

## Research Article

# A Secure Cloud Storage Algorithm for University Financial Data Based on the Blockchain Technology

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In order to increase the secure storage capacity of university financial system process operation data under the blockchain environment, a secure cloud storage algorithm of university financial data based on the blockchain technology is proposed. The blockchain storage structure model of university financial system process operation data is first constructed, and then the mapping method of Atlas features is adopted. Finally, the blockchain equilibrium configuration parameter analysis model of university financial system process operation data is established. According to the outcomes of the feature extraction process of cloud resource storage Atlas of university financial system process operation data, the fuzzy clustering method is implemented to comprehend the rational planning of cloud storage space. The resource cloud storage structure configuration of university financial system process operation data in cloud environment is realized by using the method of block link fusion and channel equilibrium configuration. The multi-layer modal structure decomposition and fuzzy clustering processing are carried out on university financial system process operation data storage information in blockchain environment by using the empirical mode decomposition method. According to the data graph clustering results, the cloud resource graph of university financial system process operation data becomes smooth in the adjacent wave domain through cloud information fusion and block clustering, which effectively reduces the data storage overhead and improves the secure cloud storage capability of university financial data. The simulation outcomes indicate that this approach can significantly increase the storage performance of process operation data of university financial system under blockchain environment, with better data classification storage, internal structure information fusion performance of university financial data, and lower storage overhead than other methods. We observed that this improvement, in terms of storage overhead costs, can be as high as 43.67% higher than the wavelet method and 30.45% higher than the mode decomposition approach.

## 1. Introduction

With the uninterrupted upgrading of information management of university financial system, higher necessities are put forward for the security of university financial system process operation data. Combined with the process control of university financial system process operation data, the secure cloud storage design improves the secure cloud storage capability of university financial system process operation data. The secure storage design of university financial system process operation data is based on the encryption design of process operation data information,

combined with the information encryption of university financial system process operation data, and carries out information perception and coding storage of university financial system process operation data under blockchain environment [1].

In the cloud storage environment, a large number of university financial system process operation data in blockchain environment need to be stored and scheduled by cloud storage, which provides users with large-scale integrated information storage space [2]. The cloud storage of university financial system process operation data in blockchain environment can be divided into public cloud,

private cloud, and hybrid cloud. The reasonable planning of university financial system process operation data cloud storage space in blockchain environment can improve the ability of data receiving and dispatching and integrated scheduling of university financial system process operation data in blockchain environment [3]. In the cloud storage system of university financial system process operation data under blockchain environment, it is necessary to extract the Atlas features of university financial system process operation data under blockchain environment. These Atlas features include high-order spectrum, time spectrum, wavelet information spectrum, LORFA spectrum, etc. The Atlas features of university financial system process operation data under blockchain environment can effectively reflect the data storage structure and internal characteristic performance in cloud storage. Combined with the method of spectrum feature extraction, cloud storage control of university financial system process operation data under blockchain environment can be realized [4].

The high-order spectral characteristic features of university financial system process operation data in blockchain environment can effectively reflect the internal inherent modal characteristics of the data and extract the high-order spectral characteristic feature map information of university financial system process operation data in blockchain environment, which can, in fact, diminish the storage cost of data cloud resources. Traditionally, the Atlas design and feature extraction methods of university financial system process operation data in blockchain environment mainly include Atlas feature extraction method based on time-frequency analysis, Atlas design method based on time scale coupling blockchain environment, and Atlas extraction method based on instantaneous frequency Hilbert transform blockchain environment. The above method decomposes the process operation data of university financial system in blockchain environment into a limited number of inherent modal functions, and through time-frequency transformation and nonlinear time series analysis, it realizes the extraction of Atlas features of university financial system process operation data in blockchain environment. The extracted Atlas features can effectively reflect the nonlinear feature information of sensing data, thus guiding the optimization of cloud storage structure of university financial system process operation data in blockchain environment. However, the above method will generate data redundancy under the influence of external uncertain interference vectors, resulting in excessive storage overhead and poor convergence.

In this regard, the related literature has improved the algorithm design, among which, in reference [5], a method of extracting the frequency spectrum features of university financial system process operation data based on vertical hierarchical bloom filtering is proposed. Redundant data are deleted according to the uniqueness of matrix singular value decomposition vector, which reduces the storage cost of university financial system process operation data in blockchain environment and improves the storage performance. However, this method has a large amount of calculation, and it is a cloud resource of university

financial system process operation data in large-scale integrated blockchain environment. In reference [6], a map detection method based on the accurate location and ranging of the nodes that are present within the cloud storage structure of the financial system flow data in colleges and universities in terms of the blockchain platform and background is proposed. The self-adaptive equilibrium model can be implemented for the big data mining, and, data analysis, clustering processing, and the high-order spectrum analysis and map design are combined with the time-frequency feature extraction algorithm, which improves the storage structure. Nevertheless, the calculation cost and overhead of this approach are too high and, also, its real-time performance is not worthy [7]. Unfortunately, the above-discussed method including the wavelet approach and the mode decomposition approach has not used the blockchain technology in their implementation. Furthermore, storage overhead of the cloud resource is not analyzed.

To answer the above issues, a cloud resource storage Atlas feature extraction method of university financial system process operation data under blockchain environment is proposed, in this paper, which is based on empirical mode decomposition under high-order cumulant postfocus and realizes the reasonable planning of cloud storage space. Firstly, the storage structure analysis and data information flow model construction of university financial system process operation data under blockchain environment are carried out, and the data fusion and feature extraction of university financial system process operation data under blockchain environment are realized. The postfocusing performance of high-order cumulant is used to extract the features of high-order spectral features, and a complete energy distribution spectrum (Hilbert spectrum) is obtained by empirical mode decomposition of the extracted features of high-order spectral features, thus realizing the reasonable storage planning of cloud resources. Finally, the performance analysis of spectrum feature extraction is carried out through simulation experiments, the cloud storage performance is tested, and the validity conclusion is drawn. The fundamental contributions can be summarized as follows:

- (1) In order to improve the secure storage capacity of university financial system process operation data under blockchain environment, a secure cloud storage algorithm of university financial data based on blockchain technology is proposed.
- (2) The blockchain storage structure model of university financial system process operation data is constructed, the mapping method of Atlas features is adopted, and the blockchain equilibrium configuration parameter analysis model of university financial system process operation data is established.
- (3) According to the feature extraction results of cloud resource storage Atlas of university financial system process operation data, the fuzzy clustering approach is adopted to realize the rational planning of cloud storage space.

The rest of this manuscript is structured in the following fashion. In Section 2, cloud storage structure model and data structure analysis of data are deliberated. In Section 3, university financial data storage optimization of cloud resources model is demonstrated. In Section 4, simulation and result analysis are investigated. Lastly, in Section 5 we discuss the fundamental outcomes and discuss key directions for further research.

## 2. Cloud Storage Structure Model and Data Structure Analysis of Data

*2.1. Resource Cloud Storage Structure Model of University Financial Data under Blockchain Environment.* In order to optimize the resource cloud storage structure of university financial system process operation data under blockchain environment and improve data storage performance, it is necessary to first analyze the resource cloud storage structure model and data structure model of university financial system process operation data under blockchain environment, carry out information fusion and feature extraction of cloud storage resources of university financial system process operation data under blockchain environment, and realize accurate estimation of observed data and target resource information map [8]. A data fusion model of university financial system process operation data cloud storage system under multi-block chain environment is established. In the process operation data cloud storage system of university financial system under multi-block chain environment, there are usually different measurement characteristics among the process operation data cloud storage systems of university financial system under each block chain environment. Model the network data information of the process operation data cloud storage system of university financial system under block chain environment, and connect the graph  $G$ ;  $V$  represents the resource distribution network node set of the cloud storage system,  $V^2$  represents the two-point edge set of any cloud storage node, and the distance between the nodes of the cloud storage system of university financial system process operation data under the environment of block chain. Assuming that the scheduling set of the process operation data storage node of the university financial system conforms to the constraint conditions given in equations (1) and (2), the time slice  $L$  is used to perform linear programming measurement on the cloud storage resource scheduling subset  $\{S_1, \dots, S_L\}$  of the process operation data of the university financial system.

$$S_i \cap S_j = \emptyset, \forall i \neq j, \quad (1)$$

$$\cup_{i=1}^L S_i = V - \{\text{Sink}\}. \quad (2)$$

At this time, the data storage nodes in the process operation data aggregation tree  $S_k$  of university financial system can carry out multi-point cloud integration of the cloud storage system in the  $k$ th time slice. This should be noted that after the cloud storage data  $V - \cup_{i=1}^k S_i$  of the process operation data of university financial system is fused, then the state equation of the check information for

quantifying the process operation data vector  $\mathbf{q}_i(k)$  of university financial system is defined as illustrated in

$$\begin{aligned} V_i(t+1) &= wV_i(t) + c_1 \times \text{rand}(\cdot) \times (P_i - X_i(t)) \\ &+ c_2 \times \text{rand}(\cdot) \times (P_g - X_i(t)), \end{aligned} \quad (3)$$

wherein  $k$  belongs to  $L$  and  $k$  is given by  $k = 1, 2, \dots, L$ . By reorganizing the feature space in the storage nodes of university financial system process operation data in the blockchain environment, all the process operation data of university financial system in the blockchain environment will gather the drift data on the sink in  $L$  time slices through static blocks. Based on client/server, reasonable storage and scheduling of process operation data of financial system in colleges and universities under blockchain environment are realized [9].

Assuming that the process operation data cloud storage systems of university financial system in each blockchain environment are independent of each other, the measurement model of the process operation data cloud storage system of university financial system in this multi-blockchain environment can be expressed as follows in

$$z_k^i = h_k^i(x_k, u_k) + v_k^i, i = 1, 2, \dots, M. \quad (4)$$

In the above formula,  $i (i = 1, 2, \dots, M)$  represents the distributed iterative positioning parameter of the data cloud storage system corresponding to the process operation of the financial system in colleges and universities under the blockchain environment (e.g.,  $z_k^i$  is the measurement vector of the storage node  $i$  at the moment  $k$ ). Moreover,  $v_k^i$  is the measurement interference point of the first node in the beacon nodes of the process operation data of the financial system of colleges and universities in the environment of six blockchain randomly selected, and there is  $E[v_k^i (v_j^i)^T] = R_k^i \delta_{kj}$ ,  $E[w_k (v_j^i)^T] = 0$ . Considering the characteristic information parameters of Atlas structure of cloud storage system nodes of university financial system process operation data in  $N$  blockchain environment, a failure node is randomly generated in the initial reference node, the redundant overload edge of cloud storage cluster system of university financial system process operation data in blockchain environment is obtained in the next time period, and  $e_{ij} (e_{ij} \geq 0)$  is the decomposition characteristic of each file  $E_i$ . According to the energy redundancy cutting rule of the high-order spectrum of the source node in the storage system, the expression of failure overload ratio of offspring nodes of the financial system process operation data storage system in colleges and universities under the blockchain environment with the mean and standard deviation of each dimension is expressed as follows:

$$e_{ij} = p_1(i) \cdot p_2(j+1) \cdot p_3(ij). \quad (5)$$

Based on the feature extraction of cloud resource information of university financial system process data cloud storage system in wireless blockchain environment, the resource cloud storage structure model of university financial system process data in blockchain environment is analyzed, and the following, as given by equations (6) and

(7), data fusion problems of dynamic cloud storage system are obtained:

$$x(k+1) = A(k)x(k) + \Gamma(k)w(k), \quad (6)$$

$$z_i(k) = H_i(k)x(k) + u_i(k), \quad i = 1, 2, \dots, N, \quad (7)$$

wherein  $\mathbf{x}(k) \in \mathbf{R}^{n \times 1}$  is in amplitude modulation state and  $\mathbf{A}(k) \in \mathbf{R}^{n \times n}$  is the storage medium transfer matrix of hybrid cloud data [10]. The other variables are defined as discussed in the preceding sections. This should be noted that through the above design, the resource cloud storage structure model of university financial system process operation data under blockchain environment is obtained as shown in Figure 1.

In the blockchain environment, as shown in Figure 1, the resource cloud storage structure model of university financial system process operation data is used for data fusion and adaptive feature extraction, and the postfocusing of high-order cumulants is used for map design to improve the reasonable planning ability of storage space [11].

**2.2. University Financial Data Structure Analysis and Information Flow Model Construction.** On the basis of constructing the resource cloud storage structure model of university financial system process operation data in blockchain environment, the data structure analysis and data information flow model construction are carried out to provide an accurate data basis for extracting the map features of university financial system process operation data in blockchain environment [12]. In the data storage structure model of university financial system process operation data in blockchain environment, the energy consumption  $E_{\text{comm}}$  model and expression of the cloud storage node information flow transmitted in data packets are assumed as follows:

$$E_{\text{comm}} = \left( \frac{P_{T\text{-elec}} + P_{R\text{-elec}} + P_t}{R} \right) \cdot (L_{\text{DATA}} + L_{\text{ACK}}) + 2 \cdot (P_{T\text{-start}}t_{T\text{-start}} + P_{R\text{-start}}t_{R\text{-start}}) \quad (8)$$

$$= k_1 \cdot (L_{\text{DATA}} + L_{\text{ACK}}) + 2 \cdot k_2,$$

$$k_1 = \frac{(P_{T\text{-elec}} + P_t) + P_{R\text{-elec}}}{R}, \quad (9)$$

$$k_2 = P_{T\text{-start}}t_{T\text{-start}} + P_{R\text{-start}}t_{R\text{-start}}, \quad (10)$$

wherein  $k_1$  is the characteristic code of the cloud storage system that transmits 1 bit information and  $k_2$  is the startup energy consumption of cloud resource information storage on the node that transmits a data packet for the process operation data of university financial system in the blockchain environment [13]. The energy consumption characteristic model of university financial system process operation data cloud storage system based on blockchain environment is established. The process coordinate  $(x_{i,t+1}, y_{i,t+1})$  of the nodes of university financial system process operation data cloud storage system in blockchain

environment is randomly distributed on behalf of node  $o_i$ , and the calculation formula is as follows:

$$\begin{cases} x_{i,t+1} = \frac{(x_{i,t} + x'_{i,t+1})}{2}, \\ y_{i,t+1} = \frac{(y_{i,t} + y'_{i,t+1})}{2}. \end{cases} \quad (11)$$

The strong tracking fusion technology is used to solve the interference problem of the limited bandwidth of the cloud storage system network of university financial system process operation data under the blockchain environment [14]. After transmitting a data packet, the percentage of the original measured value of cloud resource information and the quantization noise is estimated using:

$$\eta_{\text{comm}} = \frac{k_1 \cdot l}{E_{\text{comm}}} \cdot (1 - p_{\text{drop}}), \quad (12)$$

wherein  $p_{\text{drop}}$  is the probability of failure of the transmission of the process operation data of university financial system in the cloud storage system under the blockchain environment. Through the above analysis of data structure, the information flow model of university financial system process operation data under blockchain environment is constructed, and the storage clustering model of university financial system process operation data under blockchain environment is studied [15, 16]. This should be noted that the fuzzy C-means clustering is adopted to detect data characteristics. Firstly, the time-frequency state transition model of signal characteristics is built, and the inherent modal function of state space of university financial system process operation data under blockchain environment is as follows:

$$y(t) = \frac{1}{\pi} P \int \frac{x(\tau)}{t - \tau} d\tau = x(t) * \frac{1}{\pi t}. \quad (13)$$

In the above formula,  $P$  is the characteristics of data packet energy consumption and energy efficiency,  $x(t)$  is the time series of university financial system process operation data under the original blockchain environment, and  $\tau$  is the characteristic time scale of data time series. For the information flow  $x(t)$  of university financial system process operation data resources under any original blockchain environment [17, 18], it is used as the spectrum characteristic packet of university financial system process operation data under the blockchain environment, and the decomposition formula is obtained through empirical mode decomposition of data information flow as illustrated mathematically from

$$E'_{\text{comm}} = E'_{TX} + E'_{RX}, \quad (14)$$

$$E'_{TX} = N \cdot \frac{P_{T\text{-elec}}}{R} \cdot I_{\text{DATA}} + N \cdot \frac{P_t}{R} \cdot I_{\text{DATA}} + N \cdot P_{T\text{-start}}t_{T\text{-start}} + E_{TX}, \quad (15)$$

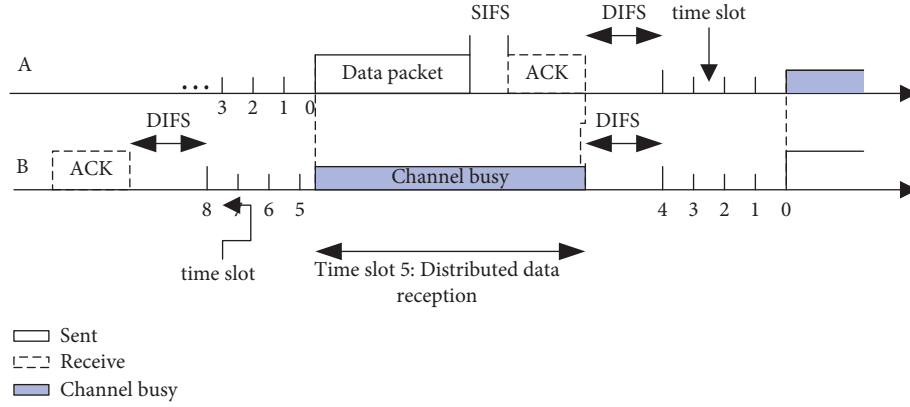


FIGURE 1: The cloud resource storage structure model of process operation data of university financial system under the blockchain environment.

$$E'_{RX} = N \cdot \frac{P_{R-elec}}{R} \cdot L_{DATA} + N \cdot P_{R-start} t_{R-start} + E_{RX}, \quad (16)$$

$$\begin{aligned} E'_{comm} &= N \cdot k_1 \cdot L_{DATA} + N \cdot k_2 + E_{comm} \\ &= (N + 1) \cdot k_1 \cdot L_{DATA} + k_1 \cdot L_{ACK} + (N + 2) \cdot k_2, \end{aligned} \quad (17)$$

$$\eta'_{comm} = \frac{k_1 \cdot l}{E'_{comm}} \cdot (1 - p'_{drop}). \quad (18)$$

In the above equations,  $N$  is the number of requests for cloud resource storage, and  $p'_{drop}$  represents the packet loss rate of data storage under the data storage behavior of university financial system process operation under the specific network blockchain environment [19]. Through the above data structure design of cloud resources, the packet loss rate can be effectively reduced, and the storage performance can be improved through the map design [20].

### 3. University Financial Data Storage Optimization of Cloud Resources

**3.1. Extraction and Design of Atlas Features of University Financial Data.** On the basis of the analysis of distributed optical fiber sensor number structure and the construction of information flow model, the Atlas features of cloud resources are extracted, which can effectively reflect the internal inherent modal characteristics of the data by extracting the high-order spectral features of university financial system process operation data in blockchain environment [21]. By optimizing Atlas design, the Atlas information of high-order spectral features of data can be extracted, which can reduce the storage cost of data cloud resources and data redundancy. By analyzing the traditional approaches, this could be easily understood that the current method decomposes the data sequence into a limited number of check data blocks for spectrum decomposition, and when the data are disturbed by external uncertain information, the feature mapping performance of the

spectrum is not good. In order to overcome the disadvantages of the traditional methods, this paper proposes a cloud resource storage map feature extraction method which is based on the empirical mode decomposition under high-order cumulant postfocus [22]. The process of cloud resource storage map feature extraction of university financial system process data under blockchain environment is described as follows.

The process operation data of university financial system under complex blockchain environment are decomposed by empirical mode decomposition, and the data fusion and feature extraction of process operation data of university financial system under blockchain environment are realized. Subsequently, the instantaneous frequency IMF component of process operation data of university financial system under multiple narrow-band blockchain environments is obtained, which is expressed as given in

$$x_{min,j} = \max\{x_{min,j}, x_{g,j} - \rho(x_{max,j} - x_{min,j})\}, \quad (19)$$

$$x_{max,j} = \min\{x_{max,j}, x_{g,j} + \rho(x_{max,j} - x_{min,j})\}. \quad (20)$$

In the above formulas, the interval  $[x_{min,j}, x_{max,j}]$  constitutes the sliding time window SW of the characteristic time scale of the process operation data of university financial system under the blockchain environment. Furthermore,  $\rho$  is the adjustment coefficient of local maximum point, and the postfocusing performance of high-order cumulant is used to extract the features of high-order spectral feature. The high-order cumulant is defined as given using

$$P = \frac{\sum_{o \in N_{k-dist}(p)} lrd_k(o) / lrd_k(p)}{|N_{k-dist}(p)|}, \quad (21)$$

wherein  $|N_{k-dist}(p)|$  represents the time scale and  $d_k(o)$  is the high-order spectral component. Moreover, the average values of the upper and lower envelopes are calculated to acquire the high-frequency superimposed wave component of the process operation data of university financial system under the blockchain environment, as well as, under the background noise of storage, which is expressed as illustrated in

$$Y_k = [y_{k1}, y_{k2}, \dots, y_{kj}, \dots, y_{kI}] \quad (k = 1, 2, \dots, N). \quad (22)$$

The fuzzy clustering approach is implemented in order to realize the rational planning of cloud storage space. The partition block link fusion and channel equilibrium configuration method are adopted to realize the resource cloud storage structure configuration of university financial system process operation data in cloud environment. In this paper, an empirical mode decomposition method is adopted to filter the instantaneous interference information obtained by Hilbert transform of IMF components to remove false components. After the IMF components of university financial system process operation data storage characteristics in blockchain environment are subjected to high-order cumulant postfocusing processing, the cloud resource map becomes smooth in adjacent wave domain, and at this time, the frequency modulated Hilbert spectrum offset will be generated, which is illustrated as given in

$$f_i(n) = \frac{\|\ln[\lambda_i(n)]\|}{2\pi\Delta t}, \quad (23)$$

wherein  $\Delta t$  characterizes the sampling time interim of high-order spectral characteristic quantity. Based on the above analysis, this paper introduces the screening strategy under the control of threshold conditions and adaptively corrects the Atlas of university financial system process operation data under blockchain environment, so as to realize the Atlas feature extraction. The algorithm implementation process is shown in Figure 2.

As can be seen from Figure 2, in the process of extracting the spectral features of the whole university financial system process operation data, by calculating two consecutive screening results, the high-order spectral feature extraction is realized based on the model parameter estimation of the university financial system process operation data.

**3.2. University Financial System Process Operation Data Storage Optimization.** In order to ensure the effectiveness of cloud storage optimization scheduling, the IMF components are scheduled after the high-order spectral decomposition of the process operation data of the university financial system so as to improve the cloud storage optimization performance. This is attained through assuming that the spatial vector of cloud resource storage meets  $H = L^2(R)$  in a linear combination frequency band of a certain basis function. The basis function of university financial system process operation data storage under a certain blockchain environment is selected to match the map features, and the matching degree between the basis function  $f$  and the base  $d_{\gamma_0}$  is as follows in

$$\lambda^n(d_{\gamma_0}) = \int_{-\infty}^{+\infty} f(t)d_{\gamma_0}^*(t)dt. \quad (24)$$

At this time, the adaptive cloud storage space scheduling is adopted, and the linear maximal irrelevant group is searched in the basis function. Assume that the expansion density  $L^2(R)$  in the finite dimensional feature space of the

graph subset  $\{d_{\gamma}\}$  under which the process operation data of university financial system want to be reasonably stored is dense. Moreover, the correlation coefficient method is introduced to identify false components, and the matching projection method is used to filter the correlation decomposition of the stored graph of the process operation data of university financial system, which satisfies the requirements characterized by

$$R_{x,c'_i}(\tau) = E[x^*(t)c'_i(t+\tau)] = E\left[\sum_{j=1}^n c_j^*(t)c'_i(t+\tau)\right], \quad (25)$$

wherein  $i = 1, 2 \dots n$ , and due to empirical mode decomposition, it is known that if the false component  $L^2(R)$  of financial resources under this set of complete vector sets constitutes  $r_k$  which has little correlation with the map  $x(t)$  of the original storage space, then the map of reasonable storage of process operation data of university financial system can be articulated by a linear combination of several vector basis functions as follows:

$$\Lambda_0 = \left\{ \beta \in \Gamma: \left| \langle f, d_{\gamma_0} \rangle \right| \geq a \sup_{\gamma \in \Gamma} \left| \langle f, d_{\gamma} \rangle \right| \right\}. \quad (26)$$

Obtaining the instantaneous frequency Hilbert energy spectrum of the process operation data of the financial system in colleges and universities,

$$h(\omega) = \int_0^T H(\omega, t)dt. \quad (27)$$

Energy spectrum expresses the global capability of the process operation data of university financial system at each frequency, which represents all the accumulated ranges in the statistical sense. Through cloud information fusion and block clustering, the cloud resource map of the process operation data of university financial system becomes smooth in the adjacent wave domain, effectively reducing the data storage overhead and improving the secure cloud storage capability of university financial data. Through the above analysis, the cloud storage optimization design of the process operation data of university financial system is realized, and the storage performance is improved.

## 4. Simulations and Analysis of Results

In order to test the performance of secure cloud storage of university financial system process data designed in this paper, using certain assumptions several simulation experiments were carried out. In the experiment, Lab-Windows/CVI, C/C++ development tools are used to design and collect the data storage structure of university financial system process operation. Similarly, the MATLAB version 7 simulation software is used to design and program the algorithm of university financial system process operation data village, and Hadoop platform is used to design the cloud platform of university financial system process operation data storage. The hardware environment is configured as

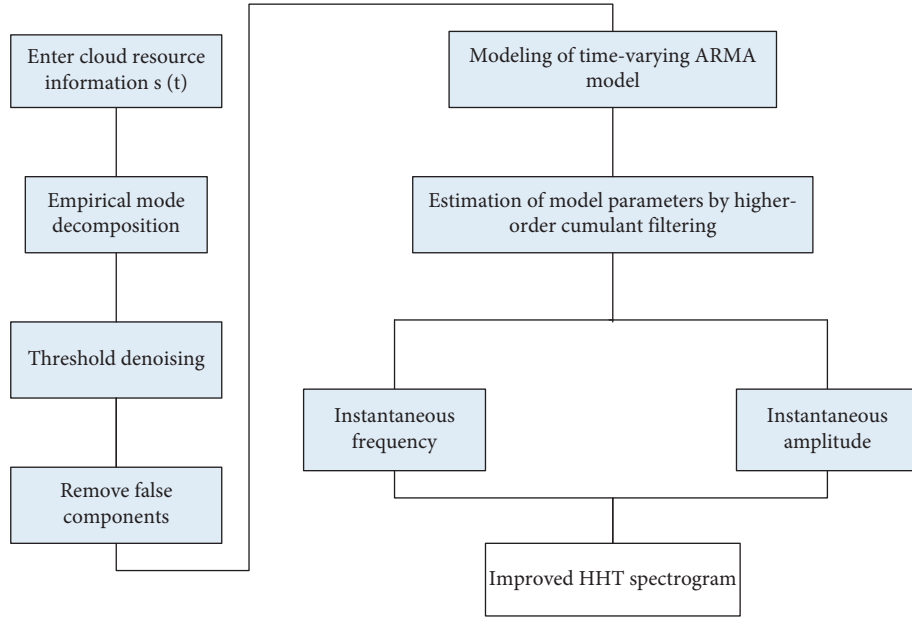


FIGURE 2: The process of extracting the Atlas features of the process operation data of financial system in colleges and universities.

CPU: Intel (R) Core (TM) CPU T6600, 2.2 GHz. On the basis of the above simulation environment design, the simulation parameters are set, assuming that the fundamental frequency spectrum of university financial system process operation data collection in blockchain environment is 50 Hz, the modulation frequency is 10 Hz FM, and the threshold is  $\eta = 5$ . The cloud resource information of university financial system process operation data in blockchain environment increases linearly from 1024 B to 1 GB with 10 MB as a unit. According to the above parameter setting results, the storage structure analysis and data information flow model construction of university financial system process operation data under blockchain environment are carried out, and the cloud resource storage data information flow collection is realized. The data collection results are shown in Figure 3.

Data fusion and Atlas feature extraction are carried out on the abovementioned output results of empirical mode decomposition of university financial system process operation data, and high-order spectrum feature extraction is carried out by using the postfocusing performance of high-order cumulant to obtain a complete energy distribution spectrogram (Hilbert spectrum). In order to compare the performance, the cloud resource Atlas information extracted by this method and the traditional method is shown in Figure 4.

It can be seen from Figures 4(a), and 4(b) that using this method for Atlas design and feature extraction can accurately reflect the internal structure information features of university financial system process operation data under blockchain environment and improve the cloud storage performance. In order to quantitatively analyze the improved performance of this method, the cloud resource storage overhead is taken as the test object, and the

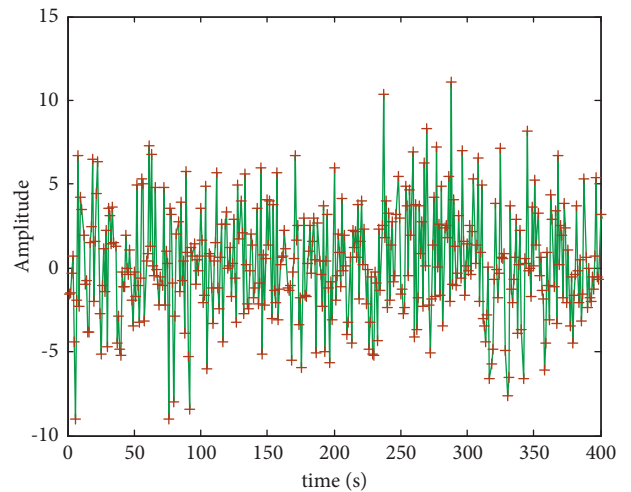


FIGURE 3: Data collection results of process operation of financial system in colleges and universities.

comparison result is shown in Figure 5. It can be seen from the figure that using this method can effectively reduce the storage overhead and improve the data throughput. Also, we can comprehend that the overhead does not change with the number of iterations. The overhead of the wavelet analysis method is among the range of 0.91 and 0.94 which is significantly higher than that of the empirical mode decomposition methods, i.e., between 0.62 and 0.634. The overhead of the proposed method is significantly lower than the both methods that remains within the range of 0.3 and 0.315. In fact, we observed that this improvement can be measured as 43.67% higher than the wavelet method and 30.45% higher than the mode decomposition approach.

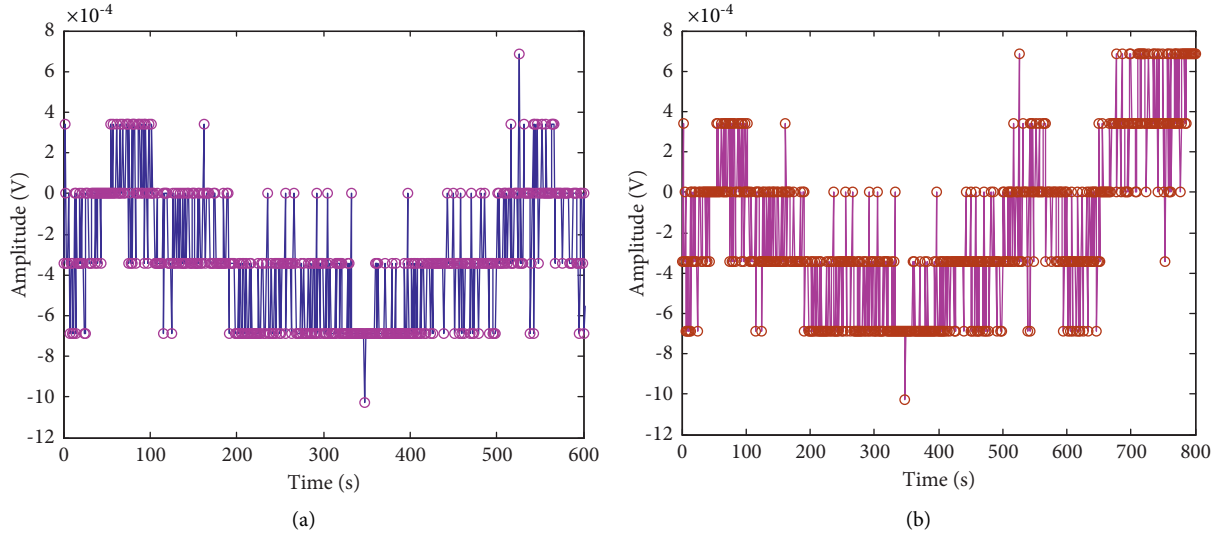


FIGURE 4: Spectrum distribution of data storage structure of financial system process operation in colleges and universities. (a) High-order cumulant postfocusing Hilbert spectrum in this paper. (b) Wavelet spectrum.

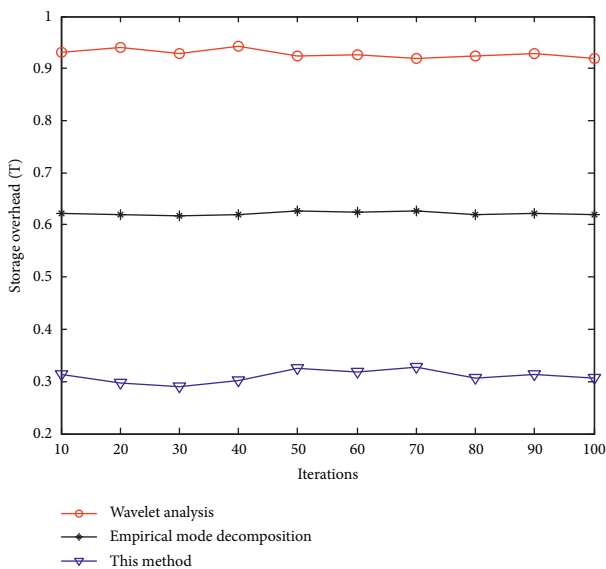


FIGURE 5: Quantitative analysis of performance comparison.

## 5. Conclusions and Further Research

In this paper, a cloud resource storage Atlas feature extraction method of university financial system process operation data under the blockchain environment, which is based on empirical mode decomposition under high-order cumulant postfocus, is proposed to realize the reasonable planning of cloud storage space. Firstly, the storage structure analysis and data information flow model construction of university financial system process operation data under the blockchain environment are carried out to realize the data fusion and feature extraction of university financial system process operation data under the blockchain environment. Secondly, the postfocusing performance of higher-order cumulant is used to extract the features of higher-order

spectral features, and a complete energy distribution spectrum (Hilbert spectrum) is obtained by empirical mode decomposition of the extracted features of higher-order spectral features. Thus, the secure storage of university financial system process operation data cloud is realized, and the security performance of the data storage, as well as the distribution performance of storage structure, is improved. The research shows that this method can improve the storage performance of university financial system process operation data cloud resources, with accurate analysis of spectrum features and good application value.

As a future plan, we intend to design the proposed model in a real environment and generalize the attained findings. Similarly, we will apply this model to other cloud computing resources such as data processing and will investigate the execution times. In fact, the emerging edge model can be utilized to improve the processing times. We will implement the proposed work over an edge cloud setup to further reduce the storage overhead costs. Besides, computational costs should be investigated. In the future, we will use other important evaluation metrics to quantify the storage overhead analysis and generalize the outcomes.

## Data Availability

The data used to support the findings of this study can be obtained from the corresponding author upon request.

## Conflicts of Interest

The authors declare that they have no conflicts of interest.

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