig. 3.** A complete deep learning architecture

It can be seen from Fig. 3 that the level of independence of students is the basis for grouping. Compared with grouping by age or ability, this grouping can provide more autonomy support for students' growth. Learning initiative focuses on how to make students "own" their own learning, such as setting meaningful goals and taking responsibility for their own learning and personal development. Extended school year/study day extends students' immersive learning to school holidays, which provides more time and opportunities for students to use school space to achieve their goals. Mixed age/peer learning aims to encourage students to learn from and teach each other (mainly older students teach younger students), and promote the establishment of collaborative relationships and other effective relationships. Community learning provides students with more learning opportunities, such as lectures, field research, community services, and interaction with other members. The learning space provides a supportive environment for student centered learning experiences.

In the process of recommending college art education resources, the learning methods under the in-depth learning framework are personalized and reflect students' initiative: the learning experience is customized according to students' learning path and pace, and the education of each student is jointly developed and shaped by students and teachers. Students spend half of their time learning through projects. All projects are interdisciplinary and focus on exploring solutions to real problems. Such a learning framework can promote the production of in-depth learning results.

The efficiency of classroom teaching is one aspect that teachers pay most attention to. The classroom teaching oriented to deep learning should pay more attention to classroom efficiency, otherwise it is difficult to have time to cultivate high-level abilities and their transfer applications. In deep learning, classroom efficiency can be reflected by the effectiveness of learning tasks, which is generally measured by the competency to promote students' development towards goals [6]. Goals can guide teachers to determine which learning tasks are (or are not) important. When they are clearly presented to students and the designed tasks focus on these expected goals, learning tasks are highly effective. The open evaluation indicators can let students know clearly what performance they should eventually have. With the instant feedback function of the smart classroom environment, students can know their learning progress and current performance in real time, which helps students to make self adjustment in time. The evidence used to evaluate students' performance, in addition to traditional test scores and assignments, is more important than performance evaluation, which points to deep learning.

## 3 Personalized Recommendation of Art Education Resources

With the support of deep learning algorithm, to improve the personalized recommendation method of college art education resources, it is also necessary to calculate resource similarity based on the distribution of education weight values, and develop a recommendation list by combining relevant education resource vectors.

### 3.1 Distribution of Education Weight

On the platform related to college art education resources, the user behaviors mainly include watching course videos, participating in course discussions, browsing course

chapters, participating in course forum interactions, etc. In the above various user behaviors, relevant detailed behaviors will be generated. For example, when users watch a video course, they will have the detailed behavior of watching the video, including the exit point, fast forward, fast backward position and times of watching the video. The user behavior studied in this paper is mainly from the perspective of behavior frequency statistics. Different user behavior times are taken as an important basis for user item scoring estimation, and the detailed behavior data is not discussed.

Based on the standardized records of user project behavior times, the behavior information entropy can be calculated according to the definition of information entropy. The specific meaning of behavior information entropy is that the more uniform the distribution of behavior times, the greater the behavior information entropy and the weaker the personalized characteristics of behavior. In the determination of user behavior weight, the larger the information entropy value of learning behavior is $u$, the smaller the corresponding behavior weight value is $Y_u$. When the learning behavior vector is constant $\vec{R}$, the solution expression of weight value $Y_u$ can be defined as:

$$Y_u = \frac{-\sum_{\chi=1}^{+\infty} \log \vec{R}}{\sum_{\chi=1}^{+\infty} R_1 \cdot R_2 \cdot \cdots \cdot R_n} \times P \cdot u \tag{2}$$

In the formula, $\chi$ represents the information entropy index based on the depth learning algorithm, $R_1$, $R_2$, and $R_n$ represent the tag coefficients of $n$ randomly selected art education resources, and the inequality value condition of $R_1 \neq R_2 \neq \cdots \neq R_n$ is always valid.

In the art teaching practice, the computer network can transmit colorful image information to students. These plane and three-dimensional sound light color combination, multi form, multi touch and all-round image thinking language have greatly broadened the students' vision, enriched their imagination space, stimulated their thinking ability and improved their creativity. Modern computer multimedia teaching can play its unique role in painting design, craft production, works appreciation and other aspects [7]. Network information resources have greatly broadened the content of art teaching, and the resources are more abundant. The knowledge package of network resources has huge capacity and covers a wide range of fields. It is a treasure house for learners to gain knowledge through research learning. It has unlimited openness and sharing of resources, and it makes up for the shortcomings of other media communication methods.

On the basis of formula (2), let $w'$ represent the established allocation parameter of art education resources, $\phi$ represents the allocation coefficient based on the deep learning algorithm, and $q$ represents the core allocation value, jointly establish the above physical quantity, and derive the art education weight allocation expression is as follows:

$$E = \frac{1 - Y_u}{q - \phi w'} \tag{3}$$

The network information resources, especially the images, animations, images and sounds, make these learning resources more vivid, transform the static beauty solidified

in traditional textbooks into dynamic beauty, and fully display the artistic beauty such as artistic conception, music and poetry contained in textbooks. Traditional culture is often static, while modern media art is mainly dynamic. In modern media art, network media is an important form that best represents the epochal characteristics of modern media art. With the development of the Internet, there are more and more web pages. Static text, pictures and music are being displayed on the network platform as a new dynamic image through the production of animation software.

### 3.2 Resource Similarity

Resource similarity refers to the degree of similarity between the art education resources of colleges and universities to be allocated. In the deep learning algorithm cognition, the higher the level of similarity, the greater the resource information recommendation pressure that the campus network host needs to bear; On the contrary, if the level of similarity is relatively low, it means that the campus network host needs to bear less pressure on resource information recommendation. Today's art education in colleges and universities has never really got rid of the single realistic education model, which has led students to have a wrong understanding of some related concepts of art, so that students just regard it as a professional skill, without a deeper and more comprehensive understanding of the essence and connotation of art. This education model will even have an impact on training objectives and teaching thinking, Thus, students' perception of things becomes dull, their thinking is rigid and inflexible, and their learning motivation gradually decreases, not to mention the cultivation of innovation ability, which ultimately leads to students' confusion and loss of their own goals. The teaching form and method of teachers are too old and single, the teaching efficiency is not high, and the teaching approach is monotonous and lagging behind, which leads to the students' low learning initiative and enthusiasm, and the students' lack of independent thinking ability. Most art teachers use the teaching method when teaching art theory courses. Because of the lack of interaction with students in the teaching process, it is difficult to stimulate the students' initiative, making the classroom atmosphere more depressed, boring Dull. The teaching process pays too much attention to the grasp of the basic skills of modeling, thus neglecting the cultivation of students' creativity. This will lead to the accumulation of a large number of art education resources, which not only brings a great burden to students' daily learning, but also increases the pressure of resource recommendation borne by the campus network host.

The orientation of college art education is biased, and college art education is not given due attention. Although art education in colleges and universities is attracting more and more attention from the public, many colleges and universities still do not attach great importance to it as a "foil" or auxiliary discipline, so their investment in it is also very limited. This problem has always been a source of great distress for some art education researchers in colleges and universities, because the development of art education in colleges and universities is very unfavorable if it goes on like this for a long time, It will eventually lead to such an empty shell of college art education, which does not actually contain any substantive content [8]. Due to the insufficient investment of art education funds in colleges and universities, and then the treatment of art teachers

can not be improved, which leads to the lack of energy input of teachers, no enthusiasm for creation, and no enthusiasm to continue to study and explore art education in colleges and universities, so that their teaching ability and scientific research ability are stagnant, which has a great impact on the development of art education in colleges and universities. Set $\gamma$ and $\varphi$ to represent two independent indicators for personalized recommendation of college art education resources, the calculation formula of the personalized recommendation index of college art education resources is as follows:

$$A = E \times \frac{S_\gamma \cdot S_\varphi}{\left|\vec{S}_\gamma\right| \cdot \left|\vec{S}_\varphi\right|} \tag{4}$$

In formula, $S_\gamma$ represents the recommendation coefficient based on the coefficient $\gamma$, $\vec{S}_\gamma$ represents the step length value of the recommendation instruction execution based on the coefficient $S_\gamma$, $S_\varphi$ represents the recommendation coefficient based on the coefficient $\varphi$, and $\vec{S}_\varphi$ represents the step length value of the recommendation instruction execution based on the coefficient $S_\varphi$.

College art education belongs to art, and art is an important part of human culture. It is not only the carrier of culture, but also the product of culture. The government should urge all colleges and universities to use local materials to find art teaching content and carry out art teaching activities according to local actual conditions. More importantly, these art forms are closely related to the daily life of local students, which is very helpful to stimulate students' enthusiasm and enthusiasm for learning. Students' creative thinking, autonomy and scientific research ability have been greatly improved in art teaching practice, At the same time, it also played a significant role in the inheritance and development of traditional culture.

### 3.3 Recommended List

The recommendation list determines the distribution ability of the campus network host to the college art education resources. A complete recommendation list includes both named nodes, coded nodes and statistical indicators. Under the effect of deep learning algorithm, the following issues should be paid attention to when making personalized recommendation list of college art education resources:

Provide personalized recommendations: such as popular ranking. Switch to personalized recommendation when user behavior data is collected.
Use registration information, such as age and gender, to make coarse grained recommendations.
Users are required to give feedback on some items when registering. Collect user interest information.
Users can be classified according to their registration information, and the classification can be multi classification.

Avoid a single art education resource occupying the recommended path of the recommended campus network host for a long time.

Let $G$ represent the core recommendation index of art education resources in colleges and universities, and the solution formula is as follows:

$$G = \frac{1}{\phi} A \cdot (f-1)^2 \tag{5}$$

In the formula, $\phi$ represents the action strength of the deep learning algorithm, and $f$ represents the personalized allocation vector.

On the basis of formula (5), let $\varepsilon$ represent the transmission coefficient of art education resources in the campus network environment, $l_1$ represents the accumulation of named node, $l_2$ represents the accumulation of coding node, $\Delta L$ represents the statistics of art education resources in universities per unit of time, and $j$ represents the statistical coefficient.

Based on the above physical quantity, the function expression of personalized recommendation list of university art education resources can be defined as:

$$K = \int_{\varepsilon=1}^{+\infty} G \cdot \frac{\sqrt{l_1^2 + l_2^2}}{j \times |\Delta L|} \tag{6}$$

Table 1 reflects the necessary constraints for the recommendation list.

**Table 1.** Recommended list of university art education resources

| The name of the node | Content |
|---|---|
| Named nodes | Decide the naming method of fine arts education resources in colleges and universities |
| Coding node | Code the resources of college art education |
| Statistical indicators | Record the recommended contents of fine arts education resources in colleges and universities |

Informatization is the major trend of the world's economic and social development. Information technology, with network technology and multimedia technology as its core, has become a creative tool to expand human capabilities. The application of information technology in art learning is not only the introduction of technology, but also an all-round reform. The application of network technology to learning has changed the traditional learning mode and learning method. The popularity of the network has made education and teaching enter a higher stage of development again. The art teaching style under the network environment is more unique. The art teaching has diversity, flexibility and visibility. The application of network teaching has very obvious advantages in cultivating students' innovation ability.

### 3.4 Analysis of Personalized Recommendation Characteristics

Personalized education, based on the premise of discovering and respecting students' personality differences, provides learners with diversified educational resources conducive

to their own personality development for their own choice, promotes the improvement of learners' personality to the maximum extent, and finally enables learners to develop their personality fully and freely.

Taking college art education resources as the research objective, we can see that personalized recommendation methods have three main characteristics: democracy, pertinence and diversity:

Democracy is one of the characteristics of individualized education. The democracy of individualized education is mainly reflected in giving certain rights, making it maintain its relatively democratic position in the education process, so that students' personality can be maintained, developed and improved. Personalized people are in the main position in learning. Only after recognizing the subjectivity of learners can personalized education be possible [9]. In personalized education, teachers are not only teachers but also friends of students. Students are not passively accepting knowledge, but actively learning. The democracy of personalized education makes personalized education pay more attention to shaping a harmonious environment, so that learners can fully develop their personality in a democratic learning environment.

Targetedness refers to providing democratic education suitable for individual characteristics for learners with different personalities. As mentioned above, everyone is unique, and the differences between people are shown in gender, age, personality and other aspects. Personalized education is based on the uniqueness of people, so it should be different from the unified education. It is a negation of the unified education thought. Personalized education attaches importance to the individual characteristics and unique values of people. When implementing personalized education, it should be targeted to provide different learning environments, learning contents and learning methods for different learners.

Diversity means that when implementing individualized education, educational methods, educational systems, educational evaluation and educational content should be diversified. Learners can choose their own educational content and methods from different educational contents and methods according to their different personality characteristics [10]. As far as educational evaluation is concerned, different students should evaluate with different standards; As far as the educational content is concerned, the same knowledge point should be expressed in multiple forms, so as to meet the learners with different personalities.

Personalized education emphasizes the pertinence, diversity and presentation of learning content. In this paper, students' personality characteristics are taken into account, combined with collaborative recommendation, to provide learners with appropriate learning content, and presented in a preferred way.

## 4 Example Analysis

### 4.1 Experimental Preparation

Collect 540G data of art education resources to be tested on the public network platform of art education resources in a university, and store them all in the art education resources database. The information samples obtained in the experiment are divided into two parts, one part is the experimental object of the experimental group, and the other part is the

experimental object of the control group. The campus network platform structure and experimental equipment are shown in Fig. 4 and Table 2 respectively.

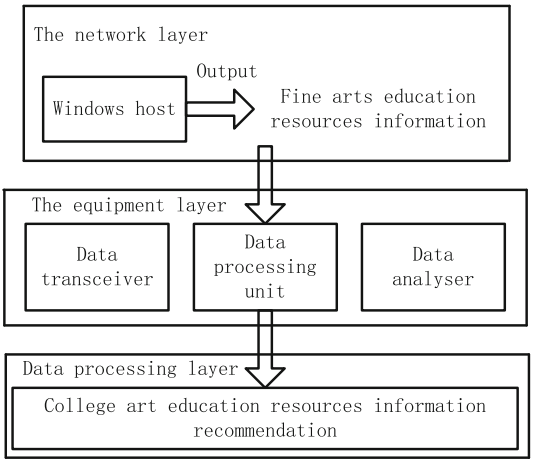


**Fig. 4.** Campus Network platform

Table 2 records the selection of the relevant experimental equipment.

**Table 2.** Selection of experimental equipment

| Campus network host | GTX1650 |
|---|---|
| The operating system | Windows 10 |
| Data transceiver | AMD Eight nuclear A9 |
| Data processing unit | RTX3060 |
| Data analyser | RTX2060 |

In order to ensure the absolute fairness of the experimental results, except for the different experimental methods, the selection of other instruments and equipment in the experimental group and the control group is completely consistent.

### 4.2 Test Steps

The specific implementation process of this experiment is as follows:

Step 1: Select the personalized recommendation method of college art education resources based on in-depth learning as the application technology of the experimental group;

Step 2: Select the conventional recommendation strategy as the application technology of the control group;

Step 3: Use the experimental group method to control the campus network platform, and record the proportion of learning allocation of the selected art education resources under the effect of this method;

Step 4: reset the display of experimental equipment to zero, use the control group method to control the campus network platform, and record the proportion of learning allocation of the selected art education resources under the effect of this method;

Step 5: Compare the proportion of learning allocation of art education resources between the experimental group and the control group, and summarize the rules of this experiment;

### 4.3 Data Processing and Experimental Results

Figure 5 reflects the specific numerical change of the learning allocation ratio index of art education resources under the recommended methods of the experimental group and the control group.

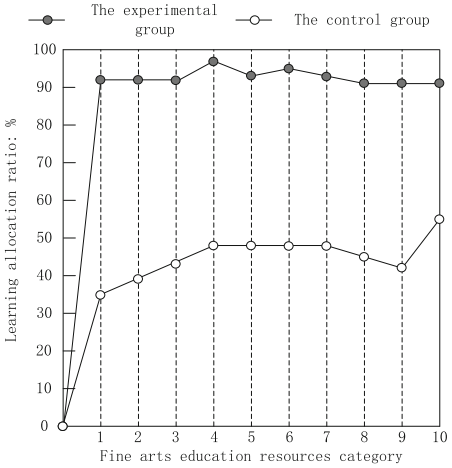


**Fig. 5.** Index of the proportion of learning allocation of art education resources

Experimental group: when the category of art education resources is 4, the proportion of learning allocation in the experimental group reaches the maximum of 96.71%; When the categories of art education resources are 8, 9 and 10, the minimum value of the learning allocation proportion index of the experimental group is 91.04%, and the difference between the two is 5.67%. Throughout the experiment, the average value of the learning allocation proportion index of the art education resources of the experimental group is always greater than 90%.

Control group: when the category of art education resources is 10, the proportion of learning allocation in the control group reached the maximum of 55.02%; When the category of art education resources is 1, the minimum value of the learning allocation proportion index of the control group is 35.99%, with a difference of 19.03%, which is greater than the difference level of the experimental group. However, the average value

of the learning allocation proportion index of the art education resources of the control group is always lower than the experimental group throughout the experiment.

To sum up, the conclusion of this experiment is:

(1) Under the effect of the conventional recommendation strategy, the value level of the proportion index of learning and distribution of art education resources is always relatively low, which means that the application ability of this method in solving the problem of uneven distribution of education resources is relatively limited, and cannot guarantee the personalized recommendation ability of the campus network host to art education resources.

(2) The recommendation method based on deep learning can greatly improve the value level of the proportion index of learning and distribution of art education resources, which means that this method can better solve the problem of uneven distribution of education resources, and has relatively strong application ability in ensuring the personalized recommendation ability of campus network hosts for art education resources.

The reason why the recommendation method designed in the article has comparative advantages is that it first designs the deep learning structure of art education in colleges and universities, which provides a good structural basis for subsequent recommendation. According to the principle of educational weight distribution, the similarity of educational resource information is calculated, which helps to improve the accuracy of resource data recommendation; Based on the in-depth learning algorithm and the resource vector to be allocated, the personalized recommendation list of art education resources in colleges and universities is formulated, and the proportion index of learning and allocation of art education resources is finally improved.

## 5 Conclusion

In this information age of education, the overwhelming art resources are full of the network. In order to use the art resources on the network more effectively, the strategies and methods of using the network art education resources are particularly important. To improve the effectiveness of the recommendation of the campus network host to the art education resources, we need to go through a certain screening process, improve our own sensitivity to excellent resources, and ultimately achieve better use of the network art education resources and improve the learning efficiency of students.

In general, the personalized recommendation method of college art education resources based on deep learning can establish the user's knowledge point interest model according to the analysis of user behavior, and recommend the resources to the user in the current learning state according to the model. However, the proposed algorithm still has many shortcomings. The future research work mainly includes the following aspects:

(1) Optimize the interest model of the deep learning algorithm, and try to introduce other parameters to express students' interest characteristics.
(2) Consider optimizing the personalized recommendation method when the art education resources are sparse, and modify the deep learning algorithm to improve the performance of the recommendation list when the sparsity is low, and improve the accuracy of the recommendation.

(3) Considering the time interval optimization of students' interest transfer in art knowledge points, a dynamic time interval adjustment scheme suitable for students' personalized learning behavior is established.
(4) Improve the deep learning algorithm model to make it have the parallel processing ability, so that it can still maintain a high level of recommendation accuracy when facing massive data and student users.

**Acknowledgement.** Fundamental Education Research Achievement Cultivation Project of Fuyang Normal University: Research on the Path to Improve the Teaching Ability of Fine Arts Students (2017JCY12).

## References

1. Liu, S., Wang, S., Liu, X., Gandomi, A.H., Daneshmand, M., Muhammad, K., Victor, H.C.: De Albuquerque, Human Memory Update Strategy: A Multi-Layer Template Update Mechanism for Remote Visual Monitoring. IEEE Transactions on Multimedia **23**, 2188–2198 (2021)
2. Lili, W., Weitong, G., Hongwu, Y.: Study on realizing personalized course recommendation by using learner portraits. E-education Research **42**(12), 55–62 (2021)
3. Fang, L., Feng, T., Xin, L., et al.: A collaborative filtering recommendation method for online learning resources incorporating the learner model. CAAI Transactions on Intelligent Systems **16**(6), 1117–1125 (2021)
4. Bigham, B.S., Noorizadeh, F., Khodayifar, S.: A polynomial time algorithm for big data in a special case of minimum constraint removal problem. Evol. Intel. **13**(4), 1–8 (2020)
5. Pane, S.F., Awangga, R.M., Majesty, D.: Mapping log data activity using heuristic miner algorithm in manufacture and logistics company. TELKOMNIKA (Telecommunication Computing Electronics and Control) **19**(13), 781–791 (2021)
6. Daves, M., Ervin, E.K., Zeng, C.: Experimental data interpretation using genetic algorithm for global health assessment of reinforced concrete slabs subjected to cracking. Adv. Struct. Eng. **24**(3), 411–421 (2021)
7. Dillon, P., Aimmanee, P., Wakai, A., et al.: A novel recursive non-parametric DBSCAN algorithm for 3D data analysis with an application in rockfall detection. J. Disaster Res. **16**(4), 579–587 (2021)
8. Casado-Vara, R., Rey, M.D., Affes, S., et al.: IoT network slicing on virtual layers of homogeneous data for improved algorithm operation in smart buildings. Futur. Gener. Comput. Syst. **102**(1), 965–977 (2020)
9. Shekhawat, S.S., Sharma, H., Kumar, S., et al.: BSSA: binary salp swarm algorithm with hybrid data transformation for feature selection. IEEE Access **9**(99), 14867–14882 (2021)
10. Helong, Y., Lin, S.: Accurate recommendation algorithm of agricultural massive information resources based on knowledge map. Computer Simulation **38**(12), 485–489 (2021)