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Construction of Higher Education Management Cloud Space Based on Machine Learning and Artificial Intelligence

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Abstract: In the context of the “Internet plus” era, the use of online learning has become the mainstream trend, and mobile learning, as a new learning method, is favored by more and more people. The cloud space of higher education management (HEM for short here) has been continuously developed, providing great convenience for people’s learning. However, the traditional management of higher education is gradually difficult to adapt to the development of the times, and many problems have emerged. In order to improve the practicability and popularity of HEM, deep learning (DL) in machine learning (ML) algorithm can be used to store data, and artificial intelligence (AI) technology can be used for intelligent analysis. This paper compared the construction of HEM cloud space based on ML with traditional methods in theoretical education and practical education. The experimental results showed that the practicability of HEM cloud space based on ML and traditional methods was 65% and 55.4% respectively. The average popularization rate of theoretical education was 71.8% and 62.6%, and that of practical education was 73% and 59%. Therefore, the HEM cloud space based on ML under AI can improve the practicability and the popularity of learning.

1. Introduction

With the continuous development of society, information technology has developed rapidly, and people’s lives are closely related to the network. The world’s education technology has been rapidly popularized, and the development of new technologies has promoted the continuous transformation, development and upgrading of education. The traditional HEM is gradually out of touch with today’s society, and the idea of promoting the combination of informatization and HEM has been constantly raised. The construction of HEM cloud space has gradually entered people’s vision. It is the product of education management in the information age. The traditional HEM pays attention to physical objects. The increasingly large system has exceeded its acceptable range, and the construction of higher education cloud space through the network can solve these problems. The construction of HEM cloud space based on ML under AI can accommodate massive teaching resources. Through the analysis of data by ML and the processing of AI technology, the dynamic collection and efficient management of resources can be realized, and the popularity and learning rate of higher education can be continuously improved. Therefore, this paper had research significance.

With the continuous development of the network, HEM has been constantly mentioned. Bond, Melissa studied two data sets on the use and perception of digital tools by students (n=200) and teachers (n=381). The survey results showed that both teachers and students used a limited number of digital technologies to complete the main assimilation tasks, and the learning management system was considered to be the most useful tool [1]. The purpose of Williamson, Ben was to study the government and business drivers of the large-scale technical effort to collect and analyze student data in the UK [2]. Abazi-Bexheti, Lejla introduced a new method to study the use of LMS (Learning Management System). He identified the determinants of the increase in the use of LMS activities through empirical analysis of the situation of South East European University [3]. JJackson, Nicole C identified three common pitfalls faced by higher education programs and managers by outlining the historical trajectory that led to the problem of higher education. He linked these issues with the absorptive capacity of higher education to explore the need for such a balance - usually defined in the strategy as the need for flexibility or the ability to solve innovation. In order to solve these pitfalls, he took the absorptive capacity framework and strategy of education practitioners as the basis for future change management tools [4]. These have provided good theoretical support for HEM and promoted the development of HEM, but they have not been analyzed in combination with the actual situation.

Based on ML algorithm, HEM cloud space can be better constructed, and relevant researchers apply ML algorithm to it. In order to promote the application of new design concepts, Wang, Jun-Bo proposed a ML framework for resource allocation assisted by cloud computing [5]. Williamson, Ben highlighted a major active data infrastructure project in British higher education. He reviewed the organizations that make up the infrastructure, the social technology network of software programs, standards, dashboards and visual analysis technologies, and how these technologies are integrated with the government requirements of market reform. These analyses indicated how to reconstruct a better HEM system through the utopian ideal of “smarter universities”, and reform through market-oriented political projects [6]. The construction of HEM cloud space based on ML can effectively improve the penetration rate, but there is no comparative analysis from other aspects.

In the context of AI, supervised ML algorithm has always been the leading method in the field of data mining [7]. Through statistical processing of the data of HEM cloud space, and analysis and prediction of the user’s favorite learning style, the construction of HEM cloud space is carried out. The HEM cloud space based on ML can be compared and analyzed with traditional methods. The construction of HEM cloud space using ML can improve the practicability and popularity of education.

2. Construction Method of Cloud Space for Higher Education Management

Higher education management is an issue that people pay more and more attention to at present. Under the premise of the continuous development of computer technology, the method of constructing higher education cloud space gradually appears in people’s vision. According to various international reports, AI in education is one of the emerging fields in educational technology. Although it has existed for about 30 years, educators still do not know how to make use of its teaching advantages in a wider range, and how it has a meaningful impact on the teaching and learning of higher education [8]. Cloud space is developed by relying on cloud technology and the Internet, which can allow people to view the information anytime and anywhere when there is a network. The conceptual diagram of cloud space is shown in Figure 1.

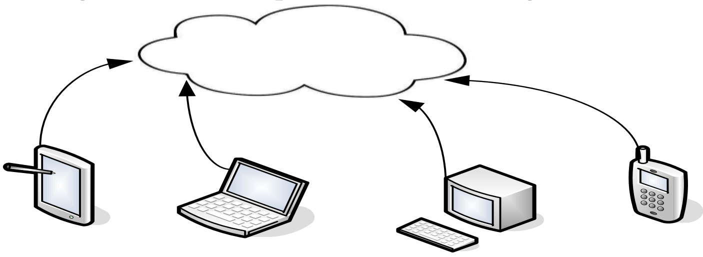


Figure 1: Cloud space concept map

In Figure 1, the concept of cloud space is described. It is a large service platform for storing data. It supports the synchronous update of common data on mobile phones, tablets, and computer devices, and uploading cloud backup by itself. The data it can store is huge and can move around. The emergence of HEM cloud space has realized the picture of learning management anytime and anywhere.

In the past decade, new technologies have emerged in the field of computer science [9]. The cloud space of HEM is the carrier, tool, platform and link for the reform of teaching methods and means, teaching content and learning methods in the information age.

2.1 Construction of Higher Education Management Cloud Space

The construction of HEM cloud space can help students to have reflective thinking, knowledge sharing, cognitive participation and cognitive existence experience. Cloud-supported collaborative learning can plan and manage the potential of students' learning experience. Cloud tools can provide students with the necessary skills to collaborate with each other and improve communication between all users [10]. Therefore, the construction of HEM cloud space is extremely important. The structure of HEM cloud space is shown in Figure 2.

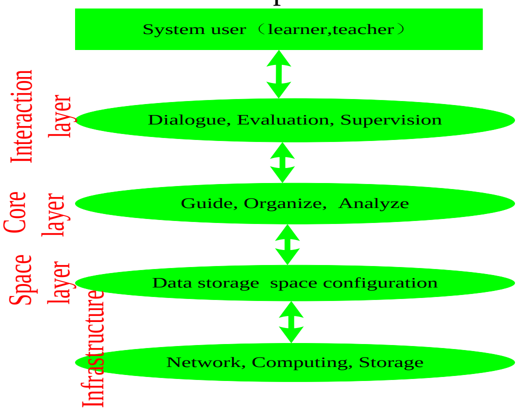


Figure 2: Cloud space structure of HEM

In Figure 2, the basic structure of HEM cloud space is described. The cloud space of HEM is to store educational resources by means of network. It makes full use of the computing power of the data center to integrate, classify and search teaching resources, realize resource sharing, and ensure that everyone can enjoy teaching resources equally.

The spatial structure of HEM cloud is mainly divided into four parts, namely, interaction layer, core layer, space layer and infrastructure layer. Its main purpose is to make learning more convenient for learners. Through cloud space, learning resources can be obtained more quickly and conveniently, and resources can be shared for more people to learn.

People's first impression of the cloud space of HEM is usually very different from the traditional education model. The virtual teaching method without physical objects makes people unable to have a psychological belief that it cannot play a role and let people learn knowledge, so they are not optimistic about its appearance.

However, the cloud space of HEM is generated in response to the current information era, and it is a powerful and massive data repository. It has a powerful resource storage function, breaking the shackles of traditional paper media, which can provide more people with more learning opportunities and learning types.

2.2 Artificial Intelligence Technology

AI is an important technology to support daily social life and economic activities. In recent years, AI has attracted much attention as the key to economic growth in developed countries such as Europe and the United States and developing countries such as China and India. People's attention is mainly focused on the development of new AI information communication technology (ICT) and robot technology (RT) [11].

AI is an intelligent machine, which is the combination of intelligence and human. It is a technology based on data. The most prominent feature is that it has learning ability and can optimize algorithms based on previous machine experience. It includes language recognition technology, intelligent language processing, robot and image recognition and other systems, which can effectively analyze and process teaching resources stored in cloud space.

AI algorithms, especially DL, have made significant progress in image recognition tasks. AI methods are good at automatically identifying complex patterns in imaging data and providing quantitative rather than qualitative radiographic feature evaluation [12]. It can identify the complex part of the data, and then use the classification method in ML to distinguish the teaching resources. Its feedback to the AI program for identification has greatly helped the construction of HEM cloud space.

2.3 ML Algorithm

ML is a kind of AI. DL is part of a broader series of ML methods, which can intelligently analyze data on a large scale [13] and process data stored in cloud space. The schematic structure of ML is shown in Figure 3.

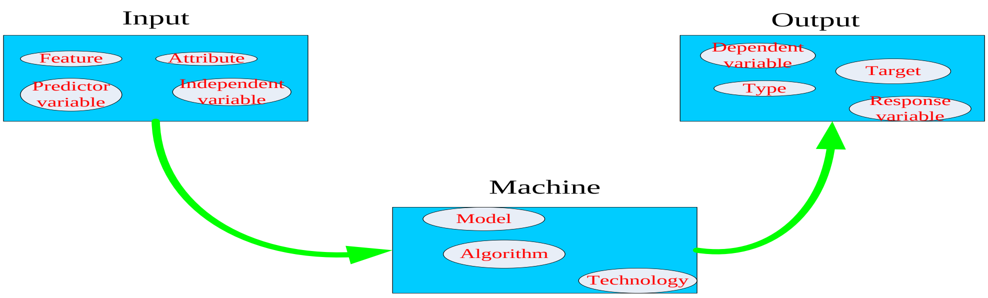


Figure 3: Schematic structure of ML

In Figure 3, the schematic structure of ML is described. It inputs terms from the input, processes them through ML algorithms, models and technologies, and finally outputs terms. The data of HEM cloud space can be input and processed by ML algorithm.

Deep learning algorithm is a new field in machine research. It is developed on the basis of ML and belongs to unsupervised learning. Deep learning uses multiple layers to represent data abstraction to build a computing model. Some key DL algorithms, such as generating confrontation networks, convolutional neural networks and model transfer, have completely changed the view of society on information processing [14].

Convolution neural network is a kind of DL algorithm. When the DL algorithm processes the input data in the cloud space of HEM, the convolution layer of the convolution neural network is used for convolution, and $\omega_{m,n}$ is used as the weighted mask of dimension $b \times b$. $y_{i,j}$ is the input activation at position (i, j), and f is the activation function. a is the deviation, and the output formula of hidden neurons after convolution is as follows:

$$conv(x,y)_{ij} = f(a + \sum_{m=0}^{b}\sum_{n=0}^{b}\omega_{(m,n)}y_{i+m,j+n}) \tag{1}$$

The activation function expressions commonly used in deep networks are as follows:

$$f = \max(0, y) \tag{2}$$

The main advantage of this function is that it is easy to implement. It can use this activation function to perform convolution operation on the input layer to extract the output.

When the convolution neural network is used for data analysis, it is necessary to predict and analyze the optimal data resources suitable for the construction of HEM cloud space. The convolution neural network can be used to output different types of data, and then the SVR model (Support Vector Region) can be used to predict the demand for HEM cloud space, whose expression is as follows:

$$L(a_m, b_m) = \exp(-\frac{(a_m - b_m)^2}{2\gamma^2}) \tag{3}$$

SVR has high consistency, and has a greater degree of generalization when applying invisible data. The main idea of demand forecasting based on SVR is to find a regression function in the high-dimensional feature space, and map the input data to the output through the nonlinear function, so as to carry out linear regression. The regression output modeling expression is as follows:

$$f(a) = \sum_{m=1}^{n}(\omega_m - \omega_m^*)L(a_m, b_m) + X \tag{4}$$

The regression function can be used to predict different types of education management data to facilitate the construction of HEM cloud space.

The loss function uses the negative log function of softnax, and the softmax loss function focuses on the fitting or classification of training data [15]. The data can be normalized, and the normalization formula is as follows:

$$L(\omega) = -\sum_{i=1}^{m} z_i \log(y_i) \tag{5}$$

The total loss value is recorded as:

$$L(M) = \frac{1}{W}\sum_{x=1}^{W} L_x(f(a_x, M), b_x) + \lambda K(M) \tag{6}$$

3. Experiment on Cloud Space Construction of Higher Education Management

3.1 Data Source of Students' Online Access

The construction of HEM cloud space is mainly based on the network, and students' time on the network largely affects their use of cloud space. Therefore, it needs to analyze the online time of college students. In order to effectively analyze the length of college students' online time, this paper used a questionnaire to analyze the influencing factors of cloud space construction. In order to make the survey data authoritative and accurate, this paper made data statistics on 500 college students. It mainly counted the time they spend on the network every day. The results of the survey on the average daily online time of college students are shown in Table 1.

Table 1: Online time

Serial number	Internet time	Number of people	Percentage
1	Within an hour	15	3%
2	One to three hours	115	23%
3	Three to five hours	175	35%
4	Five to eight hours	125	25%
5	eight to twelve hours	30	6%
6	More than twelve hours	40	8%

It can be seen from Table 1 that more than 60% of college students spent less than 5 hours online every day, of which 61% spent less than 5 hours online, and 35% spent less than 3 to 5 hours online. Nearly 40% of college students spent more than 5 hours online, accounting for 39%. In addition, nearly 90% of college students used computers to surf the Internet, and more than 60% of college students used mobile phones to surf the Internet. This showed that the Internet has become a very important part of students' lives.

During the online period, what college students are doing is also worth exploring, because understanding their online behavior can better infer their attitude, and it is more convenient to build HEM cloud space. They can predict their trajectory through the time they spend on the network and build cloud space. The survey results of college students' online behavior are shown in Table 2.

Table 2: Online behavior

Serial number	Internet behavior	Percentage
1	Social chat	85%
2	Learning	62%
3	Entertainment	60%
4	Pass the time	50%
5	Understand current events	40%

In Table 2, the time behavior of college students spent on several behaviors on the network was counted. Among them, more than 80% of students were mainly engaged in social chat, accounting for 85%. Sixty percent of students studied online, accounting for only 62 percent, while the rest were entertaining or killing time. There were still few people who really used the network to obtain knowledge, and some of them were due to the huge resources and messy content on the network. Therefore, it was necessary to build a cloud space for HEM.

3.2 Experimental Design of Higher Education Management Cloud Space

The construction of HEM cloud space is mainly to improve the tightness between education and students. Therefore, the analysis of students' online time and online behavior is conducive to the construction of HEM cloud space. In order to accurately analyze the construction effect of HEM cloud space based on ML, this paper would compare and analyze with traditional HEM methods.

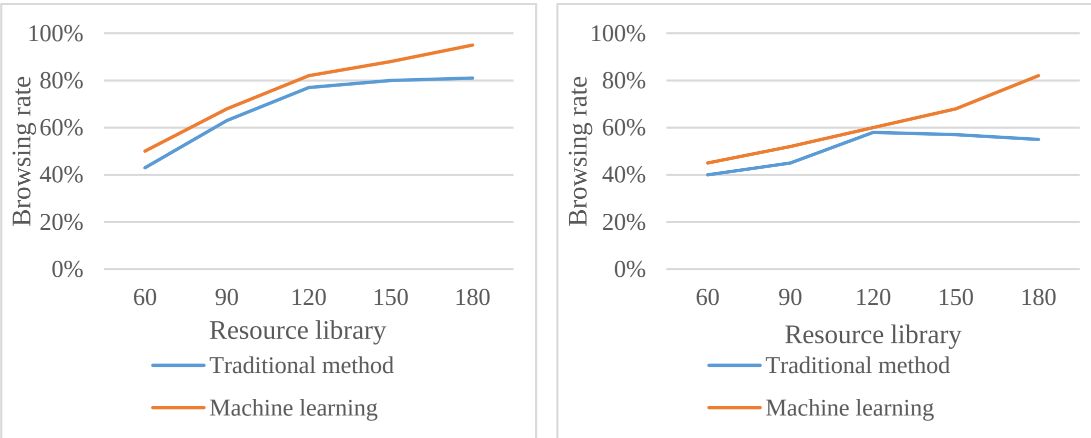
The construction of HEM cloud space based on ML can process the data through the DL algorithm of ML, and analyze it using AI technology, which is recorded as ML method. The traditional HEM is recorded as the traditional method.

In order to make a comprehensive comparison between the two modes of HEM, different variables can be set in the experiment based on the evaluation data of students' HEM after use. The experiment is carried out by increasing the resource pool, the time of use, the year of development and the number of times of use of cloud space storage. In different types of HEM systems, students have different requirements for the way. This paper selected practical education and theoretical education for experimental analysis of HEM.

4. Results of the Construction of Higher Education Management Cloud Space

4.1 Cloud Space Browse Rate of Higher Education Management

The purpose of students entering HEM cloud space is to better and more convenient learning. Higher education management cloud space can introduce more resource libraries, enrich knowledge content and attract more visitors. This paper compared the number of views of the cloud space construction of higher education between theoretical education cloud space and practical education cloud space, and the results of the comparison of the viewing rate of cloud space were shown in Figure 4.



(a) Comparison of theoretical education cloud space browse rate (b) Comparison of practical education cloud space browse rate

Figure 4: Cloud space browse rate comparison results

In Figure 4 (a), the comparison results of the browsing rates of the two cloud space constructions in theoretical education were described. The cloud space browse rate of the traditional method tended to be stable after rising, reaching the highest when the resource pool was 180, and the browse rate was 81% at this time. When the resource pool was 60, the browse rate was the lowest, 43%. In the cloud space of HEM based on ML, the browse rate was constantly increasing, and the browse rate was 50% when the resource database was 60. When the resource pool was 180, the browse rate reached the highest, 95%, and it was still rising steadily. In Figure 4 (b), the comparison results of the browsing rates of the two cloud space constructions in practical education were calculated. The cloud space browse rate of traditional methods was maintained between 40% and 60%. It reached the maximum when the number of resource databases was 120, and the browse rate was 58%. In the ML method, the browsing rate of cloud space has been increasing, reaching a maximum of 82% when the number of resource databases was 180. Therefore, the construction of higher education cloud space using ML can improve the browsing rate and attract people to learn.

4.2 Practicability of Higher Education Management Cloud Space

The construction of HEM cloud space should improve its usability as much as possible and reduce useless information. Higher education management cloud space should be easy to understand, easy to operate and have certain guiding functions. The practicability of two kinds of cloud space construction for HEM is compared and analyzed. During the experiment, the practicability of the two kinds of cloud space construction is analyzed by using the experimental data of the length of time. The comparison results of the practicability of the two HEM cloud spaces are shown in Figure 5.

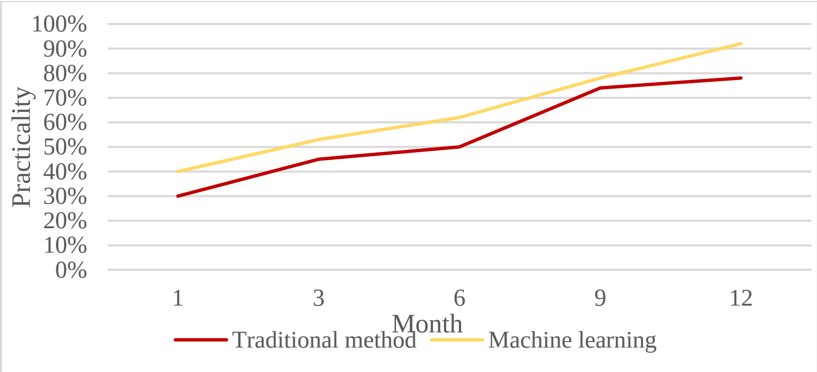


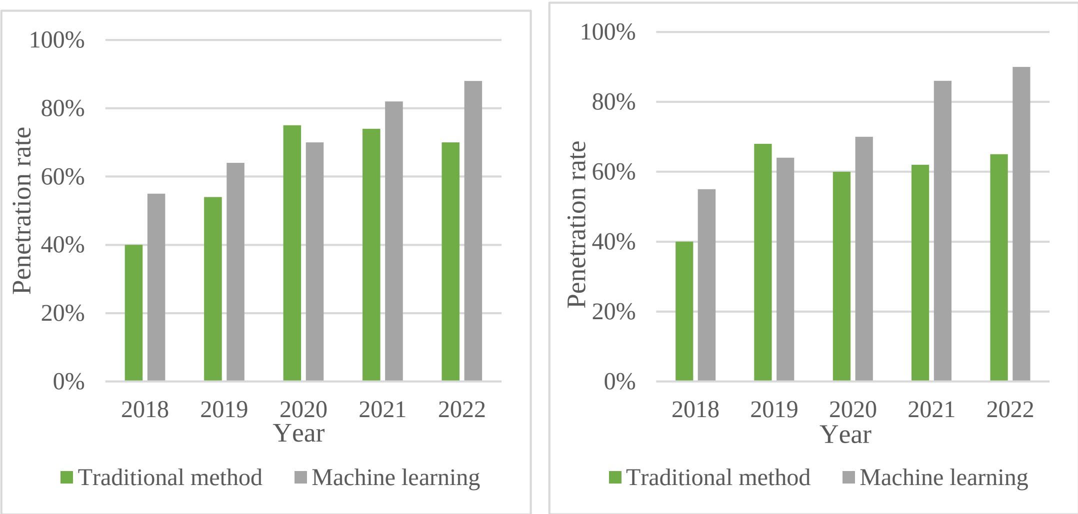
Figure 5: Comparison results of cloud space practicability

In Figure 5, the comparison results of the practicability of two kinds of HEM cloud space are summarized. The practicability of the traditional method is 30% when the user uses it for one month, 78% when the user uses it for 12 months, and the average practicability is 55.4%. In the ML method, the practicability of cloud space is continuously improving in a straight line, reaching a maximum of 92% when users use it for 12 months, and the average interface practicability is 65%. Therefore, the practicability of higher education cloud space management can be improved through ML and other methods.

4.3 Higher Education Management Cloud Space Penetration Rate

The cloud space for HEM needs not only browsing volume and practicality, but also its popularity in the society. The higher the popularity of HEM cloud space, the better it can prove its value. A comparative analysis of the popularity of the two types of HEM cloud space construction is carried out. The detailed comparison results are shown in Figure 6.

In Figure 6 (a), the comparison of cloud space penetration rates of two kinds of HEM was described. Among them, the penetration rate of traditional methods reached the highest in 2020, with 75% penetration rate and 62.6% average penetration rate. Among ML methods, the penetration rate has increased year by year, reaching the highest level in 2022. At this time, the penetration rate was 88%, and the average penetration rate was 71.8%. In Figure 7 (b), the comparison between the two HEM cloud space penetration rates was analyzed. The traditional method reached the highest in 2019, at which time the penetration rate was 68%, and the average penetration rate was 59%. In the ML method, DL algorithm and other technologies are used to build cloud space, and the average user penetration rate was 73%. Therefore, higher education cloud space management based on ML can improve the popularity of education.

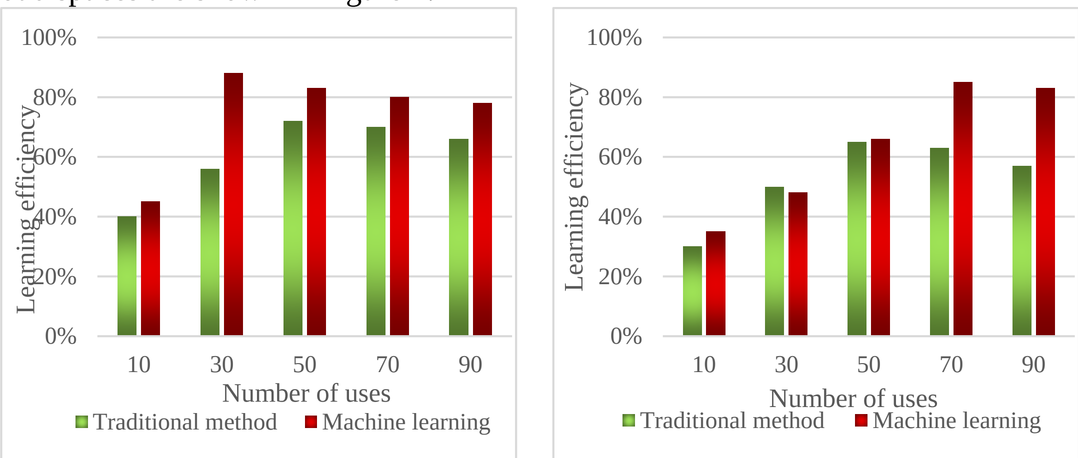


(a) Comparison of cloud space penetration rate of theoretical education (b) Comparison of cloud space penetration rate of practical education

Figure 6: Comparison results of cloud space penetration rate

4.4 Higher Education Management Cloud Space Learning Enthusiasm

The construction of HEM cloud space is to enable people to learn better and more conveniently. Its ultimate goal is to enable people to really learn knowledge, learn more actively, improve people's interest index, and learn happily. This paper compared and analyzed the learning enthusiasm of the two types of cloud space construction for HEM. In the process of the experiment, the learning enthusiasm generated by the two types of cloud space construction was analyzed by using the number of times of data. The comparison results of the learning enthusiasm of the two HEM cloud spaces are shown in Figure 7.



(a) Comparison of theoretical education cloud space learning enthusiasm (b) Comparison of practical education cloud space learning enthusiasm

Figure 7: Comparison results of cloud space learning enthusiasm

In Figure 7 (a), the comparison of two types of HEM cloud space construction was described. The learning enthusiasm of the traditional method reached the highest when the user used it 50 times. At this time, the learning enthusiasm was 72%, with an average of 60.8%. In the ML method, the user's learning enthusiasm reached the highest when the number of times of use was 30, at this time, the learning enthusiasm was 88%, the average value was 74.8%. In Figure 7 (b), the comparison of learning enthusiasm of two HEM cloud spaces in practical education was analyzed. Among them, the traditional method reached the highest when the number of times of use was 50, and the learning enthusiasm at this time was 65%, the average value was 53%. Among the ML methods, the highest learning enthusiasm was 85% when the number of times of use was 70, with an average of 63.4%. Therefore, HEM cloud space based on ML can improve users' learning enthusiasm.

5. Conclusions

In the era of intelligence, the reform of HEM is imperative, and the construction of HEM cloud space provides great benefits for contemporary education. This paper analyzed the construction of HEM cloud space based on ML under AI. Through the statistics of college students' online time and online behavior through questionnaire survey, it can be concluded that the network would become the mainstream way for people to learn, and compare it with the traditional HEM. The experimental results showed that the construction of HEM cloud space based on ML can improve the knowledge, practicality and popularity of education. It can better stimulate people's learning enthusiasm, greatly improve their education level, and then cultivate more talents. After the construction of HEM cloud space, the development of education would become more rapid and comprehensive, which would be an important way for people to learn. However, this paper only compared the theoretical education cloud space with the practical education cloud space, and the analysis of the types was not comprehensive. Therefore, further improving the type of HEM cloud space would be the direction of future research.

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