Research Article

Construction and Sharing of Network Education Resources Based on DM Technology

Haiyan Lv

College of Marxism, Xi'an Fanyi University, Xi'an, Shaanxi 710075, China

Correspondence should be addressed to Haiyan Lv; lvhaiyan@xafy.edu.cn

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In traditional teaching, teachers mainly rely on books to impart knowledge to students, and students mainly broaden their knowledge and enrich their knowledge reserves through books. In network teaching, network construction is the foundation, resource construction is the core, teaching application is the purpose, teachers or students can query through the network, and transfer the required content from the repository of teaching information resources, teaching or learning. It is a new achievement of modern information technology applied to education, which breaks through the time and space boundaries and is different from the traditional classroom teaching mode. Based on DM technology, this paper studies the construction of network education resources, collects all aspects of attribute information of visitors, recommends the most interesting content to visitors on the premise of grasping the scope and characteristics of visitors’ needs, and adjusts the changes of users’ interests at any time to remove the information never visited. Using DM technology, the mining data source can be obtained by data cleaning. DM technology can be divided into classification and prediction, cluster analysis and association analysis according to functions.

1. Introduction

With the progress of science and technology and the development of information technology, the amount of knowledge and information produced by the society has multiplied, and all walks of life have higher and higher requirements for the ability and quality of staff. In traditional teaching, teachers mainly rely on books to impart knowledge to students, and students also use books to broaden their knowledge and enrich their knowledge reserves [1]. In the network teaching, network construction is the foundation, resource construction is the core, and teaching application is the purpose. Teachers or students inquire through the network, transfer the required content from the information database storing teaching information resources, and teach or learn [2, 3]. Network education, in a nutshell, is a teaching mode carried out by using media such as TV and Internet. It is a new achievement of modern information technology applied to education, which breaks through the time and space boundaries and is different from the traditional classroom teaching mode [4]. At present, the network teaching resource base mainly provides mechanized functions such as browsing, downloading, and uploading on the basis of developed courseware, materials, network courses, lesson plans, and other teaching resources. It is mainly centered on “materials” and does not reflect the idea of “learners”. Online education does not need a specific place, is not limited by age and education background, and can be studied anytime and anywhere, or can be selectively studied according to one’s own needs, which really provides a convenient relearning way for people who have stepped into the society [5, 6]. Teaching information resources is one of the key issues in the implementation of network teaching. Without a considerable quantity and quality of multimedia teaching information resources, network teaching will become a straw without water, which is unsustainable.

Data mining (Abbreviation: DM) technology is not only a combination of technologies, but also combined with different fields. We can take it as a way of thinking or operation mode. The socialization and openness of its resource management and the provision of long tail services will affect the construction and application of online
education resources. DM technology is to apply DM technology to the use of data site resources. By analyzing the user’s access content, residence time, frequency, and other factors, we can get knowledge about students’ access interest and access mode characteristics [7]. According to the characteristics of these users, the data site can dynamically recommend teaching resources for learners and provide learners with links to the content they care about [8, 9]. DM is to mine implicit, previously unknown, and potentially valuable knowledge and rules for decision-making from a large number of incomplete, noisy, fuzzy, or random data. These knowledge and rules contain the specific relationship between a group of objects in the database and reveal some useful information [10]. There is no generally accepted and unified definition of the concept of DM, but we can define it from the technical and commercial levels. Technically speaking, DM can be defined as an operation that extracts information useful to a specific people from fuzzy, noisy, large, random, and incomplete data and hides it in these data. People do not know it in advance, but it has potential value information or knowledge [11, 12].

Personalized information query mode based on DM technology. Collect all aspects of attribute information of visitors, recommend the most interesting content to visitors on the premise of grasping the scope and characteristics of visitors’ needs, and adjust the changes of users’ interests at any time to remove the information never visited [13, 14]. Using DM technology, we can get mining data sources by data cleaning. Scan the data source to establish a user session, that is, create a user session for each new IP address. Join the continuous requests issued by the user in this session. By ranking the results of search engine by relevance, clustering the results of deceleration and feedback by relevance, a personalized information query system of online teaching based on DM is constructed to improve the service quality of online teaching websites [15]. In the same user session, if the user visits n pages in the website, then the conversation is represented by an N-dimensional vector, and the value of the 1-dimensional vector represents the user’s interest in the lth page, that is, the weight. DM technology, as a frontier research field of database system, has been developed for twenty years, and various technologies have taken shape and become mature. DM technology can be divided into classification and prediction, cluster analysis and association analysis according to functions.

2. Related Work

Literature [16] proposes that, from a broad perspective, teaching resources can include anything that can help individuals learn and operate effectively. It includes network-based educational environment, support system, teaching materials, and personnel. “Network teaching resources” mainly refers to network-based teaching materials, that is, information-based teaching resources based on Internet operation. Literature [17] through the big data analysis method, educational resources are an important part in the development of network education system. It is a necessary condition for the success of network education that students carry out exploratory learning without geographical and temporal constraints and provide them with a large number of comprehensive and open resources. Literature [18] points out that we can take it as a way of thinking or operation mode. The socialization and openness of its resource management and the provision of long tail services will affect the construction and application of online education resources. DM technology is to apply DM technology to the use of data site resources. By analyzing the user’s access content, residence time, frequency, and other factors, we can get knowledge about students’ access interest and access mode characteristics. Literature [19] proposes that, from a technical point of view, the current organization of resources is not enough to meet the needs of users. The system will store the uploaded resources according to the location specified by the administrator in advance. When storing uploaded resources, the system will automatically judge the resource type and determine the storage method of resources. Literature [20] through the big data analysis method, learners use the resource database to learn. When they encounter problems, they cannot find resources to solve problems, or cannot find resources suitable for their learning ability. Both situations affect the learners’ utilization of resources. There are two situations in which no resources can be found to solve the problem. One is that the resources do not exist, and the other is that the resources exist but have not been found. Learners’ search purpose is clear. If they search just for the gap of resources, they must return in vain. Literature [21] research shows that network education, as an important form of contemporary distance education, seems to be an important part of today’s education. Network education is not only a powerful supplement to traditional education, but also an important guarantee for the realization of universal education, continuing education, and lifelong education. Literature [22] How to make learners stay longer on their own resource pool website is indeed a challenge for resource pool designers. Experts classify and judge the content, which is an integrated and centralized management method. Many Web2 0-based applications are bottom-up, and their contents are jointly constructed and managed by participants, for example, Wikipedia is used to compile encyclopedias. Literature [23] through the big data analysis method, the development and utilization of online education resources are not satisfactory. The main reason is the lack of uniform format, exchange standard and general technical means, which forms an information island, makes it difficult to carry out effective resource retrieval and resource sharing among different systems. Literature [24] research shows that there is no resource suitable for one’s own learning ability, which is mainly based on the following reasons: first, there is a difference between learners’ existing knowledge structure and the difficulty of resources, and the smaller the difference between them, the higher the utilization rate. Once the difference is too great, even the best resources are useless to learners. Second, learners’ cultural background affects the utilization of resources, and language barriers and different ways of thinking are all related factors that affect the utilization of resources. Third, the relationship between learners’ age and their ability to accept knowledge,
Mobile Information Systems

and the relationship between learning subjects and learning effects based on network resources also have an impact on the learning process. Literature [25] puts forward that education resource database system refers to the integration of education and teaching resources by means of information technology, and finally the interactive and multimedia shared resource warehouse is built. Therefore, in the final analysis, the construction of educational resources is an educational problem, which must follow the educational reality, educational theory, and educational technology.

This paper studies the construction and sharing of network education resources based on DM technology. Although the number of network education resources is very considerable, the consideration of systematic and large-scale construction of network education resources for jobs is still insufficient, so that most learners can easily complete their learning tasks when learning a single knowledge point. Once we need to develop a systematic and large-scale e-learning system in combination with our own development, we will have no clue. Coupled with the lack of relevant guidance, it is easy to fall into learning difficulties. It can be seen that the overall planning of the construction of E-education resources is very insufficient.

3. Principle and Algorithm of DM Technology

Using DM technology, we can get mining data sources by data cleaning. Scan the data source to establish a user session, that is, create a user session for each new IP address. Join the continuous requests issued by the user in this session. By ranking the results of search engine by relevance, clustering the results of deceleration and feedback by relevance, a personalized information query system of online teaching based on DM is constructed to improve the service quality of online teaching websites. Before DM, you probably do not know what you want to mine, and you do not know the results. Preprocessing of data, that is, processing and organizing reconstruction of source data, constructing data warehouse of related topics, providing a basic platform for the next DM process, and making good preparation. It mainly includes: data cleaning, data integration, data conversion and data reduction, then establishing a mining database, and analyzing and adjusting the data. According to the characteristics of these users, the data site can dynamically recommend teaching resources for learners and provide learners with links to the content they care about. Clustering is to classify data according to their attributes. Then, get the next data after clustering, some of which can directly reflect the internal relations of objects, while other results need to be further processed by other tools. Generally, DM can be divided into three stages, namely, data preprocessing, concrete implementation of DM, and evaluation and presentation of mining results. The specific process is shown in Figure 1.

At present, there are a wide variety of educational resources on the Internet, including multimedia courseware to support teachers’ teaching, online course of DM technology to support the whole process of learning a certain subject, various material resource banks to support students to create electronic works, such as audio, video, and pictures, test question banks for students’ self-test, and a large number of auxiliary teaching materials for classroom teaching or various resources for self-study after class provided by online schools. Classification can predict the dispersion degree and no category of data objects, while prediction is used to predict the continuous value of data objects. It is necessary to establish a continuous value function model. The choice of DM technology will affect the quality and effect of the final result. Usually, a variety of technologies are combined to form complementary advantages. There are several common DM methods.

3.1. Association Analysis. Association analysis is a practical DM technology, which refers to finding useful knowledge of dependence or association from a large number of datasets. Association rules can mine interesting knowledge and patterns from a large number of transaction data or relational data.

3.2. Traditional Resource Management is Top-Down. Learners choose learning resources randomly or blindly at first. To improve the utilization rate of resources, one is to let more learners know about the resource pool, that is, to mine potential users. At the same time, in order to keep the users who are already using the resource pool from losing, that is, users staying, the mining of potential users is to identify some common descriptions of this user and old users who have already been classified by using classification technology, and to determine the user types, so as to dynamically display some special and targeted pages for users and attract users.

3.3. Genetic Algorithm. Genetic algorithm is a combinatorial optimization method based on biological evolution process, which is the product of the combination of biology and computer science. According to the principle of survival of the fittest, it simulates the evolution mechanism of life in nature, and forms a new population composed of the most suitable rules in the current population, and the offspring of these rules. It consists of three basic operators: reproduction, crossover, and mutation.

3.4. Bayesian Network. Bayesian network is a Bayesian theorem based on a posteriori probability. It is a method based on statistical processing of data. It has the functions of classification, clustering, prediction, and causality analysis. The mining data model building module completes three functions. Using the sequential pattern discovery technology in DM, we can find the behavior of learners navigating on the site in the form of pages, dynamically adjust the structure of the site for learners, make the connection between the related files accessed by learners more direct, make users easily access the pages to be accessed, increase the convenience of access, leave a better impression on users, and increase the probability of next visit. The structure is shown in Figure 2.
Bayesian method is used to train the classification model. The document classification model is discussed here, and the interest of users and the expression of documents are consistent. Assume that the set of domain types is $c = \{c_1, c_2, ..., c_n\}$, where $n$ is the size of the model and $c_j$ represents the $J$-th domain, then document $D$ is expressed as a vector...
d = \{ p(c_1|d), p(c_2|d), \ldots, p(cn|d) \} of conditional probability, where the posterior probability of document D to type \( c_j \) is

\[
p(c_j|d) = \frac{p(d|c_j)p(c_j)}{p(d)}. \tag{1}
\]

Here, \( P(d) \) is expressed as

\[
p(d) = \sum_{j=1}^{n} p(d|c_j)p(c_j). \tag{2}
\]

Assuming that all features of the document appear independently, \( P(d|c_j) \) can be expressed as the product of conditional probabilities of all features of the document.

\[
p(d|c_j) = \prod_{\eta \in d} p(t|c_j). \tag{3}
\]

Assuming that \( n(C_j, t) \) represents the number of occurrences of feature \( T \) in \( c_j \) class, \( n(c_j) \) is the sum of the occurrences of all features in \( c_j \), and \( |v| \) represents the number of all different features in the document set, according to Lidstone’s continuity law, for a positive number, the estimated value of \( P(t|c_j) \) can be expressed as

\[
p(t|c_j) = \frac{n(c_j, t) + \lambda}{n(c_j) + \lambda|v|}. \tag{4}
\]

Suppose that the current action of user \( u \) is a, its corresponding meaning is WA, the document corresponding to user action is \( D \), and \( \eta \) is the learning rate, which is a small constant. Firstly, the probability distribution of document \( D \) on the classification model is calculated, and then the conditional probability corresponding to each classification in the user interest vector is modified

\[
p(c_j|u) = \frac{p(c_j|u) + \eta u_a p(c_j|d)}{1 + \eta u_a}. \tag{5}
\]

Given the classification model \( C = \{C_1, C_2, \ldots, C_N\} \), the condition of user \( u \) is independent of document \( D \), then the probability that document \( D \) is recommended to user \( u \) can be expressed as

\[
p(u|d) = p(u) \sum_{j=1}^{n} \frac{p(c_j|u)p(c_j|d)}{p(c_j)}. \tag{6}
\]

We can calculate the probability that a document is recommended to users. Its significance lies in transforming the similarity calculation problem of probability model into the problem of finding conditional probability, which reflects the diversity of users’ interests.

Mining based on data analysis and user behavior patterns mainly includes the following methods: statistical analysis, association rules, clustering, classification, and sequence patterns. At present, there are many units and researchers engaged in Web usage mining. However, most log mining technologies are still in the experimental stage, and there is still a lot of work to be done before log mining technology is actually applied. The mining data model building module completes three functions.

1. Keywords are extracted from the user personality feature database to form an individual user model;
2. Find out the 20 users with the closest interests to the specified users and extract the features to form a group user model;
3. Integrating the characteristics of the individual user model and the corresponding group user model to form a comprehensive user model that reflects not only the personalized interest characteristics of the user, but also the interest characteristics of multiple users with similar interests to the user.

4. Research on the Construction and Sharing of Network Resources

4.1. Construction of Network Education Resources Based on DM Technology. Resource construction in network education includes talent resource construction, knowledge resource construction, and application resource construction. The Ministry of education attaches great importance to the resource construction of online education. For text, image, and other resources, they can be stored in the database together with resource metadata. For video, audio, and other resources, we adopt the quasi data storage mode of file management for the resources themselves, while the metadata of the resources is still stored in the database. The network teaching resources based on DM technology mainly include all the learning materials supported by the network teaching system. Mining based on data analysis and user behavior patterns mainly includes the following methods: statistical analysis, association rules, clustering, classification, and sequence patterns. At present, there are many units and researchers engaged in Web usage mining. However, most log mining technologies are still in the experimental stage, and there is still a lot of work to be done before log mining technology is actually applied. There are some problems in the construction of traditional network resources. These problems can be seen from two perspectives: the perspective of technology and the perspective of social culture. Using the sequential pattern discovery technology in DM, we can find the behavior of learners navigating on the site in the form of pages, dynamically adjust the structure of the site for learners, make the connection between the related files accessed by learners more direct, make users easily access the pages to be accessed, increase the convenience of access, leave a better impression on users, and increase the probability of next visit. The system will store the uploaded resources according to the location specified by the administrator in advance. When storing uploaded resources, the system will automatically judge the resource type and determine the storage method of resources. For text, image and other resources, they can be stored in the database.
原文中使用了大量案例和场景来展示如何将资源管理、个性化信息推荐和知识图谱分析结合起来，以提高学习资源的使用价值和吸引力。对于目标群体，可以通过个性化推荐系统来引导学习者的学习方向。

4.2. Experimental Results and Analysis. For relevant domestic literature, take “network platform learning”, “DM”, “network teaching,” and “distance education” as search keywords, respectively, to conduct advanced retrieval of papers in China How Net from 2014 to 2021, and remove articles that have little relationship with the subject in the process of statistics. This experiment uses academic papers and dissertation, respectively. The journal papers are compared for three times, and the results are shown in Figure 3, 4 and 5.

According to the data of the above three groups of experiments, literature [2] Professor Shen Ruimin of Shanghai Jiaotong University has done research on the design and implementation of personalized navigation system based on DM. On the basis of the distance platform education system, an adaptive mechanism is added, which can make personalized learning navigation according to learners’ personality characteristics. Literature [5] proposes and implements an intelligent distance education platform environment based on multiple agents, which can realize the sub-adaptability and intelligence of the distance education system based on Web. Literature [5] designed and implemented an intelligent learning recommender based on support vector machine algorithm. By analyzing the characteristics of students’ learning behavior, an intelligent learning recommender scheme was proposed. Literature [7] The Research Institute of South China Normal University, represented by Li Kedong and Chen Pinde’s teaching, combines intelligent teaching system, user model, hypertext, and other related fields with adaptive learning navigation system and creative tools, establishes a user-based knowledge model according to the interaction between users and systems, and guides learners’ learning direction by marking navigation buttons and hypertext links, respectively, according to the logical structure of this model and domain knowledge. Literature [9] Professor Deng Hui of the School of Computer and Information of Southwest Normal University analyzed the distribution of students’ characteristics under the network environment, and put forward the theoretical part of the user characteristics analysis system through the static and dynamic information of learners in the learning process. Aiming at the online learning of DM, a field of education and teaching, many people have been engaged in this research and made theoretical and practical achievements.

We build a mining model through these two case tables, select the decision tree as the mining technology of the algorithm, click each node box of the next branch of the tree, and we will find that the case value and probability percentage in the "characteristics" list will change accordingly, so that we can more carefully observe the characteristic value of the output result after mining. Three experiments were conducted for comparison, and the experimental results are shown in Figure 6, 7 and 8 respectively.
Figure 3: Distribution and growth trend of the total number of related research papers in China.

Figure 4: Distribution and growth trend of the total number of related research papers in China.

Figure 5: Distribution and growth trend of the total number of related research papers in China.
The experimental results show that the different distribution of network education resources construction with different allocation indexes is in line with the “pyramid” distribution of network education resources construction at different levels. At the same time, we can also take the appropriate allocation index value as a specific index in the construction of network education resources. Taking the allocation index value as a dividing point for the evaluation of the construction quality of network education resources provides a certain reference basis for us to make a more reasonable evaluation in the construction of network education resources in the future. The construction of network education resources is the fundamental problem of current network education. At present, the form of expression of online education resources in China is single, and the content is lack of systematicness and pertinence. Many resource media have only changed in form, but the content is still a replica of the traditional face-to-face teaching materials, lacking teaching design and pertinence to students’ learning. It is not suitable for students’ individualized and autonomous learning. On the other hand, the development of teaching and scientific research informatization can greatly promote the development of educational confidence, but there is still too little research on the application of DM technology in the field of education. In particular, the application of DM in e-learning needs further research, and how to use DM technology to realize the personalization of E-education resources construction will have practical significance.

Figure 6: Detailed list of network education resources construction results based on DM.

Figure 7: Detailed list of network education resources construction results based on DM.
5. Conclusions

It takes network technology as an organic element in the teaching process and provides an autonomous learning mode with learners as the main body and inquiry learning as the main way. In this mode, learners can choose the learning content according to their own interest and level. The construction of educational resource pool should not only consider the practical significance, integrate the development of related technologies, but also consider the future development trend of education, and build a forward-looking educational resource pool that conforms to quality education, continuing education, lifelong education, and new teaching modes. At present, in most of the online education resources construction platforms based on DM technology, teaching resources are stacked together by simple classification, the learning process is basically fixed, and the learning methods and modes are very simple. However, in reality, there are great differences in the learning ability, personal interests and habits, personal learning foundation, and efforts of the educated subjects. The fundamental reason for this contradiction is that the network education resources construction platform of DM technology ignores that the learning process is a personalized process. The construction of educational resources takes network technology as an organic element, learners as the main body, inquiry learning as the way, and learners choose content according to their own interests. The network teaching resource base of DM technology must support personalized learning, meet the diverse needs of learners, and build an interactive teaching and learning environment. The construction of network education resources based on DM technology also needs to consider the factors of socialization.

Data Availability

The labeled dataset used to support the findings of this study are available from the author upon request.

Conflicts of Interest

The author declares no conflicts of interest.

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