A Blockchain Based Real-Time Sharing Method for Ideological and Political Mobile Education Resources

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Abstract. In order to improve the efficiency and effectiveness of real-time sharing of mobile education resources, this article proposes a blockchain based method for real-time sharing of ideological and political mobile education resources. Firstly, build a blockchain network for sharing ideological and political mobile education resources; Secondly, extract the features of video resource data, audio resource data, and text resource data from ideological and political mobile education resources, and fuse the resource features based on Tucker decomposition data fusion algorithm; Train the features based on the fuzzy neural network model again; Finally, resource sharing is achieved based on blockchain technology. Through experimental results, it has been proven that the proposed method has a resource request processing time of 5.20 s when the data volume is 200 GB, and can achieve 98% sharing of the total data volume. The sharing efficiency is high, the sharing effect is good, and it has good practical application performance. However, current blockchain technology still has some limitations when dealing with large-scale data and high concurrency access. Future research can explore how to improve the scalability and performance of blockchain systems to meet the needs of more users.

Keywords: Blockchain · Ideological And Political · Mobile Education · Resource Sharing · Resource Characteristics

1 Introduction

With the rapid development of mobile Internet technology, mobile phones, tablets and other mobile devices have become an important tool for people to learn. Especially under the support of cloud computing, artificial intelligence and other technologies, the online, intelligent, personalized and scenario-based mobile education resources show more and more advantages, which also provides good conditions for universities to build mobile teaching ecology [1]. With the continuous advancement of education reform in colleges and universities, more and more colleges and universities begin to build localized, open and shared independent intellectual property teaching resource libraries. The development, integration and sharing of these resources have become the necessary means for

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colleges and universities to realize digital transformation and improve teaching effect [2]. The content of ideological and political courses includes political system, ideological and moral, laws and regulations, national security, world politics and other aspects. It has a strong crossover nature with other disciplines, involving philosophy, history, culture, economy and other fields. Therefore, in addition to pure knowledge, ideological and political courses emphasize the cultivation of students' political accomplishment, thinking ability, moral emotion and other aspects. The ideological and political curriculum has a very far-reaching influence on the national, cultural and ideological aspects. Therefore, actively promoting online education of ideological and political education can help improve the quality of ideological and political education, strengthen students' self-learning ability, and promote educational fairness and efficiency. Mobile education resource sharing can not only break geographical and time constraints, improve the efficiency and accuracy of educational resource utilization, but also meet the actual needs of personalized teaching, promoting the improvement of the quality and innovation level of university curriculum teaching [3]. Mobile education resource sharing can make educational resources more equitable, reduce the gap in educational resources between regions and schools, and promote educational equity. Through mobile education resource sharing, schools can access validated mobile education resources and teaching methods from other schools, which can not only improve teachers' teaching level but also improve students' learning outcomes. Fully utilize existing educational resources, avoid resource waste and duplicate construction, reduce educational investment costs, and improve resource utilization efficiency. Sharing educational resources can promote the exchange of information and knowledge among schools, and help schools improve their level of educational informatization and modernization [4].

At present, many scholars have carried out relevant research on the method of mobile educational resource sharing. Some researchers have designed a resource sharing model based on MB+ tree test method. The resource collection subsystem uses crawler technology to retrieve related resources and store them in the resource library. The MB+ tree test method is adopted to complete the test of shared resources, extract the correlation feature quantity of relevant resource sharing big data, obtain the cluster center of multi-module collaborative data mining, and adopt the method of regional networking design to obtain the resource sharing model and complete the resource sharing [5]. Although this method can effectively improve the resource utilization rate, with high resource integrity, and meet the purpose of mobile education resource sharing, in the actual process of mobile education resource sharing, when resource demanders initiate resource requests, they are prone to be affected by the surrounding environment, which increases the request processing time and the sharing process time, and affects the effect of real-time resource sharing. Some researchers put forward the sharing method of database resources based on alliance chain. Build a collaborative and shared mode for thematic database resources based on alliance chain technology, design the overall architecture of the mode, and conduct research according to the data layer, alliance chain system, and application layer of the architecture. Using practical Byzantine fault-tolerant consensus algorithm and three smart contracts for identity authentication, resource sharing, and copyright protection, effectively achieve the storage and sharing of thematic database resources [6]. Although the practical application performance of this method is good and can effectively share

resources, as the number of uploaded resources continues to increase, the number of resources that this method can share begins to decrease, weakening a certain degree of resource sharing ability.

Blockchain technology can ensure the security, fairness, and transparency of data in data sharing, while improving the efficiency of data sharing. This article proposes a blockchain based real-time sharing method for ideological and political mobile education resources to address issues such as poor resource sharing capabilities and long resource request processing time in traditional methods. In order to improve the efficiency of resource sharing and improve the application performance of resource sharing through blockchain technology.

2 Blockchain Technology

Blockchain is a distributed database with basic features such as decentralization, tamper resistance, and high trust. Blockchain is a network composed of encryption technology and distributed nodes, which completes data exchange and value transfer without the need for centralized institutions [7]. Specifically, a blockchain is composed of blocks, each containing transaction data and hash values, which are encrypted and verified before being recorded on the blockchain and cannot be tampered with. Blockchain adopts a consensus mechanism to maintain the security and integrity of data, which means that it requires collaborative verification from multiple nodes to complete the confirmation and recording of a transaction, effectively avoiding the risk of hacker attacks and data tampering [8].

Blockchain technology can provide a secure, decentralized, traceable, and highly transparent solution when it comes to data sharing. Because every data point recorded by blockchain is immutable and can be updated in real time among all parties involved, blockchain can ensure data integrity, consistency and traceability, as well as data privacy protection [9].

The application of blockchain technology can make the sharing of data more efficient and secure. Using blockchain to share data can eliminate middlemen while also encouraging sharing through enhanced security. In this case, data is ultimately stored in a distributed network, rather than restricted to a specific business application or an organization's application, where sharing and collaboration is performed among all parties involved. In a blockchain-based data-sharing network, only certain parts of the data can be disclosed to certain parties; In this case, security permissions and permissions will be assigned to ensure that unauthorized access will never be authorized in order to maintain data privacy and security [10].

Therefore, applying blockchain technology to educational resource sharing can greatly improve the credibility and security of educational resource data by utilizing its immutability and decentralization characteristics, effectively ensuring the privacy and security of educational resource data. Assist in the decentralization of educational resources, promote information sharing and exchange among the education industry, government agencies, and academia, thereby improving the efficiency and value of the entire industry.

3 Design of Real-Time Sharing Method of Mobile Education Resources

3.1 Construction of Ideological and Political Mobile Education Resource Sharing Blockchain Network

In the process of sharing ideological and political mobile education resources, the primary goal is to achieve secure sharing of mobile education resources, ensuring to the greatest extent that the shared ideological and political mobile education resource data will not be tampered with. Therefore, in the process of data sharing, it is necessary to rely on a complete ideological and political mobile education resource sharing blockchain network. Utilize the characteristics of blockchain technology to obtain decentralized data and uniformly name the data. The essence of blockchain is a decentralized and distributed storage database, which can trace the source during the traceability process. Reasonable deployment of blockchain in the ideological and political mobile education resource sharing network, and the use of asymmetric encryption methods for encryption measures when using blockchain technology for decentralized storage, can improve the application performance of the ideological and political mobile education resource sharing blockchain network.

Blockchain technology can determine the time stamp of the shared resource data of ideological and political mobile education through the identification of resource data, sort the resource data according to the time stamp, and generate the pointing sequence of blockchain technology according to the sorting result, providing an effective verification process for the data sharing of ideological and political mobile education resources. To ensure the security of data sharing process of ideological and political mobile education resources.

Figure 1 shows the basic architecture of ideological and political mobile education resource data sharing based on blockchain technology.

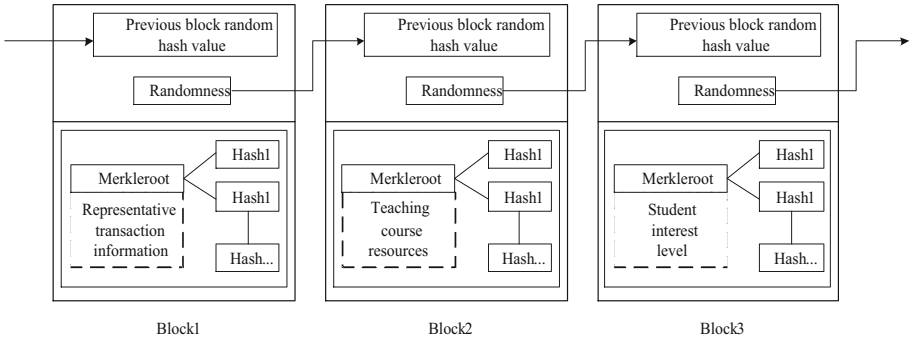

Fig. 1. Basic structure of data sharing of ideological and political mobile education resources

Observing Fig. 1, it can be seen that the basic architecture for resource data sharing built through blockchain technology can provide a secure sharing environment for resource data. In the basic architecture of ideological and political mobile education

resource data sharing, additional resource data naming services, resource data authorization storage technology, and resource data distribution technology can be added to achieve equal information exchange behavior between the ideological and political mobile education resource data sharing end and the receiving end. The blockchain network architecture for ideological and political mobile education resource sharing is shown in Fig. 2.

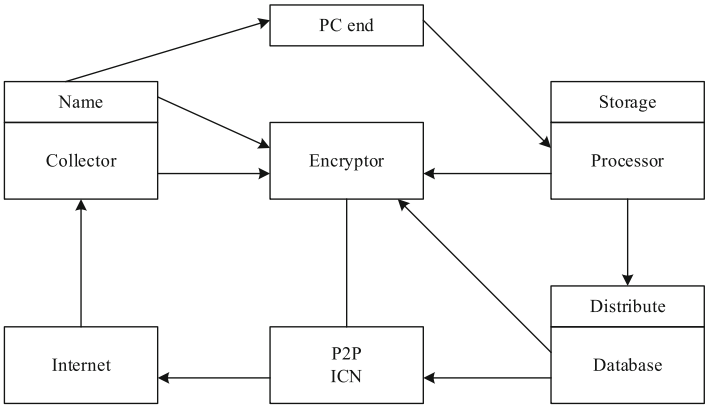

Fig. 2. Blockchain network architecture of ideological and political mobile education resource sharing

As can be seen from Fig. 2, the unified naming service of resource data is proposed on the basis of the resource sharing information model. This naming mechanism is centralized, open and independent. The purpose of this service is to process the naming of attributes that need to share resource data and reduce the calculation amount of resource data sharing. The implementation of the resource data authorization storage technology is based on the blockchain technology, which is mainly used to encrypt and store the data of ideological and political mobile education resources, so as to prevent the security of the data from being threatened due to the loopholes of the sharing network in the process of data sharing. The resource data distribution protocol is the restriction protocol of the ideological and political mobile education resource data peer-to-peer interaction network. This protocol simplifies the resource data sharing network into a point-to-point transmission network. Through data addressing and naming identification analysis, the security of ideological and political mobile education resource data sharing can be protected.

3.2 Feature Extraction of Ideological and Political Mobile Education Resources

In the ideological and political mobile education resources, the main collected resource data is video, audio, and text data. Therefore, this article extracts the features of video, audio, and text data from the collected multi-source data to obtain multi-source data features, making the fusion of multiple types of data more rapid and effective, and

improving the efficiency of resource sharing. The specific feature extraction process is as follows:

(1) Video resource data: Using the FACET facial expression analysis framework, extract video features of ideological and political mobile education resources to form a video feature set;
(2) Audio resource data: In this paper, COVAREP acoustic analysis framework is used to extract audio features from ideological and political mobile education resources to form audio feature sets;
(3) Text resource data: Firstly, the spoken words in ideological and political mobile education resources are preprocessed through global word vector, and the spoken words are coded; Then, we use the short-short memory network to learn the spoken text with time correlation. Finally, the text after continuous learning is input into the neural network for convolution, and the convolution layer is used to extract finer grained text features. The feature extraction process of text resource data is shown in Fig. 3.

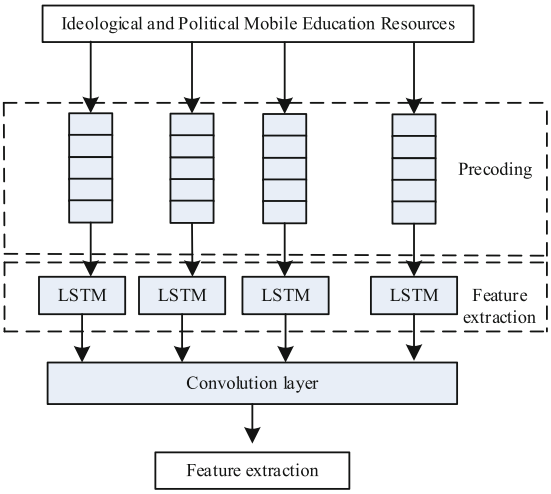

Fig. 3. Feature extraction process of text data for ideological and political mobile education resources

3.3 Feature Integration of Ideological and Political Mobile Education Resources

After completing the feature extraction of ideological and political mobile education resources, in order to improve the accuracy of resource sharing, Tucker decomposition algorithm is used. After feature fusion, the ideological and political mobile education resources are integrated together, so that the teaching resource features of different formats of ideological and political mobile education resources can be uniformly processed.

Set $z_v = \left(z_v^1, z_v^2, z_v^p\right)$ as the video data feature of the extracted ideological and political mobile education resources, $z_a = \left(z_a^1, z_a^2, z_a^q\right)$ as the audio data feature of the ideological and political mobile education resources, and $z_t = \left(z_t^1, z_t^2, z_t^m\right)$ as the text data feature of the ideological and political mobile education resources. Through the data fusion algorithm based on Tucker decomposition, three kinds of feature data sets are fused and the feature set Z after fusion is output. In the process of multi-source data fusion of ideological and political mobile education resources, a high-order tensor W is introduced, and the tensor W exists in the data feature space. Through the mode of the tensor W, the spatial mapping of data features of each ideological and political mobile education resources is realized. Therefore, by using the high-order tensor W, the characteristic modes of the data of ideological and political mobile education resources can be effectively corrected and the modal characteristics of the data of ideological and political mobile education resources can be memorized. The multi-source data fusion process of ideological and political mobile education resources is shown in Fig. 4.

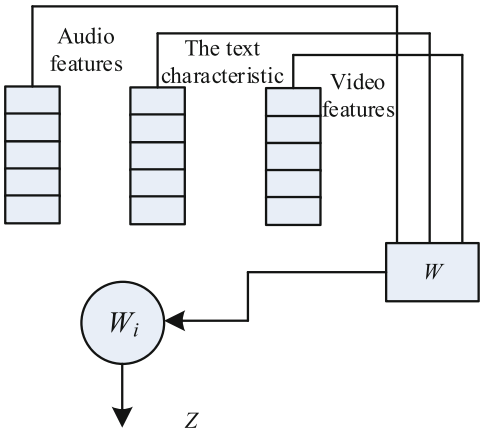

Fig. 4. Multi-source data fusion process

From Fig. 3, it can be seen that when the characteristics of the ideological and political mobile education resource data to be processed are z_a, z_t, and z_v in sequence, the higher-order tensor W is in a third-order form, that is, the three dimensions of tensor W correspond to the feature space of the teaching resource data features z_a, z_t, and z_v. At this time, by multiplying the teaching resource data features and corresponding feature spaces, the memory unit $\hat{W}$ of the current teaching resource data features can be obtained, Starting from this, fusion processing is carried out, and feature fusion is mainly achieved in three steps:

(1) Make modular multiplication of memory unit $\hat{W}$ and audio data feature z_a according to the first-order state to obtain a new memory unit $\hat{W}_1$ with feature z_a.
(2) Make modulo multiplication of memory unit $\hat{W}_1$ and video data feature z_v according to the second-order state to obtain a new memory unit $\hat{W}_2$ with features z_a and z_v.
(3) Perform modular multiplication of memory unit $\hat{W}_2$ and text data feature z_t according to the third order state to obtain the fusion tensor Z with three features, and represent the above steps through formula (1):

$$Z = ((W \times z_a) \times z_v) \times z_t \tag{1}$$

Through the operations of the above steps, data fusion of different types of teaching resources is realized, and the feature set Z after fusion is output.

3.4 Feature Training

In order to meet the demand for resource sharing and improve the sharing ability of data, a model based on fuzzy neural network is constructed by combining fuzzy theory with neural network according to feature categories. The network model consists of input layer, fuzzification layer, fuzzy rule layer, and output layer. In the fuzzy neural network model, the dataset of ideological and political mobile education resources is used as input samples. After processing at each layer, it is compared with the expected values, and the weights of each layer are adjusted. After continuous correction, the error of each training is minimized. This operation is repeated until all ideological and political mobile education resource features are trained, and the best dataset after training is obtained.

The number of input layers is determined by the number of parameters in the feature set Z, and then Z uses the fuzzy layer to obtain the membership function and fuzzy it. At the same time, the feature training is carried out in the fuzzy rule layer, so that the nodes with the same result are structured into a fuzzy quantity. The sum operation is adopted in the output layer to achieve the target fuzzy and output the result after decision level fusion. The training process is achieved through the following steps:

Suppose the first layer of the model's fuzzy input of ideological and political mobile education resources z_i in the following form:

$$z_i = [z_1, z_2, ..., z_n]^T \tag{2}$$

In the formula, n is a natural integer; T is the number of iterations.

In the first layer of the model, the fuzzy input is dimensionally reduced to generate the first layer network output. The specific output calculation is as follows:

$$I_i = z_i(i), i = 1, 2, ..., n \tag{3}$$

Where, I_i represents the data set of ideological and political mobile education resources after dimension reduction operation.

The processed I_i is transferred to the second layer of the model, where the fuzzy set of input feature quantity is analyzed, and the Gaussian function is adopted as the membership function. The specific output calculation is shown as follows:

$$\mu = \exp\left|\frac{-(z_i - c_{ij})^2}{2\sigma_{ij}^2}\right| \tag{4}$$

where, μ represents the fuzzy set of input characteristics; Among them, c_{ij} is the core of the Gaussian membership function of I_i; σ_{ij} is the width of the function.

Through the second layer of fuzzy processing, the fuzzy dataset h_i is output:

$$h_i = f\left(\sum_i^n W_{zy} \times I_i + \beta_i\right) \tag{5}$$

where, W_{zy} is the fuzzy weight coefficient; β_i represents fuzzy threshold; f is the weight coefficient of objective function.

In the third layer of the network model, fuzzy rules are designed, and each rule is described by nodes. In the output process of this layer, all fuzzy nodes are Defuzzification by summation, and fuzzy rule f_j is represented by formula (6):

$$f_j = \min\left(z_{1j}, z_{2j}, ..., z_{nj}, 1\right), z_{1j} = \alpha_1, \alpha_2, ..., \alpha_n \tag{6}$$

In the formula, z_{nj} represents the fuzzy feature set; α_n represents the applicability of fuzzy rules, and outputs the results of deblurring operations at this layer to obtain the optimal dataset after training, as shown in formula (7):

$$y_j = F\left(\sum_i^n W_{ij} \times g_i + \beta_j\right) \tag{7}$$

In the formula, y_j represents the best dataset after training; F represents the local weight of fuzzy rules; β_j represents the speed of deblurring; g_i represents the fuzzy median.

3.5 Real Time Sharing of Blockchain

After completing the feature training of ideological and political mobile education resources, the best data set was obtained. Based on this data set, real-time sharing of ideological and political mobile education resources is completed according to the resource sharing request issued by users.

Reg, short for registry regedit, is a registry script file. It is a command that adds, changes, imports, exports, and performs other operations on registry subkey information and registry key values. For a specific resource request Reg, the resource requester R will the request information as a transaction, stored in the blockchain system. The resource request record contains the ID of R, the request description, and the corresponding time stamp. The resource request description information includes R's description of the type of resources, data format, and size that need to be obtained for ideological and political mobile education resources. The purpose of this request transaction information is for resource retrieval to achieve real-time resource sharing. Specifically, based on the resource request information, a similarity matching algorithm is used to retrieve the data summary information of each node on the blockchain. The feature of the request information is matched with different types of teaching resource data to reduce request processing time and forward the request to meet the resource needs of the requester, achieving effective resource sharing. The specific sharing steps are as follows:

(1) Resource requester R publishes the sharing request Reg for ideological and political mobile education resources on the blockchain;

(2) Based on the resource request information, the blockchain system matches the data summary information of all nodes on the chain to query the resource characteristics related to the requested resource;
(3) Reg the resource sharing request to the queue of each resource provider;
(4) Each data provider iterates in response to the corresponding resource sharing request;
(5) The resource update record is used as the shared transaction information to generate the block, which is verified by the block broadcast network and reaches a consensus to upload the block to the chain;
(6) According to the consensus mechanism, the specific node is responsible for uploading the model file to the server for encrypted storage;
(7) Data requester R downloads the encrypted resource file, obtains the shared ideological and political mobile education resources after decryption, and the resource sharing task is finished.

4 Experimental Analysis

4.1 Experimental Setup

To verify the sharing ability of the method in practical application, this article selects the ideological and political mobile education resources of a local university as test data, and shares the teaching resources of ideological and political courses on the online education platform of the university to verify the resource sharing ability of the method in this article. Select the resource sharing method based on MB+tree test proposed in reference [5] as control group 1, and the resource sharing method based on alliance chain proposed in reference [6] as control group 2, and conduct experimental testing together with the method proposed in this article.

A large number of data of ideological and political course teaching resources are randomly selected and input into the self-built database. The data in the database is checked, and the invalid data less than 30 s in video resources and voice resources and less than 20 KB in text resources are eliminated. Finally, a total of 200 GB of ideological and political mobile education resources are retained in the database. The data sets of specific audio resources, video resources and text resources are shown in Table 1.

Table 1. Test data set

The data type	Data quantity/piece
Teaching video resource dataset	234220
Teaching Voice Resource Dataset	762342
Teaching Text Resource Dataset	324000
Teaching courseware dataset	354320
Course Dataset	213450
Course Extension Content Dataset	23500

On board inter@core In the Windows 10 system with i7 processor, this article runs the self built database using Matlab2019a simulation software, and uses three different methods to share and test the ideological and political mobile education resources in the database.

Taking the processing time of resource requests and the amount of shared data as the testing indicators for this experiment, the lower the processing time of resource requests, the higher the amount of shared data, the better the real-time sharing effect, and the higher the sharing efficiency. This proves that the application performance of the sharing method is better.

4.2 Resource Request Processing Time

When resource demanders initiate resource requests, the processing time of resource requests for ideological and political course teaching resources under different resource sharing methods is calculated, and the results are shown in Fig. 5.

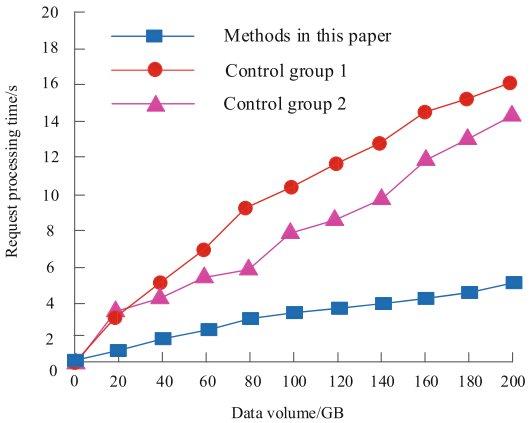

Fig. 5. Comparison of resource request processing time of ideological and political curriculum mobile education resources

Analyzing Fig. 5, it can be seen that the processing time of resource requests for mobile education resources in ideological and political courses will increase with the increase of data volume. The resource sharing method based on MB+tree test method from control group 1, when the data volume of mobile education resources in ideological and political courses is 100 GB, the processing time of resource requests is 10.25 s, and when the data volume is 200 GB, the processing time of resource requests is 16.33 s; The resource sharing method based on alliance chain from control group 2, when the data volume of mobile education resources in ideological and political courses is 100 GB, the processing time of resource requests is 8.02 s, and when the data volume is 200 GB, the processing time of resource requests is 14.25 s; The resource sharing method proposed in this article takes 3.22 s to process resource requests when the data volume of mobile education resources in ideological and political courses is 100 GB, and 5.20 s when the

data volume is 200 GB, which is much lower than the two comparison methods and can always maintain within 6 s. This indicates that the blockchain based real-time resource sharing method proposed in this article has high sharing efficiency. This is because the sharing method designed in this paper adopts the similarity matching algorithm to retrieve the data summary information of each node on the blockchain according to the resource request information, and matches the characteristics of the requested information with the data characteristics of different types of teaching resources, which can reduce the request processing time to a certain extent and improve the efficiency of resource request processing. It can meet the requirements of real-time resource sharing.

4.3 Data Quantity of Shared Resources

When the number of uploaded mobile education resources for ideological and political courses continues to increase, the resource sharing ability of different methods is evaluated based on the resource sharing ability of different methods. The comparison results are shown in Table 2.

Table 2. Comparison of Shared Data Volume by Different Methods

Number of experiments/times	Amount of uploaded resource data/GB	Shared data volume/GB		
		Method in this paper	Control group 1	Control group 2
1	20	100.00	96.35	97.25
2	40	200.00	195.63	196.44
3	60	300.00	291.42	285.83
4	80	400.00	394.42	388.55
5	100	498.82	49.742	491.62
6	120	594.23	577.46	585.73
7	140	686.82	654.13	652.71
8	160	781.63	736.14	716.14
9	180	876.64	825.34	817.36
10	200	976.53	903.42	886.45

According to Table 2, under different experiment times, with the increasing amount of uploaded mobile education resources of ideological and political courses, the amount of shareable resources of different methods also decreases to a certain extent. Among them, when the amount of uploaded resources is less than 80 GB, effective and comprehensive sharing can be achieved by applying the proposed method. At this time, the amount of shareable data of the resource sharing method based on MB+tree test from control group 1 is 394.42 GB, and that of the resource sharing method based on alliance chain from control group 2 is 388.55 GB. Are significantly lower than the method in this paper. When the amount of uploaded resource data reaches 200 GB, the three literature

methods compared have a significant decrease in the amount of shared data. Although the amount of shared data in this method has also shown a downward trend, the amount of shared data can still reach 976.53 GB, which can achieve 98% sharing of the total data. This indicates that this method has the ability to share a large amount of data and has a good sharing effect. This is because the method proposed in this article combines fuzzy theory with neural networks to construct a model based on fuzzy neural networks. Through feature training, the error of each training is minimized to obtain the optimal dataset after training, meeting the requirements of resource sharing and improving the ability to share data.

5 Conclusion

In view of the shortcomings of current resource sharing methods in the process of real-time sharing, this paper proposes a real-time sharing method of ideological and political mobile education resources based on blockchain.

(1) The ideological and political mobile education resource sharing blockchain network is constructed, the features of video resource data, audio resource data and text resource data in ideological and political mobile education resources are extracted, and the resource features are fused based on the data fusion algorithm of Tucker decomposition; Feature training is conducted based on fuzzy neural network model, and real-time sharing of ideological and political mobile education resources is completed based on blockchain technology.
(2) The experimental results show that when the data volume is 200 GB, the processing time of resource request is 5.20 s, and the method proposed in this paper can realize the sharing of 98% of the total data volume, with high sharing efficiency, good sharing effect and good practical application performance.

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