Optimization and Integration of Network Teaching Resources of Ideological and Political Course Based on Big Data

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Abstract. In the current optimization and integration method of teaching resources, in the design of teaching resources integration method, the compatibility of the method framework is poor. When the constraint conditions are changed, the integration efficiency will be greatly affected. Therefore, this paper proposes the optimization and integration method design of network teaching resources of Ideological and Political Courses Based on big data. Firstly, according to the data mode of big data, the resource integration model is established. On this basis, CFI generalization framework is used as the resource integration framework, and the calculation method of data classification is added in the framework. Finally, computer technologies such as DOI and crossref are added to the framework to realize the integration of network teaching resources. In order to verify the feasibility of the integrated method. Taking the network teaching resource data of Ideological and political course of a university as the carrier, Experiments are used to verify the data optimization and integration effect of the designed integration method. The experimental results show that the design method is less affected by constraints, and the integration efficiency is high, which meets the design requirements.

Keywords: Teaching resources · CFI generalization framework · Big data · Resource integration

1 Introduction

The traditional information carrier system is dominated by paper-based carrier, and a stable system structure is formed by the mutual compatibility of paper-based carrier with microfilm carrier, magnetic carrier and laser carrier [1–3]. With the popularization of network digital technology application, all kinds of information begin to transform in digital form, and digital information will continue to grow, and the speed will be accelerated [4, 5]. Digital information has become the mainstream information resources, the Internet has become an important channel for people to obtain information knowledge, and people's behavior of obtaining information has also changed. For colleges and universities, digital resources can be convenient for the allocation of teaching resources. However, the growing number of complex digital resources, such as overlapping content, redundant information and low knowledge relevance, have formed "digital resource

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island" and "digital resource overload". Digital resource island is the diversity and heterogeneity of storage digital resource system, which leads to digital resource It is an information environment state that is difficult to obtain and share. Digital resource overload is due to the large number of digital resources, which makes it difficult for people to accurately obtain information resources. These two dilemmas have brought a serious burden on people's utilization and access [6, 7]. Researchers at home and abroad have established a variety of resource integration systems, such as encompass with linkfinder plus and Millennium access plus map. However, in the actual use of the system, it is found that the system lacks the consideration of different constraints in the application. When different constraints are added to the resource integration, the integration running time will be significantly increased, and one-step optimization is needed in actual use.

2 Optimization and Integration of Network Teaching Resources of Ideological and Political Courses in Colleges and Universities Based on Big Data

2.1 Teaching Resource Database Model Based on Big Data

Big data is bound to play an extremely important role in resource bank project monitoring and education informatization work [8, 9]. In this paper, the establishment of teaching resource database, according to the ecological method, let the resource library achieve the growth of resource content, the increase of resource volume, the improvement of resource quality, and the realization of resource update in the continuous revision. Only by realizing ecological development can a virtuous circle be realized. The powerful functions of the resource bank in learning and teaching have been brought into full play. In this paper, the BDD model [10] is mainly used to reveal the problems existing in various aspects of the current resource library through the analysis of big data, and then formulate and implement the rectification plan for each sub project, and then accept the results. If it fails, it will be circulated once, and it will be iterated until the expert comments and passes. In order to better express this process,It is transformed into a mathematical model of sustainable development.

$$D = F(B, P1, P2, A, E, R) \tag{1}$$

Among them, D represents the effect of sustainable development of teaching resource library, F is a process function, B represents the output of big data, $P1$ represents the formulation and $P2$ represents plan of professional database. A refers to the rectification plan of the designated sub project, E indicates the assistant's assistance in the rectification, R represents the expert's evaluation and indicates the rectification result. And $P2$, A, E is a small iterative process. B, $P1$, $P2$, A, E, R is a large iterative process. In the model D, from small iteration to large iteration, the ecological development effect of the model is ensured, and the resource pool enters into a virtuous cycle and ecological development. The workflow of BDD ecological development model, first of all, through the resource system background, the professional teaching resource database and determine the active analysis $b1$, login ranking $b2$, behavior analysis $b3$, itinerary analysis $b4$, course analysis $b5$, classroom teaching $b6$, performance analysis $b7$ to generate reports.

To analyze the use of the whole resource database, and to generate a detailed table of the use of the resource database by the Ministry of education.

2.2 Framework of Teaching Resources Integration

This paper uses CFI generalization framework [11] as the resource integration framework. From CFI generalization to more extensive scenarios, it can be found that in the context of service ecosystem, the fundamental task of service resource integration is to select parts optimally according to the personalized needs of users or applications, and individuals form virtual resources. The framework includes three parts: input, output and resource integration. The input includes service resource pool, application requirement description and service resource quality. Service resource pool is the collection of service resources. The same large class of resources can be in different sub categories in different classification standards, and has different evaluation criteria; application requirements description is to describe and express the personalized needs of users in a standardized form. To be able to describe and understand user requirements is the premise of personalized service resource integration; the quality of service resources includes the quality attributes of all aspects of each resource, which can be examined from two aspects: the quality records of historical use of resources and the quality declared by service resource providers. The output is the result of the integration of service resources, that is, a set of resources obtained by matching and selecting resources. At the same time, these resources may be in different positions in the organizational structure of the collection. These common points and internal relations make these resources together form a resource set which can better meet the user's personalized application needs. When generating multiple result sets, they can be divided into different priorities according to the different evaluation results. The resource integration engine implements the service resource integration method. According to the personalized constraints of user requirements, the category and quality characteristics of resources, a set of resources is selected from the resource pool to form a virtual service resource that can meet the needs of users. The description of resource integration needs to conform to the description of service resources. In reality, the resources in a certain field are often classified according to different standards, which are reflected in the multi-dimensional classification of service resources. In addition, domain resources also have a certain number of general attributes and domain attributes, which are reflected in the multi-attribute of service resources, as shown in Fig. 1.

In CFI, developers and testers will be classified by age, technology, experience and available time per week, and have many attributes such as gender, occupation, education, interest, etc.

Multi dimensional and multi-attribute service resources can be represented as four tuples $R = (RB, RU, RA, RC)$, where RB is the basic information of service resources. RU informate related to the function or use of a service resource. RA represents a collection of service resource attributes. RC represents a collection of classification tags for service resources $|RC| = |F|$. The forest is composed of domain related service resource F classification tree. The number of classifications per service resource can be expressed as $F = \{T_1, T_2, \ldots, T_m\}$, where $T = (TN, ST)$ represents the name

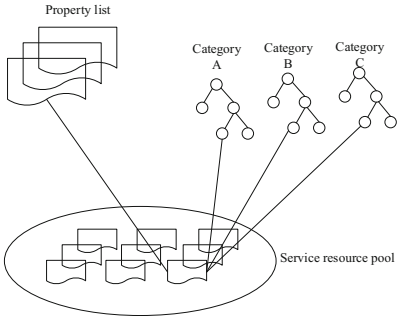

Fig. 1. Framework resource description

of the classification tree node. *TN* represents the set of sub classification trees of the classification tree, *ST* representing the classification leaf node, $|ST| = \varnothing$.

2.3 Classification of Teaching Resources

Most of the original features have little effect on the classification results [12]. The purpose of feature selection is to select the feature with the strongest distinguishing ability from these massive original feature items, so as to achieve the purpose of dimensionality reduction of high-dimensional feature vector space, reduce the amount of calculation in the subsequent classification process, and avoid "dimension disaster". Firstly, the document frequency in teaching resources is determined. The document frequency refers to the proportion of the documents with a certain feature item in the total number of documents in the corpus. The calculation formula is as follows:

$$DF(T_i) = \frac{\text{Number of documents with feature items}}{\text{Total number of documents}} \tag{2}$$

Firstly, a threshold value is set M and the document frequency value DF of all feature items is calculated. If the feature T_i of the item is removed $DF(T_i) > M$, the feature of the item T_i is retained. At the same time, $DF(T_i) < M$, to determine the statistical characteristics, this paper uses the method of mutual information [13] to extract statistical features, and calculates the statistical correlation between feature items and text categories to measure the degree of correlation. The calculation formula is as follows:

$$MI\left(T_i, C_j\right) = P\left(C_j\right) \sum\nolimits_{i=1}^{n} \log \frac{P\left(T_i \middle| C_j\right)}{P(T_i)} \tag{3}$$

In (3), $MI\left(T_i, C_j\right)$ represents the mutual information between the feature and the text, n represents the probability of the category for the text with one category in the corpus, $P\left(C_j\right)$ represents the frequency of the document with the feature item in the category, and $P\left(T_i \middle| C_j\right)$ represents the frequency of the document containing the feature item T_i. The larger the value MI, the greater the correlation between the feature and the category, the stronger the distinguishing ability of the feature item. At the same time, the feature gain

of machine learning is determined, and the text importance of features can be determined by calculating the information content of feature items. The feature item contains more information, and the more important the feature item is [14]; the less information it contains, the less important the feature item is. The amount of information contained in a feature is calculated by subtracting the information difference of the corpus without the feature from the information contained in the whole corpus. The amount of information here is expressed in terms of entropy, and its calculation formula is as follows:

$$IG(T_i) = -\sum_{j=1}^{m} P(C_j)\log_2 P(C_j) + P(T)\sum_{j=1}^{m} P(C_j|T_i)\log_2 P(C_j|T_i) + P(\overline{T}_i)\sum_{j=1}^{m} P(C_j|\overline{T}_i)\log_2 P(C_j|\overline{T}_i) \quad (4)$$

In formula (4), $P(C_j)$ represents the probability of similar texts in teaching resources in corpus. $P(T_i)$ represents the text probability of the feature item, $P(C_j|T_i)$ represents the text probability with the feature item in the class, and $P(\overline{T}_i)$ represents the text probability without the feature item. Then $P(C_j|\overline{T}_i)$ represents the text probability that does not contain feature items and does not belong to. Using the above operations, the characteristics of teaching resources are confirmed and classified according to the characteristics.

2.4 Resource Matching and Integration Technology

The integration of digital resources is not only to gather digital resources together, but also to describe, organize, process, sort, search, service and other aspects of information, which need to be supported by certain technologies [15]. At present, there are several digital resource integration technologies that attract people's attention. Using DOI technology, the unique identification code is established in the data. Its function is to assign permanent displacement identification code to digital objects. DOI provides users with permanent access to digital resources by parsing DOI. When users click DOI to ask for information, their requests are sent to the central server. The server parses DOI into URL and returns it to the end user, which enables users to access the resources. Cross ref is used to develop the reference link, and through this link, users can retrieve the metadata database and address database of crossref in different teaching resources, so as to obtain the corresponding DOI, URL and metadata. At the same time, SFX technology is added to it, which is actually a context sensitive reference link based on the open unified resource locator standard. This technology is actually a third-party service component between the link service provider and the information resources providing the link source. After receiving an OpenURL, the component obtains the metadata through parsing, and obtains the metadata through the identifier provided by the OpenURL to the relevant server, and then through the metadata, SFX can transfer the metadata to the relevant server Thus, there is no barrier between heterogeneous information sources and heterogeneous communication protocols. The overall integration process is as follows (Fig. 2):

Add the resource integration mode in the framework above, add the method of resource classification into the retrieval portal, and establish the database metadata. And

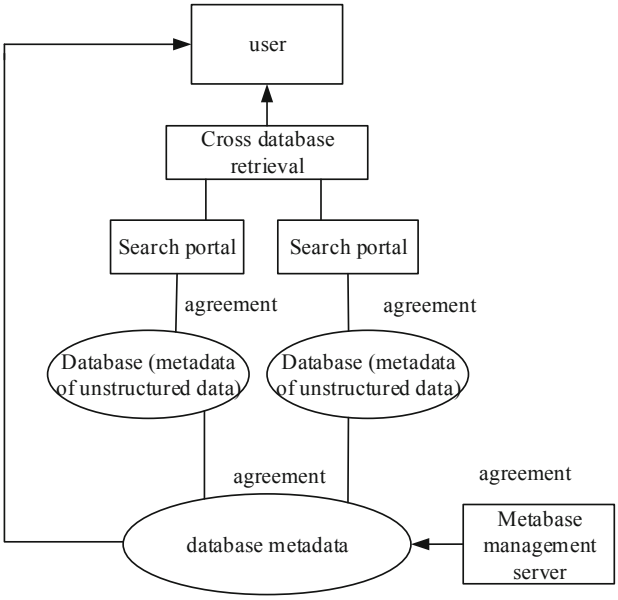

Fig. 2. Digital resource integration process

add Web services technology as a whole, and combine the advantages of distributed object technology and web technology, adopt service-oriented architecture. At the same time, through the HTTP protocol and XML data format to communicate, overcome the resources and services disordered, heterogeneous and encapsulation problems. At the same time, the XML data format is used to describe digital resources between different languages in this method. The soap protocol is used to make Wed Service eliminate the association with other heterogeneous platforms. The WSDL protocol is used to provide a unified access interface. Finally, UDDI is used for unified description, discovery and integration, so as to realize the release and sharing of digital resources, and realize the integration of resources and services. It has good applicability and flexibility. At the same time, in order to expand the data of distributed computing technology, and as a node to connect with the teaching resources users' equipment, and form a logical peer node, so that the network node has a high stability and reliability, and has the functions of client and server to complete the task cooperatively. Through direct interconnection, digital information resources can be fully shared and people can interact directly through the Internet, which makes network communication easier and resource sharing more direct. After calculation, and through various kinds of computer technology, to achieve the optimization and integration of teaching resources.

3 Experimental Demonstration and Analysis

In order to verify the effectiveness of the proposed method. In this experiment, the teaching resources of Ideological and political course in a university are used as the resource information of the experiment integration.

3.1 Experimental Environment

The experimental test environment includes one primary server and ten secondary servers, and two load generators are connected to generate the request load. The network connection structure of the server is as follows (Fig. 3):

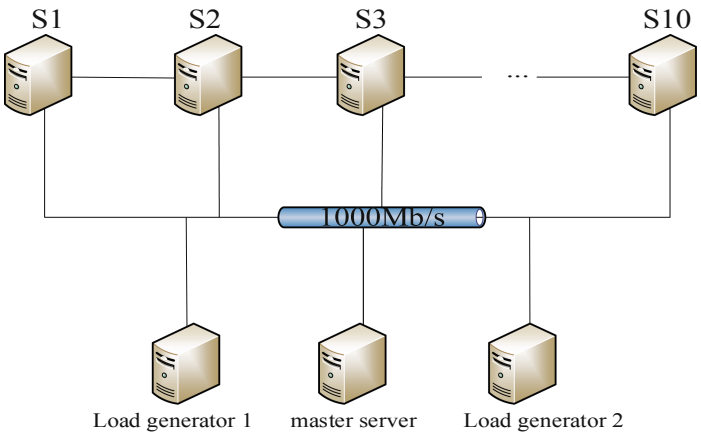

Fig. 3. Experimental server configuration

The configuration of the server is as follows (Table 1):

Table 1. Experimental server configuration

The server	Hardware configuration	Operating system	Software configuration
Load generator 1	Intel quad core 2.83 GHz, 4 GB memory, 1 GB/S	WinXP SP3	LoadRumner
Load generator 2	Intel quad core 2.83 GHz, 4 GB memory, 1 GB/S	WinXP SP3	LoadRummer
Master server	Intel quad core 2.83 GHz, 4 GB memory, 1 GB/S	Win2003 Server	Jvm1.6Master
Secondary server	Intel quad core 2.83 GHz, 4 GB memory, 1 GB/S	CentOS 5.3	JVM1.6NodeAgent

3.2 Experimental Methods

In this paper, the following experiments are carried out to verify the idle server merging and the bottleneck server splitting. Firstly, five application clusters are deployed in the system. They all have one load distributor and one web application server instance. The five application server instances are evenly distributed among the five servers. There

are 1 master server and 10 slave servers, of which 5 application server instances are deployed on 5 different slave servers. In this paper, the experimental application is CPU intensive, each visit will do 100000 floating-point operations, the weight of CPU and memory is 9:1. Due to the limited network transmission data and diskless read/write operations, the resource consumption of network read/write and disk read/write is not considered. Then turn on the global adjustment operation switch to allow the platform to integrate resources. At this time, since the application has not been loaded, the resource utilization of each application is negligible. In this paper, the methods in literature [1], literature [2] and literature [4] are used and compared with the design method in this paper.

3.3 Experimental Results

Through the five application server instances, the platform will merge them into one secondary server. After the generation merging, each application will add the corresponding load, as shown in Fig. 4.

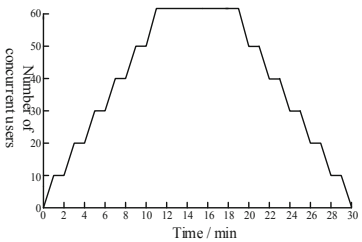

Fig. 4. Load curve of experimental application

With the gradient increase of each application load, the server load increases, and the resource usage of each application server instance increases, resulting in the bottleneck state of the only host server at present. At this time, the server splitting operation will be triggered, which will cause the platform to gradually split some cluster nodes into other servers, increasing the number of working servers. In this paper, under the condition of big data, the similar optimization effect is calculated. Four methods are used to integrate the experimental teaching resource data of Ideological and political courses in Colleges and universities. The operation efficiency in the integration process is shown in Fig. 5.

In Fig. 4, method 1 is the teaching resource integration method designed in this paper, method 2 is the teaching resource integration method in literature [1], method 3 is the teaching resource integration method in literature [2], and method 4 is the teaching resource integration method in literature [4]. In Fig. 4, it can be found that in the 200MB teaching resources integration, the running time is relatively small, but with the increase of the scale of resources, the running time has a big difference, while the first method has a shorter running time compared with other methods.In this paper, the operational constraints in actual use are simulated. And different numbers of constraints were added to the operation, and the result shown in Fig. 6 was obtained.

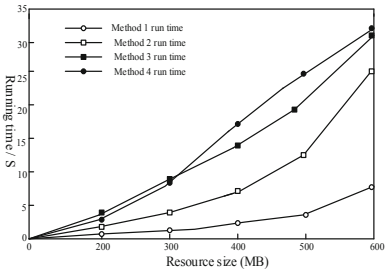

Fig. 5. Resource integration operation efficiency

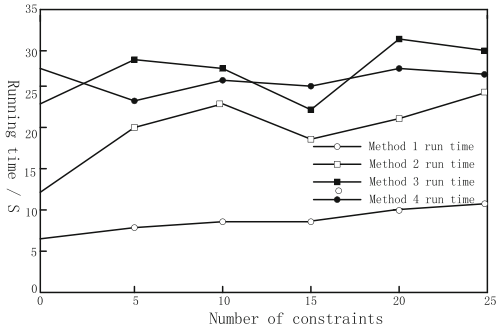

Fig. 6. Operation time under different requirements and constraints

In Fig. 6, it is found that the optimization and integration method of teaching resources designed in this paper is less affected under different constraints, while other methods are obviously affected, and the operation time changes under different constraints. Under the same number of constraints, the transportation speed of the teaching resources operation method designed in this paper is faster, which proves the feasibility of the teaching resources operation method.

4 Conclusion

In this paper, the big data model is used to establish the optimization model of teaching resources. At the same time, through the optimization of the framework, the operation efficiency of the integration method is higher. However, in this paper, due to the use of big data model to build the integration model, so the integration needs to be connected to the network, and through multiple servers, so there are still limitations.

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