

Retraction

Retracted: Construction of Social Security Fund Cloud Audit Platform Based on Fuzzy Data Mining Algorithm

Complexity

Received 15 August 2023; Accepted 15 August 2023; Published 16 August 2023

Copyright © 2023 Complexity. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

- (1) Discrepancies in scope
- (2) Discrepancies in the description of the research reported
- (3) Discrepancies between the availability of data and the research described
- (4) Inappropriate citations
- (5) Incoherent, meaningless and/or irrelevant content included in the article
- (6) Peer-review manipulation

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

References

- [1] Y. Huai and Q. Zhang, "Construction of Social Security Fund Cloud Audit Platform Based on Fuzzy Data Mining Algorithm," *Complexity*, vol. 2021, Article ID 9939454, 11 pages, 2021.

Research Article

Construction of Social Security Fund Cloud Audit Platform Based on Fuzzy Data Mining Algorithm

Yangting Huai  and Qianxiao Zhang

School of Economics and Finance, Xi'an Jiaotong University, Xi'an, Shaanxi 710061, China

Correspondence should be addressed to Yangting Huai; vivian1@stu.xjtu.edu.cn

Received 20 March 2021; Revised 12 April 2021; Accepted 21 April 2021; Published 28 April 2021

Academic Editor: Zhihan Lv

Copyright © 2021 Yangting Huai and Qianxiao Zhang. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Guided by the theories of system theory, synergetic theory, and other disciplines and based on fuzzy data mining algorithm, this article constructs a three-tier social security fund cloud audit platform. Firstly, the article systematically expounds the current situation of social security fund and social security fund audit, such as the technical basis of cloud computing and data mining. Combined with the actual work, the necessity and feasibility of building a cloud audit platform for social security funds are analyzed. This article focuses on the construction of the cloud audit platform for social security funds. The general idea of using fuzzy data mining algorithm to build the social security fund audit cloud platform is to compress the knowledge contained in a large number of data into the weights between nodes and optimize the weights through the learning of the neural network system. Through the optimization function, the information contained in the neural network is stored in a few weights as far as possible. The main information is further highlighted by network clipping and removing weights that have little impact on the output.

1. Introduction

With the obvious common benefit of the global political and economic integration, the informationization, automation, and paperless development of government management functions represented by e-government are developing rapidly in China. As an independent supervision institution, how to deal with the challenge of increasingly quantified data of auditee and how to accurately and effectively audit and analyze the massive data of auditee are urgent problems to be solved. According to the planning goal of the construction of audit information, the social security network audit system in the nine application systems of the audit data center was first introduced to improve the quality and efficiency of the audit of social insurance funds [1]. The goal of social security base audit is to ensure the safety and integrity of social insurance fund. No matter what the social insurance fund looks like from the process of income and expenditure or from a specific operation, the greater the risk is, the greater the risk is. Risks, once they occur, are likely to be hazardous. The regulation of social insurance funds directly

affects the realization of social insurance benefits and the stability of the national economy and society. Accordingly, the country must adopt effective measures to execute strict audit of the social insurance fund, build and circumvent social insurance fund risk “firewall” and “isolation zone,” and ensure the safety of the social insurance fund is complete [2]. With the continuous increase of national investment in social security, the business of social security fund has developed rapidly, with a great improvement in both types and quantities. As for the audit work, many social security services produce difficult-to-measure audit data; thus, it was difficult for the traditional computer audit method to meet the audit requirements. Therefore, a new technology represented by modern computer technology is widely used in social security information management. At the same time, there are also some significant problems in the actual work, such as the high construction cost of audit information systems in audit departments at all levels; the development of audit software is difficult and restrictive. There is a big difference in the degree of information construction between the audit department and the auditee. The social security

audit information resource sharing degree is low. The social security fund audit by cloud computing provides a way of thinking to solve the above problems.

Social security funds through a cloud of audit, pointing to will and the framework of cloud computing technologies into the social security fund audit work, making all kinds of audit resource synergy through clouds, will be a large number of social security funds audit data collected in a unified platform for integration management and reasonable scheduling, to help the auditor to further improve the work efficiency and reduce audit risk [3]. The cloud audit service of social security funds can achieve the coordinated development of audit departments at all levels to a certain extent, reduce the development cost of audit software, improve the work efficiency of audit services, and play a certain role in promoting the development of social security fund audit in China. In practical application, the primary task at present is to study how to apply the above concepts and theories into practice and build a cloud audit platform for social security funds based on data mining. The purposes of applying data mining technology to social insurance fund audit are as follows [4]: (1) to maintain the implementation of national social insurance fund management policy, ensure the normal operation of the social insurance fund, and prevent various risks of social insurance fund management; (2) analyze, comprehensively reflect, and evaluate the deviation between the management and operation status of social insurance funds and the expected standards, analyze and study the causes of the deviation and the possible damage, and provide reliable information and basis for the government to formulate and implement social insurance fund management policies; (3) correct illegal and irregular behaviors through social insurance fund audit and strengthen the self-binding force of social insurance fund management organizations.

The purpose of this article is to build an effective cloud audit platform for social security funds. Social security fund cloud audit platform is a systematic platform based on cloud computing framework to realize social security fund audit business. It is used to collect and manage social security funds needed for the audit of all kinds of information and data, to update the data stored and organic collection, intelligent choice, and use of the audit model through information sharing, information communication, and quality control, and to realize the automated processing of audit and audit intelligent management, thus saving the audit time and improving work efficiency. This social security fund audit system, cloud computing, and data mining technology, such as system theory, coordination theory, and software engineering discipline theory used as instructions, supporting social security funds through a cloud audit platform and applications are studied; for the development of social security funds, cloud audit platform has a certain role in improving user audit platform for cloud recognition degree, ultimately promoting the role of the social security fund audit cloud platform in the development of our country.

The rest of this article is organized as follows: the related work is discussed in Section 2. Section 3 elaborates the cloud audit platform of social security funds. Section 4 mainly

describes the implementation of fuzzy data mining algorithm, and Section 5 verifies the social security audit. Section 6 summarizes the whole article.

2. Related Work

At present, the computer audit technology in data acquisition, data conversion, data processing, and data analysis has been a breakthrough function in software in the following aspects: risk assessment, audit plan, paper review, fraud check/prevention and supervision, audit schedule, audit papers, audit report, project management, and problem tracking [5, 6]. Domestic research on cloud audit of social security funds started late and is still in the exploratory stage. The research of scholars can be reviewed from three aspects: computer network audit, social security fund network audit, and the application of cloud computing in the field of audit.

In the aspect of computer network audit, Parkinson et al. [7], starting from the practical application of computer audit, built the social security fund network audit platform, which provided a realistic basis for the audit department to study network audit. Xue et al. [8], starting from the key technologies involved in network auditing and applying the theory and method of information system development, put forward the implementation and deployment plan 3 of network auditing. Zhang and Li [9], starting from the principle of network auditing, introduced the feasibility of implementing network auditing projects through a comparative analysis of the costs and benefits of network auditing. From the perspective of network audit performance evaluation, Faccia et al. [10] established an analysis model for network audit by analyzing the main factors affecting network audit performance, which provided an effective method for quantitative analysis of performance evaluation affecting network audit.

In the aspect of online auditing of social security funds, Zhang et al. [11], starting from the theoretical and technical basis of online auditing, combined with the realistic demands of online auditing, completed the overall design of online auditing system, proposed solutions to possible difficulties, and proposed optimization methods for data processing. Aujla et al. [12] studied the overall framework of the networked audit system for social security funds and proposed key technologies such as data transmission, data collection, and early warning analysis that may be used in the construction of the networked audit system for social security funds. Swami and Sai Kiran [13] analyzed the role of data reduction in the network audit of social security funds and developed specific application software to achieve the application effect in the process of application. Wang and Islam [14] pointed out the practical difficulties encountered in the online audit of social insurance funds in China by analyzing the current situation of the online audit of social insurance funds in China and proposed ideas for the construction of the online audit system of social insurance funds from the perspectives of construction objectives, structural design, and operational process.

In terms of the application of data mining technology in audit, Chen et al. [15] studied the framework of audit model based on data mining. With the wide application of modern information technology in finance, enterprises, and institutions, the traditional manual audit methods cannot meet the needs of audit work, and it is urgent to adopt advanced modern audit methods and means to improve audit quality and reduce audit risks. Alassafi et al. [16] explored and studied modern audit technology under the information environment. Based on the analysis of the impact of information technology development on audit methods, this article proposes that we should use real-time online audit and data mining technology to examine and analyze many original data. Some scholars introduced and described a novel architecture scenario based on cloud computing and the innovative model of federated learning [17–20]. The proposed model is named Integrated Federated Model, with the acronym InFeMo. InFeMo incorporates all the existing cloud models with a federated learning scenario and other related technologies that may have integrated use with each other, offering a novel integrated scenario. The proposed model is also motivated to deliver a more energy-efficient system architecture and environment for the users, which aims to the scope of data management.

At present, the research on cloud audit of social security funds in the academic circle is still in the conceptual and theoretical stage and only carries out a simple study on the content. Few scholars have carried out practical research on cloud audit of social security funds [21]. It can be seen that there is still much room for development in the research on cloud audit platform of social security funds. It should be a research direction for future scholars to combine theoretical research with practical summary and qualitative research with quantitative research, build a cloud audit platform for social security funds, and test research results in practice.

3. Cloud Audit Platform for Social Security Funds

3.1. Total Framework. Regarding the present situation of the social security fund in our country, the audit institutions have started to pay more attention to the development of computer auditing, with a focus on efficiency, cost, and safety. This article argues that the auditing organs shall be responsible for auditing deployment at the national level and the provincial audit institutions will support the use of a unified audit platform by cloud service providers. According to the cloud platform of audit service provided by users of audit requirements, including social security funds through data acquisition, data storage, data processing, and data analysis, by IaaS, PaaS, and SaaS (three service modes of social security funds through a cloud audit platform), it is a construction scheme in line with the development status of social security fund audit in China and conducive to the smooth development of social security fund cloud audit platform. Through multilevel backup, data redundancy, encrypted storage, and other technologies, the application layer provides users with multilevel data security management services and guarantees the user's data through regular

data backup, remote disaster recovery backup, distributed data storage, and other schemes. At the same time, the data stored in the cloud audit platform are stored with an irreversible encryption algorithm to further reduce the risk of data theft and data leakage of social security users. Using cloud storage of data, various audit resources, including computer hardware and software equipment, audit data, and audit experience model, are shared in the cloud, and a large number of structured, semistructured, and unstructured audit data are gathered together for the integrated management and reasonable scheduling.

The social security fund cloud audit platform comprises an infrastructure layer, platform layer, application layer, and user layer, as shown in Figure 1.

Cloud audit platform infrastructure layer (IaaS) mainly provides users with hardware infrastructure composed of servers, storage, network resources, security mechanisms, and interfaces; cloud audit platform layer (PaaS) mainly provides users with standardized audit software development environment, general audit software development interface, general data exchange interface, audit software management service, and other comprehensive services [22–25]. In this layer, the platform provides the database and middleware as products to the users and provides the process service management platform for the users to manage. The cloud audit platform application layer (SaaS) mainly provides users with various audit software and audit experience databases to help audit users with audit analysis and audit decision-making. The user layer of the cloud audit platform mainly provides users with access management, authority management, identity authentication, and other functions.

The operating system used in this system is Windows 10, and its development tool is MyEclipse. The web server is Apache version 2.4.10 or above; the development technologies used include PHP5.3, HTML5, and Java.

3.2. Infrastructure Layer. In the infrastructure layer of the cloud audit platform, audit institutions can enjoy unified computer resource services. Audit platform of cloud infrastructure layer (see Figure 2) is mainly composed of server, storage, network resources, and security mechanism, such as components, through virtualization technology, to build a resource pool, such as resource pool encapsulation technology to be distributed around the organic integration of computer resources together and make the management, allocation, scheduling unified, and it provides no difference of computer infrastructure services to every user of the cloud audit platform. At the same time, the infrastructure layer also provides a security mechanism to protect better the environment security and data security of the entire cloud audit platform; in addition, the infrastructure layer provides interface services to help the infrastructure layer and the platform layer and the infrastructure layer and the external environment achieve information exchange.

Specifically, at the very bottom of the infrastructure layer, all the physical devices in the infrastructure layer are contained. In the infrastructure layer, these resources are no

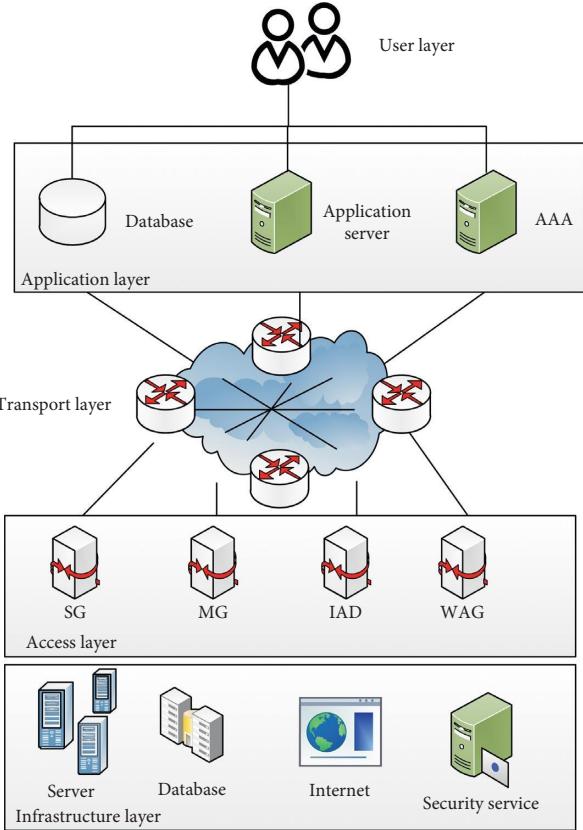


FIGURE 1: Overall structure of cloud audit platform for social security funds.

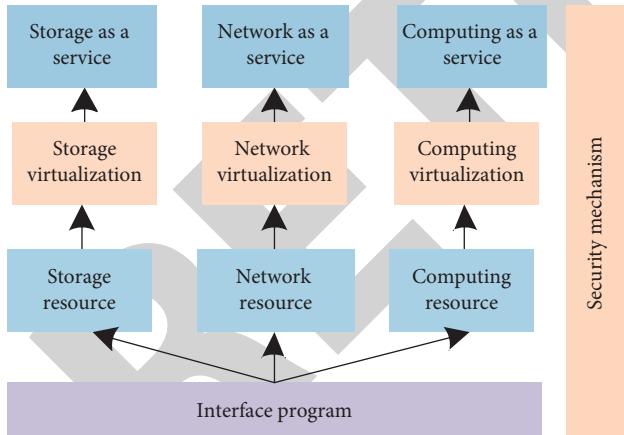


FIGURE 2: Cloud audit platform infrastructure layer.

longer scattered physical equipment but are gathered together in a unified form to provide external basic resource services, also an important feature of the existence of resources in the infrastructure layer. Since these resources are of many types and wide distribution, the aggregate referred to here is only a logical aggregate. By aggregating various resources in the infrastructure layer, cloud platform managers can operate and manage them uniformly and centrally, and they can be combined arbitrarily as needed to form a certain scale of computing power.

Through the infrastructure layer of the cloud audit platform, audit institutions at all levels do not need to independently configure resources such as storage devices, servers, and application software. As long as they are connected to the cloud audit platform, they can enjoy these services. The infrastructure layer is the foundation for the construction of the whole cloud audit platform. If the cloud audit platform of the social security fund is regarded as a computer, then the infrastructure layer provides hardware devices such as memory and hard disk.

3.3. Platform Layer. The platform layer of the social security fund cloud audit platform is located above the infrastructure layer. The platform layer of the cloud audit platform (as shown in Figure 3) provides users with functions including application development, database as a service, service integration platform, application middleware, process service, and other modules. In the platform layer, the software deployment environment is provided to the software developers by treating the platform as a service, improving software development efficiency.

The platform layer application development module mainly provides an integrated application development environment for users. In the application development module, users can obtain the development framework provided by the platform layer, the underlying technical support, and the standardized technical services, including program log, exception report, and data cache [26, 27]. By integrating data storage resources, the platform layer provides users with unified database storage services, standardized database access interfaces, and convenient database expansion functions and, at the same time, provides users with perfect database management functions, supporting the centralized management of various types of databases. Automated deployment module refers to the platform that can help users realize automatic allocation and recycling of cloud computing resources. With flexible policy-based deployment, the deployment of the application changes in time as the implementation policy changes. Moreover, the automation of the infrastructure is realized, the limited hardware infrastructure is allocated flexibly to users, and human execution errors are eliminated. The application operation module provides operation management of platform resources, including resource application, resource use, resource recovery, resource scheduling, and resource monitoring. The key point of the application running module is to solve the problem of management and scheduling of computing resources.

3.4. Application Layer. The application layer of the cloud audit platform is the core part of the cloud audit platform. The cloud audit platform provides software as a service to audit users. Users can rent or buy unified audit software services as long as they put forward requirements for audit application software. In the application layer, applications including user management, data management, custom configuration, and audit APP are provided [28, 29]. The

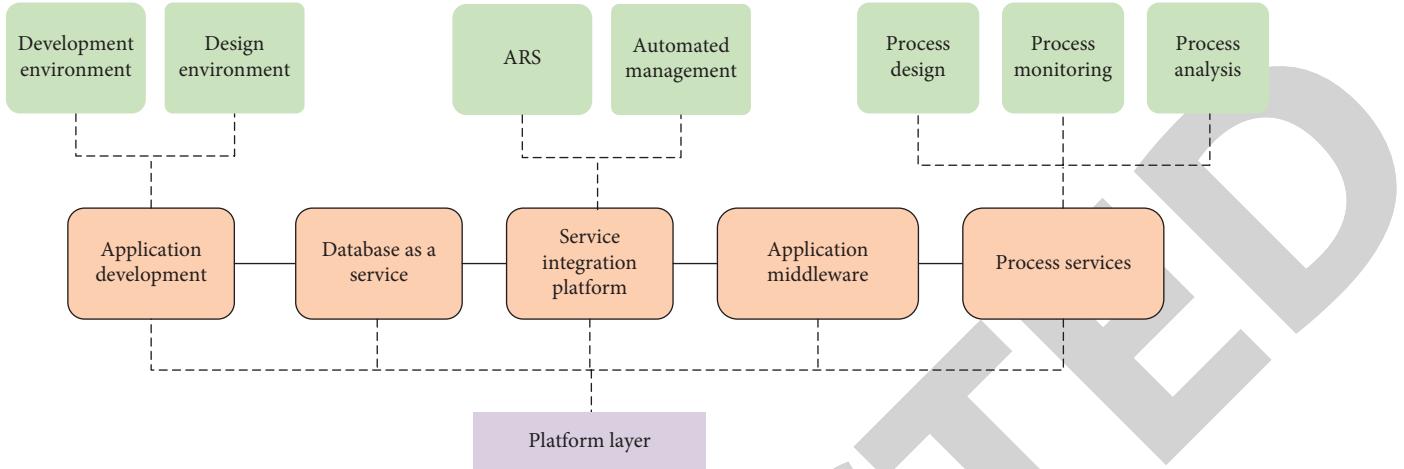


FIGURE 3: Cloud audit platform layer.

cloud audit platform application layer provides these applications as services to users.

The platform application layer provides custom configuration tools for cloud audit platform users. In the audit of the cloud platform application layer, according to their business needs, the auditor may provide the platform with the application of a combination of modules for free; according to the data, the auditor can further demand the audit of auditing data processing, data process, and data calculation at any audit platform; according to user requirements, the auditors automatically generate the need for application function and the application of interactive interface, menus, and so forth to fully meet the needs of users for various audits. The audit implementation software and the audit management software, as the achievements of the gold audit project, have been widely used in the field of audit information. Through the audit implementation software, the on-site audit implementation can be realized, and the related leaders of the audit management software can issue audit tasks to the auditors and make audit judgments according to the audit results. The application layer of cloud audit platform has developed a general audit implementation APP and audit management APP on the basis of fully drawing lessons from the two kinds of software functions, which can better help auditors implement audit work. Through the audit data analysis APP, auditors can conduct a comprehensive analysis of audit data and audit-related data and make comprehensive use of the audit analysis model in the audit platform. The audit analysis model is a logical expression of calculation, judgment, and limitation that auditors set according to the acquired data and the nature and quantity of the audit objects to test the authenticity and legitimacy of the audited data, including the audit data model, the audit experience model, and the audit laws and regulations model.

3.5. User Layer. In the cloud audit mode, auditors at all levels need to log in to the cloud audit platform to carry out the audit work of the social security fund through an entrance, which is provided by the user layer of the platform. It can

provide users with access services through computer client, mobile client, browser, and other ways, which are convenient for auditors to log in and use anytime and anywhere, making the audit work no longer restricted by office location. The main functions of the user layer mainly include access management, identity authentication, and authority management.

Access management provides various cloud platform access services for auditors at all levels through the web and other technologies, so that audit users of the cloud audit platform can access the cloud audit platform through computers or mobile phones anytime and anywhere to obtain audit data, conduct audit data analysis, and prepare audit reports. Password authentication, IP address, MAC address authentication, and other recognition technologies in cloud platform of audit control the user login when logging in to the platform to identify regular users, further reducing the illegal user's access behavior, on the one hand, enhancing the security of cloud platform of audit, and reducing the risk of audit data leakage and, on the other hand, reducing the working pressure of cloud platform server audit and improving the service efficiency of the platform. In addition, with the help of the authority management function, the auditor can only obtain the audit data related to the audit activities, the head of the corresponding audit department can obtain the audit results and a full set of audit files, and the platform maintenance personnel can only obtain the problem data and the software and hardware data of the platform. This function setting, which provides different audit services according to user identity, greatly improves the management and control ability of the platform and improves the security of the data of the cloud audit platform.

3.6. Application Layer. The social security fund cloud audit platform covers all aspects of social security fund audit. It not only needs to contact many social security business units but also needs to communicate with the social security fund management department and relevant business departments. In addition, when auditing social security fund data,

external information resources should be fully developed and utilized. It can be said that the cloud audit platform of social security fund is a large platform that needs overall arrangement and unified planning to be successfully applied. The application process of the cloud audit platform for social security funds is a process in which relevant parties of the platform (mainly staff of audit institutions) complete the audit work of social security funds by using the services provided by the platform so as to improve audit efficiency and reduce audit risks. The application process of the social security fund cloud audit platform mainly includes audit data collection, audit data pretreatment, audit data analysis, audit early warning. The application process design is shown in Figure 4.

Firstly, through the data acquisition software of the cloud audit platform, auditors collect data from different audited entities according to different audit projects. At the same time, they collect data from related audit entities that may be involved. The collected audit data are stored in the cloud platform uniformly. Secondly, through data pre-processing software, auditors conduct standardized processing on the collected audit data and related data and store the processed data in the cloud platform. Furthermore, the auditors use the audit software to analyze the preprocessed audit data, find out the audit doubts, and further analyze the audit conclusions. In addition, early warning personnel can realize automatic early warning of social security fund audit business through audit early warning software to improve work efficiency. Finally, the audit institution shall circulate the audit results to the auditees and make them known to the public.

4. Fuzzy Data Mining Algorithm Implementation

Data samples in data mining are often noisy, nonlinear, and messy data, and neural network has certain advantages in processing these data. At the same time, in the process of neural network learning, a large amount of data is needed to generate sufficient training and test pattern sets, which is exactly what data mining based on data warehouse or large database can provide. In view of the complementary advantages of data mining and neural network, this article proposes and studies the data mining method using neural network technology, which has a wide range of applications in data classification and prediction. Through the analysis of real objects, the data are processed, and the fuzzy mathematical model is constructed. Using membership relationship to make data element set into fuzzy set flexibly, determining membership function, and carrying out fuzzy statistics are mostly based on experience and human psychological process. It is usually carried out through psychological measurement, which studies the fuzziness of things themselves. Fuzzy theory is an important branch of artificial intelligence technology, which lays a theoretical foundation for describing a lot of fuzzy phenomena in real life. They imitate the intelligent behavior of human beings and show the problem-solving ability that cannot be solved by any single algorithm in the aspects of network target

detection, decision inference, and behavior planning. Information audit is often based on some fuzzy phenomena, and fuzzy reasoning process is only a simple numerical operation, which can greatly improve the performance of information audit system. The information audit technology based on feature detection is often a binary decision when matching and filtering. When a factor in the factor set is observed to have a suspicious value, the decision module directly gives a conclusion that it is bad information or normal. This is not the case: there is often a large degree of uncertainty about the impact of a single factor on the outcome. Only by considering the uncertainties of various factors can an accurate judgment be made.

According to a single factor, its corresponding fuzzy set, and membership function used to judge the decision vector, comprehensive decision vector of multiple factors, for a particular type of bad information behavior, can get a set of its corresponding bad information character descriptions by giving each of the set appropriate weighting vector elements distribution, in case each network connection can be abnormal fuzzy judgment [30].

4.1. Data Mining Platform. The platform mainly uses SPSS (Statistical Product and Service Solutions) Modeler software, a data mining tool. SPSS Modeler computer system achieves an organic combination of computing and graphics at the same time in integrated clustering analysis, decision tree analysis, Bayesian networks model, and many other algorithms, and based on the mining method, it is applied to the tools skillfully in harmony forming an organic whole, has a friendly operation interface, and is easy to use, offers other powerful graphics functions, and is supported with the exchange of data between the database and model. Its analysis results are straightforward, and users can easily achieve data mining using it [23–26]. The operation objective of SPSS Modeler is to select the required nodes according to the data and analysis requirements, connect them successively and execute the data by continuously adjusting the parameters of each node, and finally complete the process of the fuzzy reasoning model of data mining in the social security audit, as shown in Figure 5. The fuzzy reasoning process of social security fund audit includes fuzzification, reasoning implication, aggregation, and deblur.

4.2. Construct Fuzzy Neural Network Model, Training Set, and Test Set. The fuzzy neural network is divided into five layers: input layer, fuzzy input layer, hidden layer, fuzzy expected output layer, and output layer. The selection of reference set (REF) and test set (TEST) should be based on the difference between the selected targets. It can be found that the fuzzy neural network constructed is a feedforward neural network [31, 32]. The characteristics of each neuron node of the feedforward neural network are generally Sigmoid or S-type function.

4.3. Calculation of Fuzzy Membership Degree. Based on the fuzzy logic operation of neural network, the Sigmoid function is selected, and the membership function is realized by neural network.

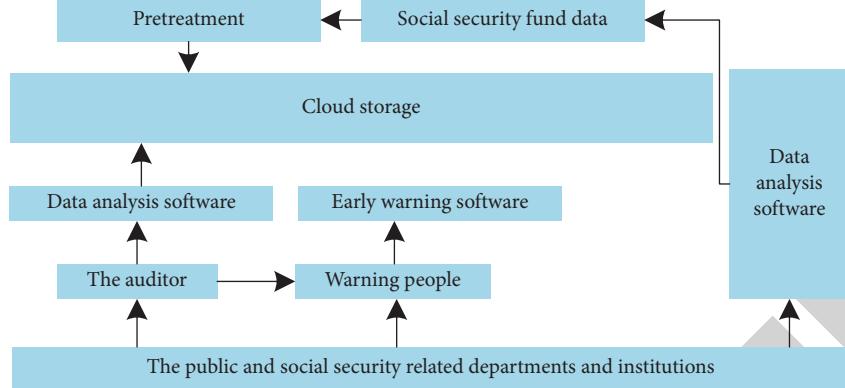


FIGURE 4: Application flowchart of social security fund cloud audit platform.

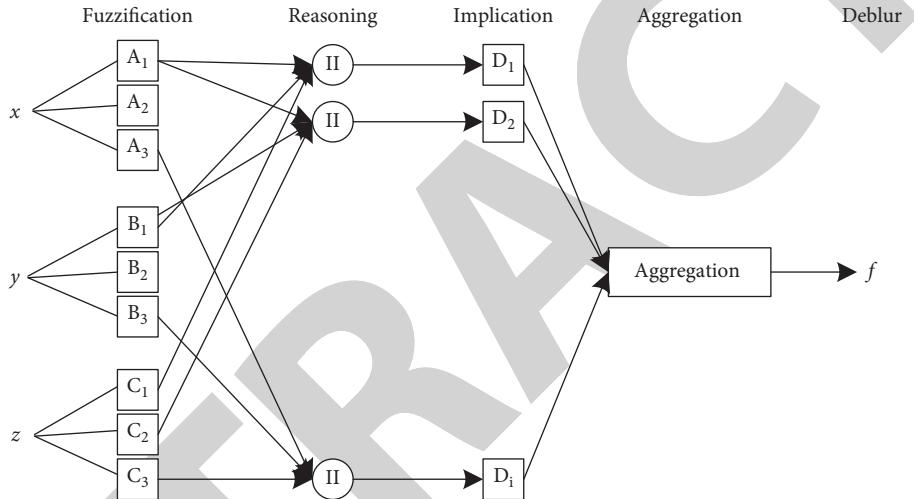


FIGURE 5: Fuzzy inference model of social security fund audit.

$$y = 1 + \frac{x}{e^{-v_1(2+v_2)}}, \quad (1)$$

where v_1 and v_2 determine the center and width of the Sigmoid function, respectively.

$$M = \frac{u}{1 + e^{v_1(u-v_2)}}, \quad (2)$$

$$N = \frac{1 + v_1}{u + e^{-v_2(1-v_1)}} \cdot v_1 \quad (3)$$

$$G = \frac{u}{1 + e^{v_2(u-v_1)}}, \quad (4)$$

where M , N , and G , respectively, represent membership values (small, medium, and large) belonging to input attributes; parameter v_1 is the parameter controlling the slope at the intersection of three membership functions; v_2 is the intersection point of membership function, which is obtained by calculating the mean and variance of sequence. Among them, the membership function values S , M , and B

are compared. The output of the maximum value is 1, and the rest are 0.

4.4. Trimming Fuzzy Neural Network. When the network training is successful, there are some redundant weights, which can be trimmed according to certain rules to minimize the number of network weights to facilitate the subsequent cluster analysis and rule extraction. Network convergence is conditional on the accuracy reaching a given error limit. The accuracy of the network refers to the difference between the expected output and the actual calculated output in the fuzzy output layer, while the correct classification of the network means that the node with the largest actual output value in the fuzzy output layer of a group of samples is the same as the node with the largest membership degree in the expected fuzzy output. The accuracy of classification is the ratio of the number of samples correctly identified by the network to the total number of samples. In this article, the purpose of trimming the network is to further optimize its structure, that is, to remove the irrelevant attributes in the audit database and determine the important audit attributes. Under the condition of not

increasing the classification error rate, the redundant weight associations and nodes are removed, and the remaining nodes and nodes can make the steps of extracting rules simpler and easier. Finally, fuzzy rule extraction is carried out.

This system tailors the experimental data and model, and the following Figures 6 and 7 are obtained for two different datasets.

In the above experiment, a three-layer neural network (input layer size is 11, hidden layer size is 30, and output layer size is 3) was combined with hidden units through analysis of the distinctiveness and the calculated results of various indicators during the pruning process of the model. The first figure compresses the Accuracy, Precision, Recall, and F1 score of the cut model, respectively. The second figure shows the time spent by the cut model to calculate the same test set. It can be seen that the clipped model can basically keep the results similar to the original model in various indicators. An obvious improvement is that the calculation time is gradually reduced along with the clipping of the model.

4.5. Cluster Analysis of Hidden Node Activation Values. The clustering problem is essentially an optimization problem, which makes the objective function of the system reach a minimum value through an iterative operation. The objective function is the evaluation function of partition, the distance is usually used as the evaluation criterion of partition, and the Euclidean distance is mainly used for the numerical attribute. There is basically a feedforward neural network between the fuzzy input layer and the fuzzy output layer in the network calculation. There is no connection between the internal nodes of the fuzzy input layer, the hidden layer, and the fuzzy output layer.

The input of each node in the hidden layer and the fuzzy output layer is the sum of the product of the output of the node in the upper layer and the weight associated with the node, and the output of each node is obtained by the input of the node through the transformation of activation function. Here, we take the activation function of hidden nodes as the inverse hyperbolic function, because its output is between 1 and +1, and the range of activation value is larger than the range of Sigmoid function, which is conducive to hidden node clustering. The method adopted is to classify the activation values within a certain classification distance by calculating the absolute value of the difference between the activation values of each hidden node. The results of cluster analysis of hidden node activation values are shown in Figure 8.

4.6. Extraction of Audit Rules. Rule extraction works by generating coverage rules. Most rule extraction algorithms start by looking for the most general coverage rule, that is, the one that covers the most instances. Then, they remove all the overwritten instances for later consideration, start over, looking for the most general rule that covers the remaining instances, and continue. After the clustering of hidden nodes is obtained, the following algorithm can be used to extract

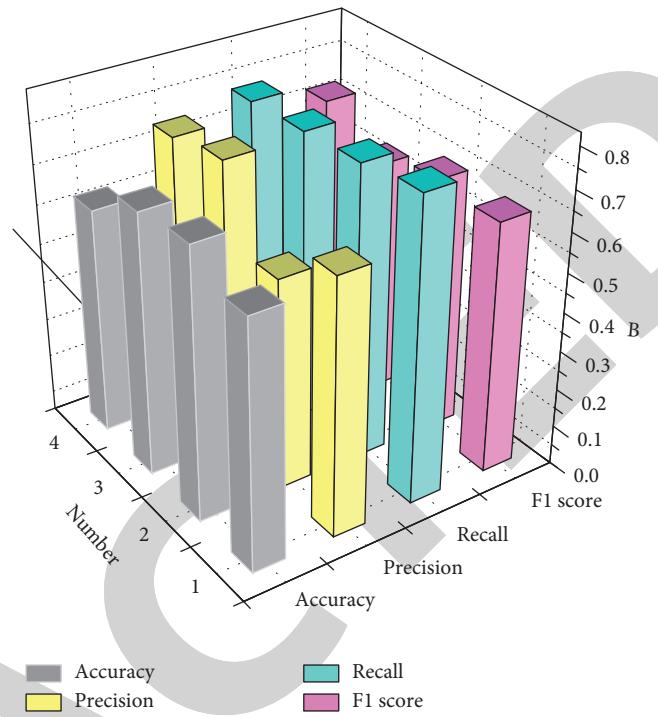


FIGURE 6: Classification based on social security financial information.

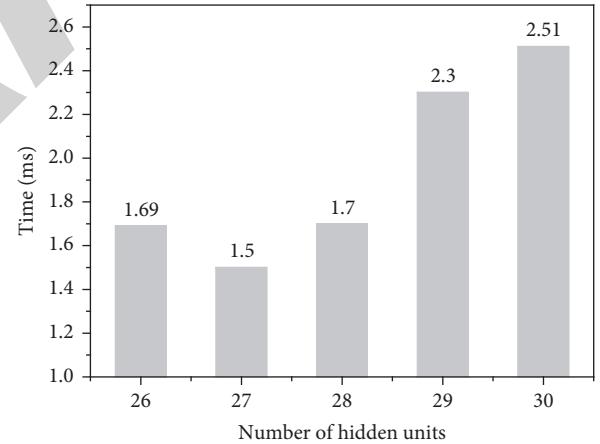


FIGURE 7: Test computation time based on the information.

rules. That is, according to the clustering of the consistently hidden nodes, the preconditions and results of the rules are combined, and the required form of audit rules is finally obtained.

$$\begin{aligned} & f((a_1 = u_1^1) \text{and} (a_2 = u_2^2) \text{and} \dots \text{and} (a_i = u_j^2)), \\ & \text{then}((y_1 = \phi_1) \text{and} (y_2 = \phi_2) \text{and} \dots \text{and} (y_i = \phi_j)). \end{aligned} \quad (5)$$

5. Verification of Social Security Fund Audit

5.1. Weight Optimization and Clipping. A fuzzy neural network with two inputs and one output is constructed, which takes the asset-liability ratio and the long-term asset

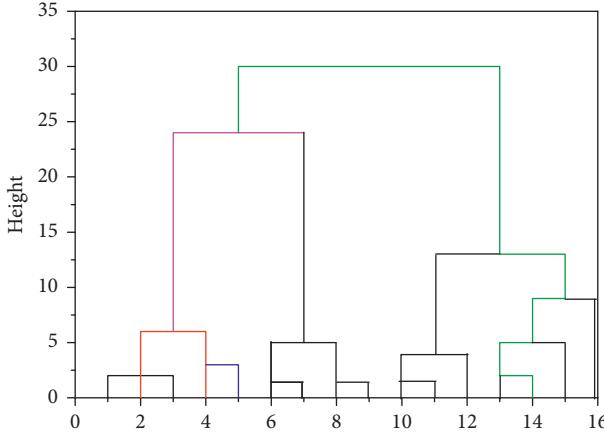


FIGURE 8: Cluster analysis of hidden node activation values.

suitability ratio as two inputs and the total asset return rate as the output. An intermediate hidden layer with 8 hidden nodes is set initially to try to extract the fuzzy rules when the input and output have fuzzy language (for example, when the asset-liability ratio is large and the long-term asset fitness ratio is large, the total asset return rate is small). After 10,000 times of training, the optimal weight was obtained through the calculation of fitness. The maximum error in the fuzzy output layer is 0.06, and the classification accuracy is 100%. After weight clipping, the error is 0.29, and the classification accuracy reaches 98%. The initial fuzzy parameters and the fuzzy parameters after training are shown in Figure 9.

5.2. Fuzzy Clustering Analysis. For each activation value, the inverse function of the hyperbolic tangent function is calculated to get the corresponding threshold value, and the weight value is clustered. After input clustering of each sample and taking the clustering distance as 0.1, it can be concluded that the first hidden layer node has four clusterings and the second hidden layer node has three clusterings. The scatterplot of the relationship between data flow and saturation is obtained, as shown in Figure 10.

5.3. Rule Extraction. REBC algorithm obtains the corresponding symbol rules from the neural network after training and pruning according to the topological structure of the neural network and the weight extraction of nodes. It is a structure-based neural network rule extraction algorithm. Through the network rule extraction of the clustering values of each hidden node, the intermediate rules from the hidden layer to the output layer are calculated. After the input mode traversal, the intermediate rules from the input layer to the hidden layer are obtained, as shown in Figures 11 and 12. The rationality of the extracted rules is verified by the substitution of actual data.

5.4. Verification Results. In 2019-2020, the financial databases of 30 state-owned large- and medium-sized enterprises in the city were analyzed, using the method of combining the fuzzy neural network and genetic algorithm to the asset-

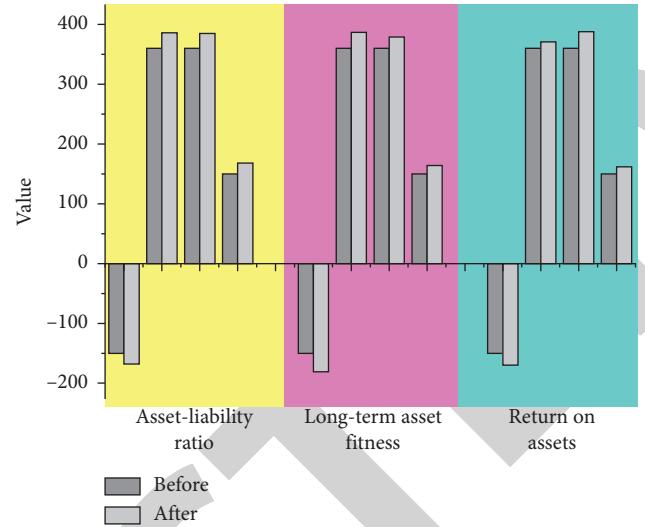


FIGURE 9: Initial fuzzy parameters and fuzzy parameters after training.

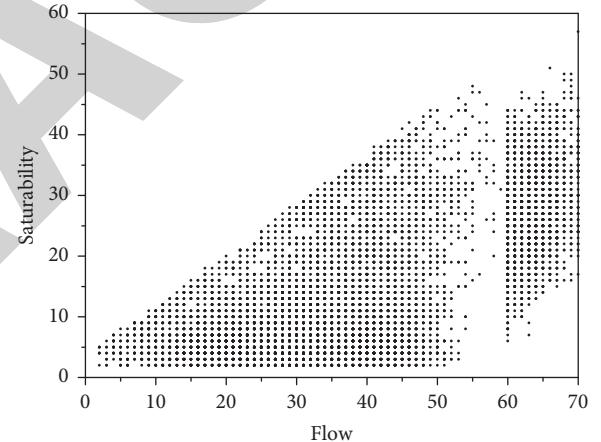


FIGURE 10: Scatter diagram of the relationship between clustering data flow and saturation.

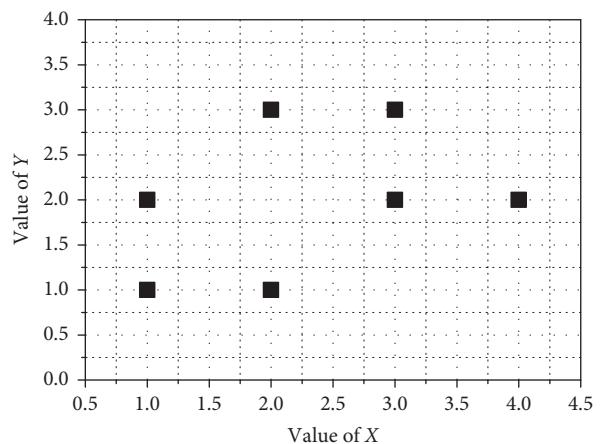


FIGURE 11: Clustering combination points of hidden layers.

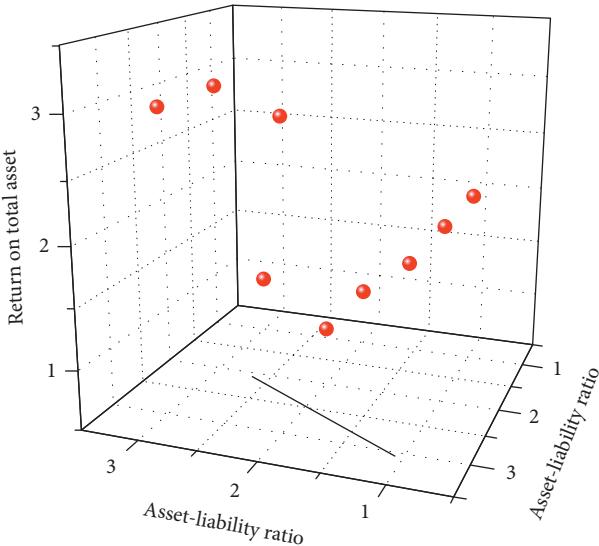


FIGURE 12: Rule extraction validation results.

liability ratio, long-term assets for rate, and the relationship between the return on total assets rules extraction to verify the validity and the rationality of the effect of data mining algorithm.

6. Conclusion

In this article, a fuzzy data mining algorithm is used to build the social security fund audit cloud platform. The general idea is to compress the knowledge contained in a large number of data into the weights between nodes and optimize the weights through the learning of the neural network system. Through the optimization function, the information contained in the neural network is stored in a few weights as far as possible. The main information is further highlighted by network clipping and removing weights that have little impact on the output. Through the network hidden layer node activation value, clustering makes the information more centralized; we will make full use of the information data warehouse contained in the future audit practice and use data mining technology to answer the audit-related questions. Therefore, it is very necessary and urgent to apply data mining technology to audit data analysis. It can be predicted that the social security fund audit using data mining technology will occupy an important position in future audit work.

Data Availability

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

Conflicts of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this article.

References

- [1] T. Cole, A. K. Bhardwaj, L. Garg, and D. P. Shrivastava, "Investigation into cloud computing adoption within the hedge fund industry," *Journal of Cases on Information Technology*, vol. 21, no. 3, pp. 1–25, 2019.
- [2] O. Boutkhoum, M. Hanine, T. Agouti et al., "A decision-making approach based on fuzzy AHP-TOPSIS methodology for selecting the appropriate cloud solution to manage big data projects," *International Journal of System Assurance Engineering and Management*, vol. 8, no. 2, pp. 1237–1253, 2017.
- [3] X. Yuan and M. Elhoseny, "Intelligent data aggregation inspired paradigm and approaches in IoT applications," *Journal of Intelligent & Fuzzy Systems*, vol. 37, no. 1, pp. 3–7, 2019.
- [4] S. Liu, Y. Dai, Z. Cai, X. Pan, and C. Li, "Construction of double-precision wisdom teaching framework based on blockchain technology in cloud platform," *IEEE Access*, vol. 9, pp. 11823–11834, 2021.
- [5] J. Sangeetha and V. S. J. Prakash, "A survey on big data mining techniques," *International Journal of Computer Science and Information Security*, vol. 15, no. 1, p. 482, 2017.
- [6] S. Raja, M. Jaiganesh, and S. Ramaiah, "An efficient fuzzy self-classifying clustering based framework for cloud security," *International Journal of Computational Intelligence Systems*, vol. 10, no. 1, pp. 495–506, 2017.
- [7] S. Parkinson, V. Somarakis, and R. Ward, "Auditing file system permissions using association rule mining," *Expert Systems with Applications*, vol. 55, pp. 274–283, 2016.
- [8] J. Xue, C. Xu, J. Zhao et al., "Identity-based public auditing for cloud storage systems against malicious auditors via blockchain," *Science China Information Sciences*, vol. 62, no. 3, p. 32104, 2019.
- [9] X. Zhang and C. Li, "The research of sentiment analysis of microblog based on data mining: exemplified by basic endowment insurance," in *Proceedings of the 2017 IEEE International Conference on Signal Processing, Communications and Computing (ICSPCC)*, pp. 1–5, IEEE, Xiamen, China, October 2017.
- [10] A. Faccia, M. Y. K. Al Naqbi, and S. A. Lootah, "Integrated cloud financial accounting cycle: how artificial intelligence, blockchain, and XBRL will change the accounting, fiscal and auditing practices," in *Proceedings of the 2019 3rd International Conference on Cloud and Big Data Computing*, pp. 31–37, Oxford, UK, August 2019.
- [11] J. Zhang, Z. Li, B. Wang, X. A. Wang, and U. Ogiela, "Enhanced certificateless auditing protocols for cloud data management and transformative computation," *Information Processing & Management*, vol. 57, no. 6, Article ID 102287, 2020.
- [12] G. S. Aujla, R. Chaudhary, N. Kumar, A. K. Das, and J. J. P. C. Rodrigues, "SecSVA: secure storage, verification, and auditing of big data in the cloud environment," *IEEE Communications Magazine*, vol. 56, no. 1, pp. 78–85, 2018.
- [13] K. S. Swami and P. Sai Kiran, "Secure cloud data deduplication with user revocation and public auditing dynamically," *Journal of Computational and Theoretical Nanoscience*, vol. 16, no. 7, pp. 2660–2665, 2019.
- [14] H. Wang and K. Islam, "An optimization model for poverty alleviation fund audit mode based on BP neural network," *Journal of Intelligent & Fuzzy Systems*, vol. 37, no. 1, pp. 481–491, 2019.
- [15] Y. Chen, H. Liu, B. Wang et al., "A threshold hybrid encryption method for integrity audit without trusted center," *Journal of Cloud Computing*, vol. 10, no. 1, pp. 1–14, 2021.

- [16] M. O. Alassafi, A. Alharthi, R. J. Walters, and G. B. Wills, "A framework for critical security factors that influence the decision of cloud adoption by Saudi government agencies," *Telematics and Informatics*, vol. 34, no. 7, pp. 996–1010, 2017.
- [17] C. Stergiou, K. E. Psannis, B. B. Gupta, and Y. Ishibashi, "Security, privacy & efficiency of sustainable cloud computing for big data & IoT," *Sustainable Computing: Informatics and Systems*, vol. 19, pp. 174–184, 2018.
- [18] S. Namasudra, "An improved attribute-based encryption technique towards the data security in cloud computing," *Concurrency and Computation: Practice and Experience*, vol. 31, no. 3, p. 4364, 2019.
- [19] M. Li, "Research on the mechanism and influence factors of urban style building based on cloud computing logistics information," *Cluster Computing*, vol. 22, no. 6, pp. 13873–13880, 2019.
- [20] C. L. Stergiou, K. E. Psannis, and B. B. Gupta, "IoT-based big data secure management in the fog over a 6G wireless network," *IEEE Internet of Things Journal*, vol. 8, no. 7, pp. 5164–5171, 2021.
- [21] Y. Zhang, G. Lin, H. Gu, F. Zhuang, and G. Wei, "Multi-copy dynamic cloud data auditing model based on IMB tree," *Enterprise Information Systems*, vol. 15, no. 2, pp. 248–269, 2021.
- [22] M. Chen, S. Lu, and Q. Liu, "Uniform regularity for a Keller-Segel-Navier-Stokes system," *Applied Mathematics Letters*, vol. 107, Article ID 106476, 2020.
- [23] J. Zhang and B. Wang, "An improved secure cloud storage auditing protocol based on distributed string equality checking," *Fundamenta Informaticae*, vol. 157, no. 1-2, pp. 185–199, 2018.
- [24] W. Liu, X. Liu, J. Liu, and Q. Wu, "Auditing revocable privacy-preserving access control for EHRs in clouds," *The Computer Journal*, vol. 60, no. 12, pp. 1871–1888, 2017.
- [25] M. C. Chen, S. Q. Lu, and Q. L. Liu, "Uniqueness of weak solutions to a Keller-Segel-Navier-Stokes model with a logistic source," *Applications of Mathematics*, pp. 1–9, 2021.
- [26] Z. Chen, J. Wang, K. Ma, X. Huang, and T. Wang, "Fuzzy adaptive two-bits-triggered control for nonlinear uncertain system with input saturation and output constraint," *International Journal of Adaptive Control and Signal Processing*, vol. 34, no. 4, pp. 543–559, 2020.
- [27] F. Orujov, R. Maskeliūnas, R. Damaševičius, W. Wei, and Y. Li, "Smartphone based intelligent indoor positioning using fuzzy logic," *Future Generation Computer Systems*, vol. 89, pp. 335–348, 2018.
- [28] J. Yang, J. Zhang, and H. Wang, "Urban traffic control in software defined internet of things via a multi-agent deep reinforcement learning approach," *IEEE Transactions on Intelligent Transportation Systems*, pp. 1–13, 2020.
- [29] F. Orujov, R. Maskeliūnas, R. Damaševičius, and W. Wei, "Fuzzy based image edge detection algorithm for blood vessel detection in retinal images," *Applied Soft Computing*, vol. 94, Article ID 106452, 2020.
- [30] K. Sim, J. Yang, W. Lu, and X. Gao, "MaD-DLS: mean and deviation of deep and local similarity for image quality assessment," *IEEE Transactions on Multimedia*, p. 1, 2020.
- [31] J. Ni, K. Zhang, and A. V. Vasilakos, "Security and privacy for mobile edge caching: challenges and solutions," *IEEE Wireless Communications*, pp. 1–7, 2020.
- [32] B. Bera, S. Saha, A. K. Das et al., "Designing blockchain-based access control protocol in iot-enabled smart-grid system," *IEEE Internet of Things Journal*, vol. 8, no. 7, pp. 5744–5761, 2021.