Received September 26, 2020, accepted October 13, 2020, date of publication October 23, 2020, date of current version November 13, 2020.

Digital Object Identifier 10.1109/ACCESS.2020.3033279

Rural Financial Information Service Platform Under Smart Financial Environment

DAI WENSHENG

China Financial Policy Research Center, Financial School, International Monetary Institute, Renmin University of China, Beijing 100872, China

e-mail: daiws@ruc.edu.cn

This work was supported by the Beijing Social Science Foundation Co-Construction Project "Research on Financial Support System for Coordinated Development of Strategic Emerging Industries in Beijing-Tianjin-Hebei Region".

ABSTRACT The development and improvement of agricultural financial information service system is of great significance to the development of rural modernization, the improvement of rural comprehensive competitiveness and the construction of new socialist countryside. The construction of rural financial information service platform is directly related to the quality of rural financial information service, and directly affects the construction of new socialist countryside. In order to solve the problems of information collection, processing and integration of rural financial information service platform in China, the diversification, personalization, timeliness and accuracy of information demand are difficult to be met, and the organization and operation mode of the platform are not perfect. In this paper, based on the intelligent sensor, the whole digital transformation is realized through the reference of big data. Based on this, this paper establishes the research model of rural financial information service platform under the smart financial environment. From the current situation of the construction and application of rural financial information service platform in China, it studies the basic situation of the construction of rural financial information service platform in China from three aspects of functional scope, service mode and operation mode, and draws the improvement conclusion. The results show that the efficiency of rural financial information service is increased by 20% after using the improved method in this paper, which has certain use value.

INDEX TERMS Smart sensor, smart financial environment, financial information service platform, big data integration.

I. INTRODUCTION

A. RESEARCH BACKGROUND AND SIGNIFICANCE OF RURAL FINANCIAL INFORMATION SERVICE PLATFORM

With the continuous development of China's rural economy, the government has led many financial reforms and made great achievements in the field of rural finance. However, with the further deepening of the reform, there are more and more obvious problems and contradictions in rural finance, rural credit cooperatives have also been affected and restructured to a certain extent. The development of new rural financial institutions has made great progress, but it is still subject to some constraints. On the basis of detailed investigation and research, this paper makes a comprehensive and in-depth analysis on the reform of rural financial services and rural credit cooperatives by using the theories of financial repression, financial service guarantee and cooperative finance. Rural credit cooperatives are faced with difficulties in business innovation, market demand, business philosophy, work style, internal control and corporate governance. Under the influence of Rural Financial Cooperatives, rural financial service industry is also facing a strong impact. External market conditions. With the reform of rural credit cooperatives, China's rural commercial banks have played an active role in agriculture, rural finance, service and support for farmers. However, due to the profitability of commercial banks, China's rural commercial banks have shown a trend of weakening support for rural economic development.

B. CONSTRUCTION OF RURAL FINANCIAL INFORMATION SERVICE PLATFORM

In terms of agricultural financial information services, China is at a relatively backward level, far behind the developed countries, and has not yet established a truly effective agricultural financial information service platform to connect developed and backward regions. This situation makes the

The associate editor coordinating the review of this manuscript and approving it for publication was Muhammad Imran Tariq.

vast rural areas still in the state of information blocking, information lag and information dislocation, which also leads to the lag of rural economic development. Due to the influence of economic conditions, consumption level, concept and other factors, the traditional media in rural information dissemination has its own insurmountable defects, such as poor feedback, service personalization is not strong, so that the majority of farmers cannot obtain. Simple, clear and practical agricultural product market information, policy information and related employment information. Mobile powered digital commerce has the potential to greatly promote financial inclusion and provide open banking services for people who have so far been isolated from it. At the macro level, it can promote economic growth and boost domestic economy and GDP. Begum M f describes that digital financial services are using digital technology to promote financial inclusion and improve financial health [1]. The determinants of consumer financial literacy and its impact on consumer financial literacy come from the survey [2]. Murendo C uses survey data from adult financial consumers to analyze the determinants of financial literacy and its impact on personal savings decisions. Financial literacy has a positive impact on the savings behavior of rural and urban residents. In addition, financial knowledge has a positive impact on informal and formal savings. In order to improve personal savings behavior, we need to take policy intervention measures to promote the popularization of financial knowledge [3]. The Koomson I study explores the impact of financial inclusion on poverty and poverty vulnerable families. Using the data extracted from the survey of living standards, this paper uses multiple correspondence analysis to generate financial inclusion index, and uses three-stage feasible least squares method to estimate the vulnerability of family poverty. In the tool variable probit technology, the distance from the nearest bank is used as a tool to solve the endogenous problem of financial inclusion [4]. Anwar m studies the relationship between the efficiency of rural banks and their loan provision to small and micro enterprises. Rural banks are special banks, usually located in regions and sub regions, and they are very involved in lending to MSBS. Anwar m uses data envelopment analysis to empirically analyze the technical efficiency of rural banks, and uses panel data analysis to reveal the impact of rural banks' efficiency on their loan provision to Minsheng Bank [5]. Parida AK proposes a local recurrent neuro fuzzy information system based on Chebyshev polynomial function for financial data forecasting and analysis [6]. TSK type feedforward fuzzy neural network usually used can not make full use of the advantages of linear fuzzy rule base in accurate input-output mapping, so the subsequent part of the rule base is nonlinearized by polynomial or arithmetic basis function. Chebyshev polynomial function provides an extended nonlinear transformation for the input space, thus increasing its dimension to capture nonlinear and chaotic changes in financial or energy market data streams. The local recurrent neuro fuzzy information system (lrnfis) includes feedback loops in both the emission intensity layer and the output layer to allow the signal to flow forward and backward, so that the lrnfis can simulate a dynamic system and provide fast convergence and accuracy in predicting time series fluctuations [7].

C. RESEARCH INNOVATION OF FINANCIAL INFORMATION SERVICE PLATFORM

Starting from the relationship between the construction of new socialist countryside and the construction of rural financial information service platform, this paper points out the role of the construction of rural financial information service platform in the construction of new socialist countryside. Through the analysis of the current situation of the construction of rural financial information service platform in the construction of new socialist countryside, this paper finds out the problems existing in the construction of rural financial information service platform, carries out in-depth analysis, and finally puts forward countermeasures. This paper studies the basic situation of China's rural financial information service platform construction from three aspects, and draws the improvement conclusion. The main innovations are as follows:

1) Based on the research and analysis of the rural financial information service platform, the construction scheme of the rural financial information service platform is established by using advanced technology and fuzzy mathematics trend prediction method. The construction scheme can provide reference for the construction and development of rural financial information service platform in other industries and regions, and has good promotion value.

2) Visit the agricultural information service platform in typical areas, find out their problems and shortcomings through personal experience, explore their advantages, find out their characteristics, and summarize the advanced experience of establishing rural information platform in various places.

II. RESEARCH METHODS OF RURAL FINANCIAL INFORMATION SERVICE UNDER THE SMART FINANCIAL ENVIRONMENT

A. FUZZY MATHEMATICS TREND PREDICTION METHOD

When fuzzy neural network is faced with big data processing, the serial execution of single machine often becomes the bottleneck. However, with the application of cloud computing more and more widely, many intelligent algorithms can adapt to the cloud platform by improving the parallelism, so as to solve the problem through the efficiency integration, and the cloud computing platform is more likely. Integrate cheap computers into computing clusters for centralized management. This trend is becoming more and more obvious to solve the bottleneck of processing massive data in fuzzy neural network network. More and more data have been accumulated in e-commerce, chemical production, automatic control, scientific diagnosis and other fields. Only relying on the traditional manual retrieval and statistical analysis methods, not only heavy workload, processing difficulty, strong subjectivity, but also can only find some general trends, it is difficult to find the tacit knowledge and rules of the data set [8]. The rapid growth of data leads to the phenomenon of "rich data and insufficient knowledge" in this field. How to make full use of and mine these data and analyze the hidden association between data is one of the main entry points for researchers in the field of data mining. In the field of data mining, Apriori algorithm and FP growth algorithm are usually used. Through the analysis of association rules, hidden data connections and patterns can be found, which can help scientific decision-making in this field. The formal definition of association rule mining is as follows:

$$Supp\,(x \rightarrow y) = \frac{\sigma\,(X \cup Y)}{|N|} \tag{1}$$

$$conf\,(x \rightarrow y) = \frac{\sigma\,(X \cup Y)}{\sigma\,(X)} \tag{2}$$

The meaning of the support of rule $x \rightarrow y$ is the probability of the existence of x and y in the item, and the meaning of the confidence of the rule is the probability of y occurring when the item appears [9], [10]. The measurement of support and confidence of association rules is an important criterion for judging association rules. The degree of support reflects the usefulness of the rules formulated, and the degree of confidence reflects the credibility of the rules. According to the two attributes of the extracted frequent item sets whose support and confidence are greater than a given threshold, a candidate k-dimensional item set is generated without generating a data set in the k-1 dimensional frequent item set generated in the previous cycle [11], [12]. First, generate candidate one-dimensional frequent itemsets from frequent itemsets, and then delete all infrequent subsets in the database to generate one-dimensional frequent itemsets C. Then, frequent itemsets are self-joined to generate candidate two-dimensional frequent itemsets, and all infrequent subsets are deleted to generate two-dimensional frequent itemsets. In the same way, the candidate k itemsets are generated by connecting frequent k-1 dimensional itemsets, and the candidate k+1 dimensional itemsets are pruned through the infrequent itemsets in the candidate k itemsets until all frequent itemsets are generated [13]. The algorithm flow chart is shown in Figure 1:

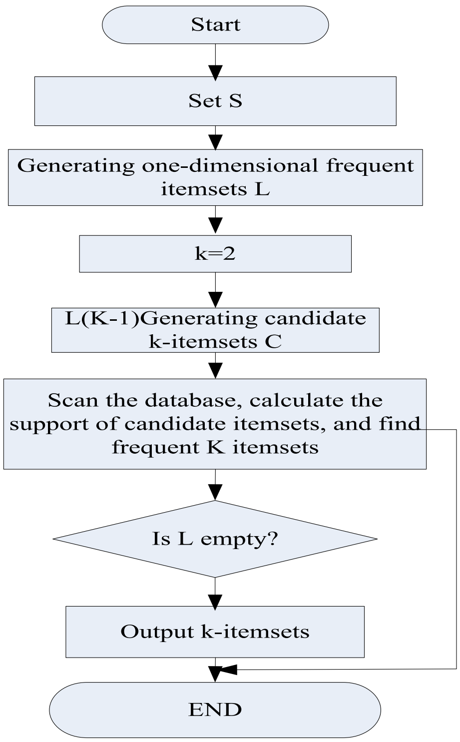

FIGURE 1. Flow chart of fuzzy mathematics trend prediction algorithm.

B. SaaS SERVICE MODEL

SaaS (software as a service) refers to the cloud computing functions provided to consumers, which use the application systems provided by providers, which run on the cloud infrastructure [14]–[16]. Users can access these applications from various client devices through web browser interface or program interface. In addition to setting limited user specific application configuration, consumers do not need to manage or control cloud infrastructure including network, server, operating system, storage, etc., or even need to consider individual application functions. For SaaS service providers, enterprises do not need to purchase additional servers, develop software systems and maintain software and hardware [17]. They only need to access the service provider's system through the Internet, and then they can use mail system, customer management system and human resources. SaaS users can use the software as planned by paying the necessary rental fee [18], [19]. SaaS service aims to integrate the general needs of users and achieve the goal of reducing costs through sharing.

In the personalized recommendation module of the system model, users and service products are regarded as two kinds of nodes. Users choose products to establish connection lines. Therefore, the user set is defined as u_i, i ∈ (1, m), and the service product set is defined as P_j, J ∈ (1, n). If the user UI selects the product PJ, that is, a corresponding relationship is established, the connection is used. At this point, Aji = 1, otherwise Aji = 0, thus forming a bipartite graph composed of N + m nodes [20], [21]. In resource allocation, each product allocates resources equally to the users who select the product through the edge of the connection; on the contrary, each user allocates all resources to the selected product through the edge of the connection. The weighted method is used to allocate u_i and P_j resources twice. The first was from PJ to user interface, and the second was from u_i to P_j.

As shown in Figure 2, P_j, u_i, j ∈ (1, n), i ∈ (1, m). After the first resource allocation, we get the following results:

$$f\,(u_i) = \sum_{i-1}^{n} \frac{a_{ji} f\,(p_j)}{k\,(p_j)} \tag{3}$$

$f\,(u_1)$ is the resource obtained by user u_1, and $k\,(p_j)$ is the degree of product p_j, that is, the number of users who choose

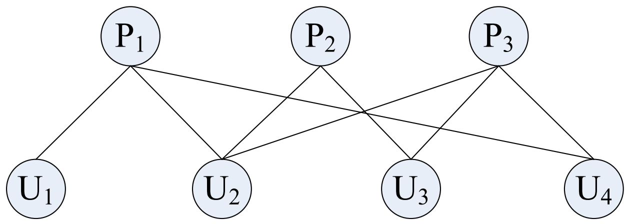

FIGURE 2. Resource allocation diagram.

this product [22]. For a specific target user 1, the selected initial product resource is set to 1, other resources are set to 0, and $f\left(p_j\right)$ represents the initial resource. If p_j is selected, the second resource allocation will return from u_i to p_j and get:

$$f\left(p_j\right)=\sum_{l-1}^{m}\frac{a_{jl}f\left(u_l\right)}{k\left(u_l\right)}=\sum_{l=1}^{m}\frac{a_{jl}}{k\left(u_l\right)}\sum_{i=1}^{n}\frac{a_{il}f\left(p_i\right)}{k\left(p_i\right)} \tag{4}$$

The above formula can also be expressed as follows:

$$f\left(p_j\right)=\sum_{i=1}^{n}w_{ij}f\left(p_i\right) \tag{5}$$

$$f\left(p_j\right)=\sum_{i=1}^{n}w_{ij}f\left(p_i\right) \tag{6}$$

Among them:

$$w_{ij}=\frac{1}{k\left(p_j\right)}\sum_{l=1}^{m}\frac{a_{il}a_{jl}}{k\left(u_1\right)} \tag{7}$$

If the adjacency matrix a_{il} with A $= \{a_{il}\}$ n $*$ m, then when p_i and u_l are connected, the values of row i and column l are 1, otherwise they are 0.

For a specific user interface, all unselected product sets p_j ($1 \leq$ j $\leq$ n, $= 0$) are sorted in descending order according to the value of $f\left(p_j\right)$, and then the top-level products are recommended to users [23], [24]. The specific number of recommended products depends on the length of the recommended list of the recommendation system. It should be pointed out that due to the different initial resource conditions of M users, the number of runs of the formula is also different.

C. DISTRIBUTED COMPUTING MODEL

Distributed algorithms are a very broad and active field [25], including classic problems such as leader election, network search, spanning tree construction, distribution consistency, mutual exclusion, resource allocation, synchronization, global snapshots, and reliable communication. Distributed computing is a computer science. It studies how to divide a problem that requires huge computing power into many small parts, then distribute these parts to many computers for processing, and finally obtain the final result by combining these calculation results. Conceptually, many computing tasks are easy to understand [26]. However, due to the large amount of data to be input, the calculation can only be completed in an acceptable time if the calculation is distributed across hundreds of computers. How to calculate in parallel, distribute data, and handle errors, all these problems are combined together, making the original calculation very simple, requiring a lot of complex code to deal with these problems. Distributed computing systems usually need to meet the following basic conditions: each computing node can communicate with each other; it needs a specific task scheduling strategy and fault tolerance mechanism; each computing node should be independent of each other. Due to the different implementation methods of data storage, data distribution and result integration, distributed computing has formed a very different system [27], [28].

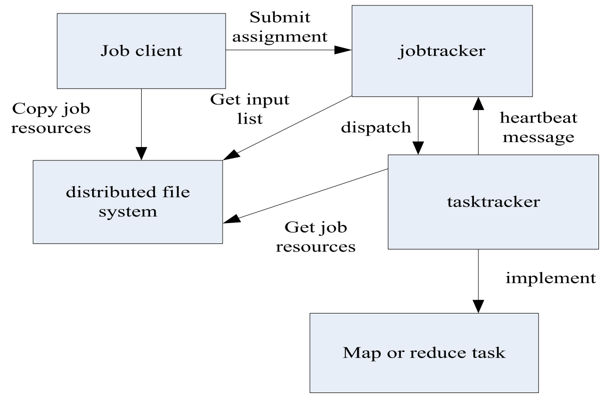

FIGURE 3. Flow chart of distributed computing system.

The calculation process of the entire job starts from the client, and the client submits the job through the interface provided by the system. The whole process is as follows: job submission > mapping task allocation and execution > reduction of task allocation and execution > job completion. When performing each task, it is divided into three sub-steps: preparing input, executing algorithm, and generating output. The specific process of each sub-stage is shown in Figure 3:

D. MULTI-SENSOR NETWORK ALGORITHM

For the multi-sensor network algorithm constructed by the rural financial information service model, it can be embedded into the parallel structure according to the specific operation defined by it, and only need to modify the corresponding operator calculation program. Other structures need not be adjusted. Most of the research direction of multi-sensor network algorithm is to estimate the single transfer function vector of the network [29]. In order to solve the real-time data processing in the network, many algorithms are proposed [30]. It includes consistency algorithm, increment algorithm and diffusion algorithm. The multi-sensor network algorithm has good scalability and stability, which can make the network have the ability of learning and adopting. This method has been well applied to biological networks with complex and self-organizing behaviors, and can solve common optimization problems:

$$\begin{cases} x_k = v_{k,i} \\ v_k = \mu_{k,i}, \end{cases} \quad k=1,2,\ldots,n \tag{8}$$

For each node k, $(k \in v)$ in the upper structure, vector $x_k, i \in R^3$ represents the position information of node k at time i, and vector $v_k, i \in R^3$ represents the speed information of node k at time i. According to the above formula, the position of node k at the next time i+1 can be expressed as:

$$x_{k,i+1} = x_{k,i} + \Delta t \cdot v_k, \quad i+1 \tag{9}$$

For the entire sensor network model, the estimated cost function of a single node w^0 for the target position (using the mean square error criterion) can be expressed as:

$$j_k (w) = w^0 - w_{k,i} \tag{10}$$

The purpose of distributed processing is to obtain the best solution of the above formula only through local data, local collaboration and local multi-sensor network. Since nodes have a common goal w^0, an important issue is how to formulate a collaboration strategy so that each node in the entire network can obtain better results than each node can obtain the best solution through collaboration. Another important issue is how to make the nodes in the network iterate continuously and exchange information flows with each other in real time [31].

III. RESEARCH ON RURAL FINANCIAL INFORMATION SERVICE PLATFORM UNDER SMART FINANCIAL ENVIRONMENT

A. DATA SOURCES

This paper tests its performance on real data sets. One of the test data sets is the real-time data collected by ZigBee wireless sensor network deployed in all financial outlets in a certain rural area within 36 days. These real-time data are obtained by sampling passenger flow and customer business module of financial outlets every four hours. Since the sensor nodes have no spatial correlation, each node independently models the local monitoring value, so the data transmission ability of the node is an important index to evaluate the algorithm.

1) DATA PROCESSING STEPS

For wireless sensors with redundant data, effective data aggregation strategy should fully consider various factors, including the collection of original data, feature attribute extraction, judgment of aggregation processing and data processing algorithm.

(1) The original data is collected in the database, and various useful information can be obtained through various sensors. Through the analysis of information data, we can know that through scalar quantization, sensor data of many sensors can be transformed into characteristic and meaningful data.

(2) After the sensor node collects the original data, the feature attributes are extracted, and the collected data and some other feature attributes will be sent to the next hop node. These characteristic attributes include data sampling time, residual energy of current node, packet length, etc. Therefore, when collecting different types of data sources, the information needs to be classified and processed.

(3) In cluster based WSN, data aggregation based on data correlation, cluster head node usually receives data from many member nodes in the cluster.

(4) Finally, the multi-sensor network algorithm is used to calculate according to the different data types in the packet [32], and the cluster head node will classify different data sources. If these data are the same type of data, there will be spatial correlation between the data of adjacent sensor nodes, and there will be a certain temporal correlation between the data collected by the same node in the adjacent time period.

B. TEST METHOD

Black box test: black box test regards the test object as a black box, regardless of the internal logic structure and internal characteristics of the program, only checks whether the function of the program meets its requirements according to the internal specification of the program. Function description. White box test: test the program according to the internal structure of the software. At this point, it considers not only the specifications, but also the internal structure. White box testing regards the test object as an open box. Testers can use the internal logical structure and relevant information to design or select test cases, and test all logical paths of the program. By checking the status of the program at different points to determine whether the actual state is consistent with the expected state.

IV. TEST AND ANALYSIS OF FINANCIAL INFORMATION SERVICE PLATFORM

A. ANALYSIS OF PLATFORM DATA PROCESSING RESULTS

As shown in Table 1 and table 2, the implementation effect of the scheme is verified by collecting, processing and storing the data of its business system. The data collection time is set as the real-time data collected by the ZigBee wireless sensor network deployed in all financial outlets in a certain rural area within 36 days. The collected data is mainly the flow information of villagers' business table. The collected data is saved in the platform data table, which is divided into two tables: Basic identity information table and business processing information table. After data access, compare and verify the data: in its business system, there are 62756 data in the financial network service platform, and 63008 data in the current basic information list of the platform. Apart from the imperfection of his original data, the data items are basically consistent. In order to reduce the influence of other factors on the experimental results, the average value of the two data processing results is taken as the experimental results.

Financial information service platform in different scales of data centralized processing, and independent system as a reference. In the stand-alone mode, the financial information service platform runs completely locally without using HDFS or loading any financial information service platform

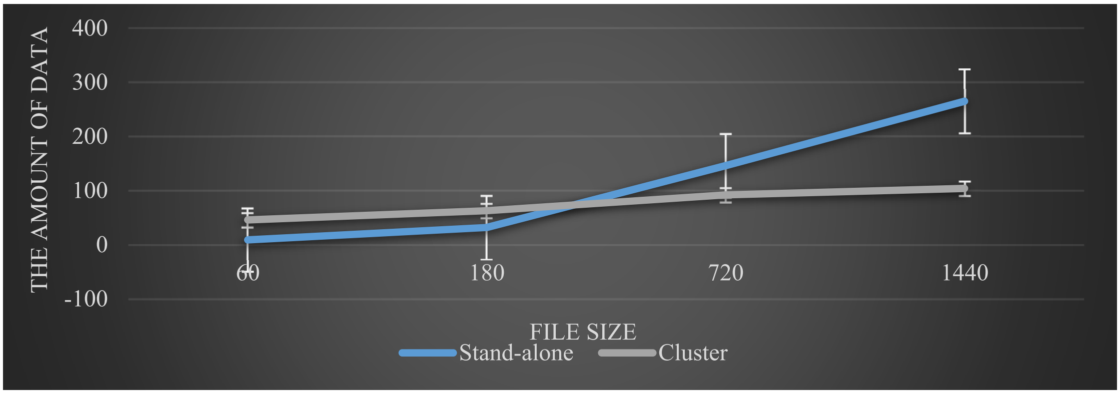

FIGURE 4. Processing efficiency of platform cluster system.

TABLE 1. Performance comparison of different algorithms.

File size	The amount of data	Multi-sensor network algorithm	Parallel algorithm
60	120	46	9
180	240	63	32
720	360	92	146
1440	480	104	265

TABLE 2. Performance comparison of different algorithms 2.

File size	The amount of data	Multi-sensor network algorithm	Parallel algorithm
60	120	35	17
180	240	42	43
720	360	96	138
1440	480	126	356

daemons. The size of data source file is 60MB, 180MB, 720mb and 1440mb respectively. By default, the textinput format interface is used to read and process files in HDFS in behavioral units. A line is an independent record, so the amount of data can represent the workload of the system. The corresponding data volumes of these documents are 1.2 million, 2.4 million, 3.6 million and 4.8 million respectively. The number of cluster nodes is 4.

As shown in Figure 4, the energy consumption ratio of both multi-sensor network algorithm and parallel algorithm decreases with the number of sensor nodes, which indicatesthat the more the number of sensor nodes and the larger the data scale, the smaller the energy consumption ratio of the algorithm. This is because the platform needs to return almost all the sensed data, and the more nodes, the more data

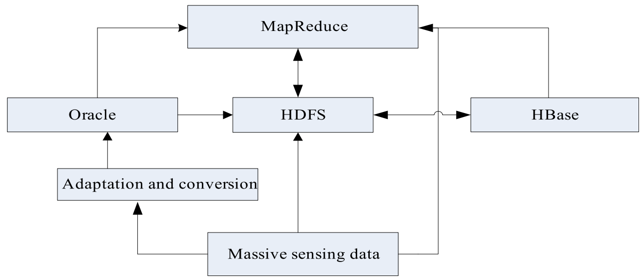

FIGURE 5. Distributed and parallel processing model structure diagram.

they need to return, and the more energy they consume. Both multi-sensor network algorithm and parallel algorithm aim to reduce the amount of data transmission in the process of data return, thus avoiding the return of a large number of useless data. Therefore, when the number of sensor nodes increases, the increment of data returned by these algorithms is far less than that of traditional methods.

Therefore, the conclusion of this paper is that the rural financial information service platform has obvious advantages in processing large data sets, which can significantly save working time and improve work efficiency, and the larger the data set, the more obvious the advantages. However, it is not as good as a single node system when dealing with small-scale data, because the time used in task scheduling cannot be ignored.

B. TEST AND ANALYSIS OF PLATFORM DATA STORAGE PERFORMANCE

As shown in Figure 5, the storage layer consists of Oracle, HBase and HDFS. A large number of sensor data collected can be directly stored in HDFS, and the effective information can be analyzed through adjustment and transformation, and then inserted into Oracle database in real time. Oracle is responsible for storing current sensing information and supporting simple retrieval tasks. In order to make up for the deficiency of Oracle's query efficiency for large data sets, the data in Oracle database is written into HDFS and HBase regularly. In HDFS, Hadoop, as the foundation of

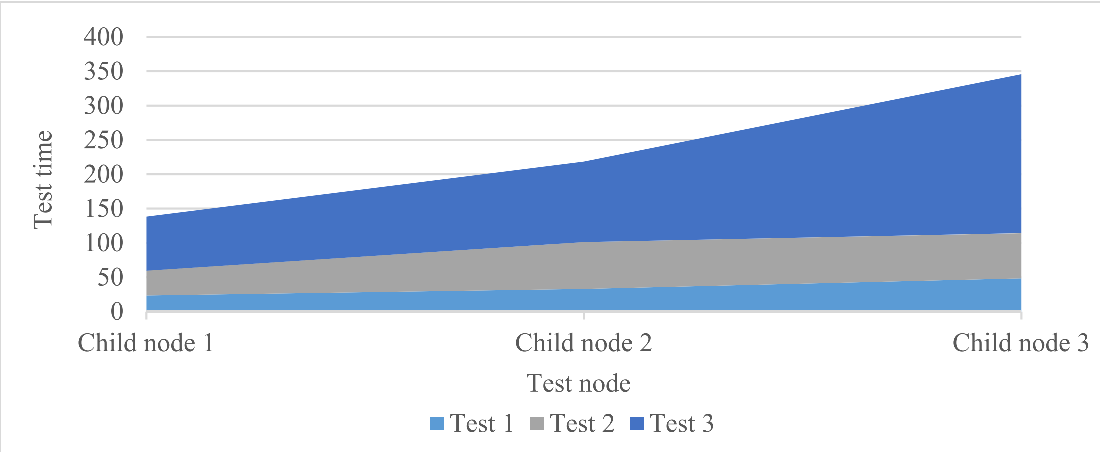

FIGURE 6. The relationship between relative concurrency and the number of child nodes.

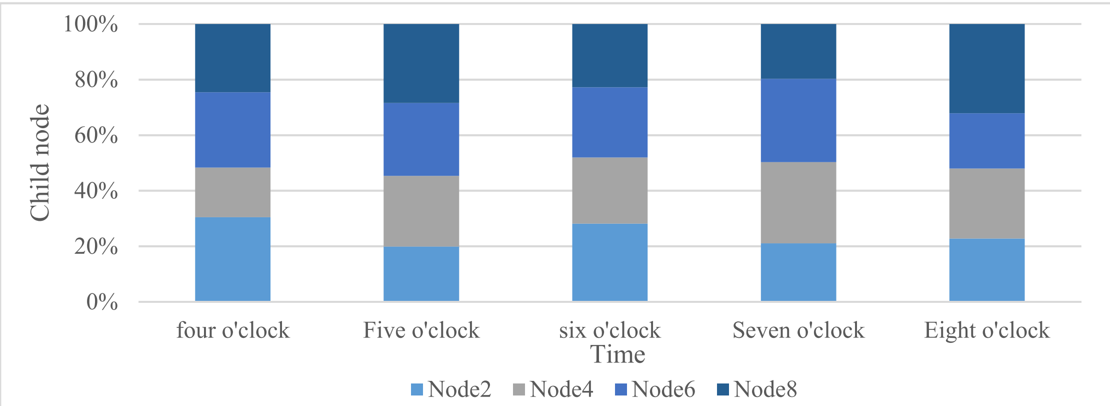

FIGURE 7. Comparison of node load performance.

distributed storage and sensing, supports a large amount of data processing. High capacity loads are used to transfer data between them. Batch loading is an effective tool for importing batch data provided by HBase.

Then consider the deployment of the computing layer. The main task is to process a large amount of sensor information through parallel computing. The parallel calculation of sensor information adopts the MapReduce model. MapReduce is suitable for write once and read many applications. The MapReduce parallel computing model can be used to randomly access static sensor information. Its outstanding advantages are scalability and availability. In addition, the keys and values input by MapReduce are not inherent attributes of the data, but are chosen by the programmer. Therefore, the data can only be interpreted when it is processed. It is particularly suitable for mixed processing of large amounts of structured, semi-structured and unstructured data, such as plain text or image data. This leads to very efficient processing of unstructured data.

As shown in Figure 6, the test carries out the concurrent performance test of query from 1 child node, 2 child nodes, and 3 child nodes, and the time required to query single point data for ten thousand times without index.

If the system does not have an index. As the number of child nodes increases, the overall concurrent performance of the system also improves. It can be seen from the trend graph in the figure that the relationship between the two is gradually increasing, that is, after each additional child node enters the system, it can provide the system with a single child node concurrency equal to the time. With the continuous increase of child nodes, it can achieve higher overall concurrency.

C. PLATFORM NODE LOAD PERFORMANCE TEST ANALYSIS

As shown in Figure 7, any unique record data is inserted into the database every minute. The memory capacity provided by each child node, and the length of each record is bytes. The system runs for a day and records the load of each child node every four hours. No child nodes will be added or deleted during the operation. When a node leaves the system, the system will quickly re-balance the load (5 o'clock), but because the same copy cannot be stored in the same node at the same time, the node will not be able to fully balance; when the node joins the system (7 o'clock), the system Give priority to the newly added node. It can be seen from the table that in the subsequent operation process, the system will consider new nodes. In the system, the maximum load distance between nodes is shrinking, and the whole system tends to gradually balance.

In the case of single node or multi node, the transaction processing ability and concurrency performance of memory based distributed database are much better than those of traditional disk database. There is an order of magnitude gap between specific performance indicators [33]. At the same time, compared with the test results of the memory database, we can see that the performance of the single node is slightly lower, but still in the comparable range. The concurrency performance of distributed memory database can be expanded by increasing the number of sub nodes. Through the test data, it can be concluded that each additional sub node in the system can provide about twice the number of concurrent nodes in a single node for the whole distributed database, and the system can achieve million level concurrency.

V. CONCLUSION

In order to solve the problems of information collection, processing and integration of rural financial information service platform in China, the diversification, personalization, timeliness and accuracy of information demand are difficult to be met, and the organization and operation mode of the platform are not perfect. In this paper, based on the intelligent sensor, the whole digital transformation is realized through the reference of big data. Based on this, this paper establishes the research model of rural financial information service platform under the smart financial environment, and studies the basic situation of the construction and application of rural financial information service platform in China from three aspects: function scope, service mode and operation mode.

The problems existing in the construction and application of rural financial information platform by agricultural financial institutions are studied theoretically, and how to solve the existing problems is discussed. Through the establishment of rural financial information service platform suitable for China's national conditions and regional characteristics, the establishment of a sound organization, operation and operation mechanism plays an important role in promoting the development of rural financial information, improving the overall level of rural financial information, and building a new socialist countryside. Service mode. Through the full text analysis, this paper draws the following main conclusions. This paper studies the key technologies of big data, mainly SaaS service model, distributed parallel computing technology and multi-sensor network algorithm. On this basis, a sensor information processing system is designed. This paper analyzes the characteristics of open sensor information and big data on the Internet of things service platform, and studies the key technologies of cloud computing, mainly SaaS service model and distributed parallel computing technology. On this basis, a sensor information processing system is designed. After comparing the existing distributed and parallel computing systems, Hadoop is chosen as the distributed and parallel processing method. This paper analyzes the Hadoop distributed file system HDFS and distributed database HBase and their data organization structure, storage mechanism, read-write process, and studies the idea and implementation process of MapReduce algorithm.

MapReduce programming model is easy to use. Users only need to use this programming model to define simple operations. Parallelization, fault tolerance, data distribution, load balancing and other complex details are encapsulated in the library. Modular method the system implementation of this paper adopts the modular method, and realizes each part of the system one by one. Each part of the system can be designed with different languages, and the storage model used is not necessarily consistent. The result of large data set system is better than that of small data set, which fully reflects the powerful ability of the model for complex data. In this paper, Hadoop processing method is successfully used to realize the massive sensor information processing, so as to realize the intelligent service on the Internet of things service platform. However, due to the complex sources, diverse structures and wide applications of massive sensing information, the system is not enough for data processing with different structures and high complexity. In the future research work, we should further improve the system's ability to process heterogeneous data.

REFERENCES

[1] M. F. Begum, "An overview of digital financial services in India: Concept, initiatives and advantages," *Asian J. Manage.*, vol. 9, no. 3, pp. 1139–1144, 2018.

[2] L. Guo, T. Sriyakul, S. Nojavan, and K. Jermsittiparsert, "Risk-based traded demand response between consumers' aggregator and retailer using downside risk constraints technique," *IEEE Access*, vol. 8, pp. 90957–90968, 2020.

[3] C. Murendo and K. Mutsonziwa, "Financial literacy and savings decisions by adult financial consumers in zimbabwe," *Int. J. Consum. Stud.*, vol. 41, no. 1, pp. 95–103, Jan. 2017.

[4] I. Koomson, R. A. Villano, and D. Hadley, "Effect of financial inclusion on poverty and vulnerability to poverty: Evidence using a multidimensional measure of financial inclusion," *Social Indicators Res.*, vol. 149, no. 2, pp. 613–639, Jun. 2020.

[5] M. Anwar, S. R. Nidar, R. Komara, and L. Layyinaturrobaniyah, "Rural bank efficiency and loans for micro and small businesses: Evidence from west java Indonesia," *Int. J. Emerg. Markets*, vol. 15, no. 3, pp. 587–610, Sep. 2019.

[6] M. Elhoseny, G.-B. Bian, S. K. Lakshmanaprabu, K. Shankar, A. K. Singh, and W. Wu, "Effective features to classify ovarian cancer data in Internet of medical things," *Comput. Netw.*, vol. 159, pp. 147–156, Aug. 2019.

[7] A. K. Parida, R. Bisoi, and P. K. Dash, "Chebyshev polynomial functions based locally recurrent neuro-fuzzy information system for prediction of financial and energy market data," *J. Finance Data Sci.*, vol. 2, no. 3, pp. 202–223, Sep. 2016.

[8] R. J. Hill and I. A. Syed, "White paper on 'financial services in the united kingdom'—I," *Rev. Income Wealth*, vol. 61, no. 3, pp. 153–164, 2015.

[9] F. Radu, C. Giju, and A. I. Tăbîrcă, "The place and role of information system in exercising the financial control," *Valahian J. Econ. Stud.*, vol. 7, no. 2, pp. 63–68, Dec. 2016.

[10] C. Jing, "Budget-financial integration information system development and application," *Sci. Technol. Innov.*, vol. 51, no. 3, pp. 185–192, 2015.

[11] Q. Jing-Wen, "Financial information management system based on UML," *Electron. Design Eng.*, vol. 22, no. 5, pp. 263–274, 2015.

[12] E. Pagourtzi, S. Makridakis, V. Assimakopoulos, and A. Litsa, ''The advanced forecasting information system PYTHIA,'' *J. Eur. Real Estate Res.*, vol. 1, no. 2, pp. 114–138, Jul. 2008.
[13] D. Maitra and P. Upadhyay, ''Fostering rural financial services through technology: The case of FINO PayTech,'' *Asian Case Res. J.*, vol. 21, no. 01, pp. 81–117, Jun. 2017.
[14] B. Hutahayan, ''The mediating role of human capital and management accounting information system in the relationship between innovation strategy and internal process performance and the impact on corporate financial performance,'' *Benchmarking, Int. J.*, vol. 27, no. 4, pp. 1289–1318, Apr. 2020.
[15] G. Mesri, ''BBC may float online arm - beeb.com - company financial information,'' *Int. J. Control Autom.*, vol. 7, no. 2, pp. 214–221, 2015.
[16] Z. Lv, L. Qiao, D. Chen, R. Lou, J. Li, and Y. Li, ''Machine learning for proactive defense for critical infrastructure systems,'' *IEEE Commun. Mag.*, 2020.
[17] N. Krishnaraj, M. Elhoseny, E. L. Lydia, K. Shankar, and O. Aldabbas, ''An efficient radix trie-based semantic visual indexing model for large-scale image retrieval in cloud environment,'' *Softw. Pract. Exper.*, 2020.
[18] J. Wang, M. Gupta, and H. R. Rao, ''Insider threats in a financial institution: Analysis of attack-proneness of information systems applications,'' *MIS Quart.*, vol. 39, no. 1, pp. 91–112, Jan. 2015.
[19] I. Ricardo, A. Gui, and C. Sabrina, ''Hospitality management information system investment (feasibility study at PT ABC),'' *Adv. Sci. Lett.*, vol. 21, no. 4, pp. 980–983, Apr. 2015.
[20] C. Sabrina, A. Gui, and H. Hendarti, ''Feasibility study for investment fixed asset information system (case study at panasonic manufacturing Indonesia),'' *Adv. Sci. Lett.*, vol. 21, no. 4, pp. 970–972, Apr. 2015.
[21] Y. Glèlè Ahanhanzo, E.-M. Ouendo, A. Kpozèhouen, A. Levêque, M. Makoutodé, and M. Dramaix-Wilmet, ''Data quality assessment in the routine health information system: An application of the lot quality assurance sampling in benin,'' *Health Policy Planning*, vol. 30, no. 7, pp. 837–843, Sep. 2015.
[22] F. Rangraz Jeddi, M. Adib Hajbaghery, H. Akbari, and S. Esmaili, ''Technological feasibility of a nursing clinical information system,'' *Electron. physician*, vol. 8, no. 9, pp. 2942–2949, Sep. 2016.
[23] M. A. Rahman, M. A. Islam, and Q. Xu, ''Barriers in adopting human resource information system (HRIS): An empirical study on selected Bangladeshi garments factories,'' *Int. Bus. Res.*, vol. 10, no. 6, pp. 98–103, 2017.
[24] C. S. Dorsch, ''On the sound financial valuation of flexibility in information systems,'' *Bus. Inf. Syst. Eng.*, vol. 57, no. 2, pp. 115–127, Apr. 2015.
[25] B. Cao, J. Zhao, Z. Lv, Y. Gu, P. Yang, and S. K. Halgamuge, ''Multiobjective evolution of fuzzy rough neural network via distributed parallelism for stock prediction,'' *IEEE Trans. Fuzzy Syst.*, vol. 28, no. 5, pp. 939–952, May 2020.
[26] J. Hoffmann and P. Heimes, ''Informationssystem-architekturen produzierender unternehmen für die digitalisierung gestalten,'' *HMD Praxis der Wirtschaftsinformatik*, vol. 55, no. 5, pp. 984–1005, Oct. 2018.
[27] O. Yiwen, ''Analyzing the impacts of implementation of human resource information system in mergers and acquisitions,'' *Technol. Econ. Guide*, vol. 35, pp. 18–20, 2016.
[28] D. S. Paraforos, V. Vassiliadis, D. Kortenbruck, K. Stamkopoulos, V. Ziogas, A. A. Sapounas, and H. W. Griepentrog, ''A farm management information system using future Internet technologies,'' *IFAC-PapersOnLine*, vol. 49, no. 16, pp. 324–329, 2016.
[29] S. K. Lakshmanaprabu, M. Elhoseny, and K. Shankar, ''Optimal tuning of decentralized fractional order PID controllers for TITO process using equivalent transfer function,'' *Cognit. Syst. Res.*, vol. 58, pp. 292–303, Dec. 2019.
[30] C. S. Dorsch, ''On the sound financial valuation of flexibility in information systems,'' *Bus. Inf. Syst. Eng.*, vol. 57, no. 2, pp. 1–13, 2015.
[31] J. P. Bruwer and Y. Smit, ''Accounting information systems—A value-adding phenomenon or a mere trend? The situation in small and medium financial service organizations in the cape metropolis,'' *Expert J. Bus. Manage.*, vol. 3, no. 5, pp. 1235–1261, 2015.
[32] W. Elsayed, M. Elhoseny, S. Sabbeh, and A. Riad, ''Self-maintenance model for wireless sensor networks,'' *Comput. Electr. Eng.*, vol. 70, pp. 799–812, Aug. 2018.
[33] S.-B. Tsai, W. Wu, S. Ma, C.-H. Wu, and B. Zhou, ''Benchmarking, knowledge inertia, and knowledge performance in different network structures,'' *Enterprise Inf. Syst.*, vol. 14, no. 5, pp. 641–660, May 2020.

DAI WENSHENG was born in Yangzhou, China, in 1968. He received the Ph.D. degree from the School of Statistics, Renmin University of China. He is currently a Teacher with the Department of Insurance, School of Finance, Renmin University of China.