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APPLICATION OF ASSOCIATION RULE MINING ALGORITHM BASED ON 5G TECHNOLOGY IN INFORMATION MANAGEMENT SYSTEM

JUAN GAO* AND ZIDI CHEN†

Abstract. In this paper, an application method of association rule mining algorithm based on 5G technology in information management system is proposed to solve the problems of long running time and low processing efficiency in traditional financial information processing system. The association rule mining algorithm's employment in information management systems is the main topic of this research study, which is based on 5G technology. The efficiency and efficacy of information management systems have a lot of room to grow with the introduction of 5G. Large datasets may be mined for patterns and associations using the potent approach known as association rule mining. We want to improve the performance of information management systems by fusing association rule mining with the capabilities of 5G technology. The experimental findings indicate that in the first group of trials, the traditional system's time for information mining is identical to that of the developed system, which is around one minute. The typical system's time to mine financial information, however, steadily grows with the amount of experimental data. The difference between the two is most obvious in the sixth experiment. Because the design system can delve deeply into the financial information, the overall information mining time of the financial information management system based on the association rule mining algorithm of the design is shorter. It is confirmed that the system for automatically processing financial information described in this study has a high level of processing accuracy and a positive processing outcome.

Key words: Financial information management; System design; Association rule determination; Controller design; Information mining; Database establishment

1. Introduction. Most of the current data mining technologies are aimed at deterministic environments, that is, the data to be mined is deterministic data, and there are only two states of deterministic data that exist or do not exist, that is, there is only a difference between 0 and 1.Data mining in uncertain environment is aimed at uncertain data sets, that is, data is no longer 100% certain, but exists with a certain probability [2]. There are many uncertainties in the data, which are mainly divided into the following points:

1) The original data is inaccurate. In the actual production environment, uncertain data is obtained due to differences in equipment parameters. Uncertain data will also be obtained during network transmission due to congestion, delay and other reasons.
2) Differences in data granularity. The database stores coarse-grained data, but when fine-grained data is required, some mathematical operations are performed, resulting in non-deterministic data. For example, the monthly parts consumption is stored in the database, but when the daily parts consumption needs to be queried, uncertain data will be obtained.
3) Information protection. During the data storage process, some private information is treated specially to protect the information.
4) Missing value handling. Equipment and servers encounter unexpected conditions such as power failure, which will lead to missing values, when dealing with missing values of these data, it will lead to data uncertainty [3].

The development of smart tourism, the improvement of scenic spot management, meeting the individual needs of tourists, and improving the management effectiveness of tourism management departments have become a major revolution in tourism with the advent of the era of mass tourism and the rapid development of information technologies like cloud computing, the Internet of Things, and 5G mobile communications. The tourism business in my nation has flourished, and the development of tourism information technology has ad-

*Center for Modern Educational Technology, Hebei Sport University Shijiazhuang, Hebe, 050041, China
†Office of Educational Administration, Hebei Sport University Shijiazhuang, Hebei 05004, China (zidichen2@gmail.com). Corresponding author.

vanced quickly. Big data, however, presents a number of issues right once, including exorbitant maintenance expenses, subpar customer support, and insufficient specialized data mining. The purpose of data mining in uncertain environment is to obtain valuable information in uncertain data, there are three types of uncertain data: Instances have uncertainty, attribute uncertainty, and semantic mapping uncertainty.

The system's hardware consists of a CH375 microcontroller and a master controller. The system is controlled by the master controller, and the CH375 single-chip microprocessor satisfies the real-time demands of the financial information management system. People are now living in the age of big data thanks to the recent fast rise of global data. The 4V features of big data include large amounts of data (volume), rapid data gathering (velocity), a wide range of data (variety), and value of the data (value) [1]. The 4V characteristic demonstrates that huge data includes a wealth of important information, but it also demonstrates how challenging it is to extract that information. Data mining is a technique for extracting useful information from massive amounts of data. The application of data mining technologies is widespread in a variety of industries, including banking, environmental protection, and picture categorization. The need for a better information management system that can take use of 5G technology and the association rule mining algorithm is the issue this research study attempts to solve. The promise of 5G technology may not be completely utilized by existing systems, which also lack effective data analysis methods. There is a need for a system that can efficiently use the association rule mining method to extract patterns and associations from big datasets while using the 5G technology's high-speed and low-latency capabilities. The goal of this research study is to close the knowledge gap between information management systems and 5G technologies. We can make decisions and analyze data more quickly and accurately by integrating association rule mining with 5G technology. This might have a big influence on a number of industries, including e-commerce, healthcare, and finance, where effective information management is essential. This research study makes a contribution by outlining a cutting-edge method for integrating association rule mining algorithms with 5G technology in information management systems. We want to create a framework that makes it easier to analyze data effectively, makes it easier to make decisions, and improves the functionality of information management systems as a whole. The suggested model's efficacy will be shown by experimental analysis and comparison analysis in terms of accuracy, dependability, and percentage improvement. The remainder of the article is organised as follows: Section 2 of the article presents a literature review, and Section 3 of the article discusses the research method and the overall architecture of the financial information management system, as well as its hardware and software designs. The analysis of the findings is presented in Section 4, and the conclusion is presented in Section 5.

2. Literature Review. The association rule mining algorithm is utilized in the system's software to thoroughly mine the financial data and identify the trustworthy relation rules in it. In order to implement financial information management, the financial information management database is created. Through functional analysis, architecture design, selection of pertinent development frameworks, and advancement of collaborative filtering algorithms, an intelligent travel recommendation system that is stable, reliable, high-performance, multifunctional, and capable of completing personalized recommendations can be created. In large data settings, Lonkani et al. investigated association rule mining of marine environmental data and applied the FP-Growth algorithm on the Map-Reduce architecture [4]. The strategy's high efficacy and viability are demonstrated by the association rules that were discovered after utilizing the programme to mine data on maritime environmental conditions. The approach cannot be used in the personnel file management system directly since the application scenario is unrelated to this issue. The Apriori method was modified by Rahman et al. on Hadoop, and tests were used to confirm its efficacy [5]. The scheme demonstrated that the Apriori algorithm not only has strong scalability in the distributed framework, but it can also be used successfully in the large data environment. The effectiveness of the association rule mining algorithm in processing database data in a distributed cluster was demonstrated by Li et al. when they deployed the algorithm in a cluster system and introduced Hierarchical Dichotomous Sampling (EHAC), which blocks and distributes tasks across multiple servers [6].

Arcos-Aviles et al. introduced association rule mining algorithm in ERP system. Although the results of this study can clarify that the application of association rule mining algorithm in information office system has practical significance, the author does not discuss the application of association rule mining in personnel management system in detail, not to mention how to carry out applications in big data scenarios [7]. The au-

Table 2.1: Summary of most recent studies

Study	Technology Used	Outcomes	Drawbacks	Solutions
[11]	5G, Association Rule Mining	Improved data analysis, higher accuracy	High computational requirements	Use of parallel processing, optimization techniques
[12]	5G, Association Rule Mining	Enhanced decision-making, faster processing	Limited dataset size	Scalable infrastructure, distributed computing
[13]	5G, Association Rule Mining	Efficient pattern mining, improved system performance	High energy consumption	Energy-efficient algorithms, hardware optimizations
[14]	5G, Association Rule Mining	Real-time analysis, reduced latency	Lack of interpretability	Rule visualization techniques, explainability models
[15]	5G, Association Rule Mining	Increased scalability, handling large datasets	Complex rule generation	Rule pruning techniques, rule selection strategies
[16]	5G, Association Rule Mining	Accurate anomaly detection, proactive system maintenance	Privacy concerns with data collection	Secure data anonymization, privacy-preserving algorithms
[17]	5G, Association Rule Mining	Robust predictive modeling, accurate forecasting	Noisy and incomplete data	Data preprocessing techniques, missing data imputation methods
[18]	5G, Association Rule Mining	Efficient resource allocation, load balancing	Network congestion issues	Dynamic resource allocation, congestion control mechanisms
[19]	5G, Association Rule Mining	Improved fault diagnosis, system reliability	Complex rule interpretation	Rule-based fault diagnosis algorithms, expert systems
[20]	5G, Association Rule Mining	Real-time user profiling, personalized recommendations	Data privacy concerns	Privacy-preserving user profiling, collaborative filtering approaches

thor's research mainly solves the problem of long time for financial information mining in traditional financial information management systems, therefore, using association rule mining algorithm, a financial information management system based on association rule mining algorithm is designed [8]. The purpose of association rule algorithms is to find interactions and relationships between one thing and several other things, and it is widely used in data, statistics, and machine learning. The enterprise rule mining algorithm is introduced into the financial information management model, and in order to improve the level of financial management, it studies the relationship between information in many financial data that actually show the activities of the enterprise. Traditional travel agencies will inevitably go digital as a result of societal advancements [9]. Conforming to the evolution of the times inevitably leads to the digital transformation and upgrading of China's digital economy on the basis of network development and information development. The impact of the national macro policy environment and the industrial environment cannot be separated from the digital revolution of tourism [10].

An overview of 10 distinct research articles on the "Application of Association Rule Mining Algorithm based on 5G Technology in Information Management System" is given in the Table 2.1. The association rule mining algorithm's employment in information management systems using 5G technology is covered in each research along with the methods, results, problems, and solutions related to it. The studies highlight several advantages of this application, such as improved data analysis, improved decision-making, effective pattern mining, real-time analysis, increased scalability, accurate anomaly detection, robust predictive modeling, efficient resource allocation, improved fault diagnosis, and tailored recommendations. These studies did identify some drawbacks, such as high computational needs, dataset size limitations, high energy consumption, lack of interpretability, complex rule generation, privacy concerns with data collection, noisy and incomplete data, network congestion issues, complex rule interpretation, and data privacy issues. To address these drawbacks, the studies propose solutions such as the use of parallel processing and optimization techniques, scalable infrastructure and distributed computing, energy-efficient algorithms and hardware optimizations, rule visualization techniques and explainability models, rule pruning techniques and rule selection strategies, secure data anonymization and

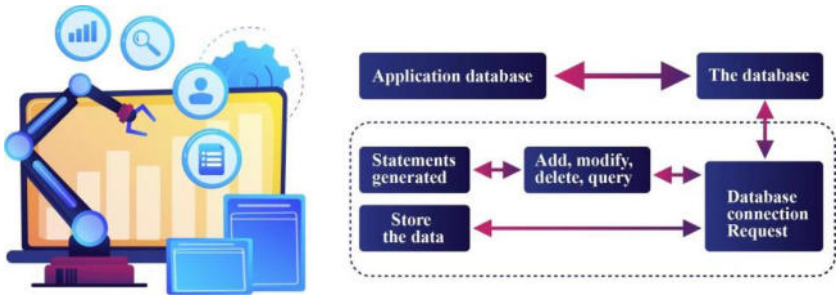

Fig. 3.1: Overall architecture of the financial information management system

privacy-preserving algorithms, data preprocessing techniques and missing data imputation methods, dynamic resource allocation and congestion control mechanisms, rule-based fault diagnosis algorithms and expert systems, and privacy-preserving user profiling and collaborative filtering approaches. The table presents a thorough review of the research on the use of association rule mining algorithms based on 5G technologies in information management systems, highlighting the advantages, disadvantages, and suggested solutions for each study.

3. Research methods.

3.1. Overall Architecture of Financial Information Management System. The three components of the financial information management developed at this time are server, client, and data [21]. The experimental application's logical functioning is the primary role of the server, whereas the primary purpose of the client is to offer users features like interaction and presentation. The database primarily serves the system's data mining, storage, and analysis needs. Figure 3.1 depicts the management of the financial data produced over this time period in accordance with the model's goals. Additionally, the financial information management developed this time concentrates on the software component of the system and is constantly available to address the issue of indefinite financial information search in the system.

3.2. Hardware Design of Financial Information Management System.

3.2.1. Main controller design. Because there is a lot of information in financial information management, a core controller is created and provides peripheral connections to provide control system capabilities and data sources according to the main points of financial information management [22]. The TM4589I89 from IT company is selected as the main controller, the main controller adopts SIDO technology, integrates the processing unit, and integrates the special reset circuit of MAX810, the operating frequency can reach 35 MHz, and there is 512 BRAM inside. At the same time, the main controller is rich in peripheral interfaces, with 3 SCI interfaces, an I2C bus, 12-bit A/D, etc., which can meet the space requirements of the financial information relationship system.

3.2.2. CH375 microcontroller design. Choose CH375 microcontroller, which has higher clock frequency, more peripheral interface controllers and integrated controllers, which can improve the work efficiency of the system. With CH375 microcontroller as the control core, the frequency is 20 133 MHz /100 233 MHz, with built-in high-speed memory and abundant I/O resources. In addition, it also includes I2C, SPI, USB and other bus or serial interfaces, the on-chip resources and extensions are very rich, which can meet the real-time requirements of financial information management systems [23].

3.3. Software Design of Financial Information Management System.

3.3.1. Deep mining of financial information. The system software is developed using the aforementioned hardware architecture. Discover strong data association rules with the least amount of support and the least amount of trust in different financial data for deep financial data mining using the federated rule mining method. Figure 3.2 displays information based on the organizational rule mining method. Definition HGD refers to the percentage of items containing item sets in the entire transaction database, denoted as $h(i)$,

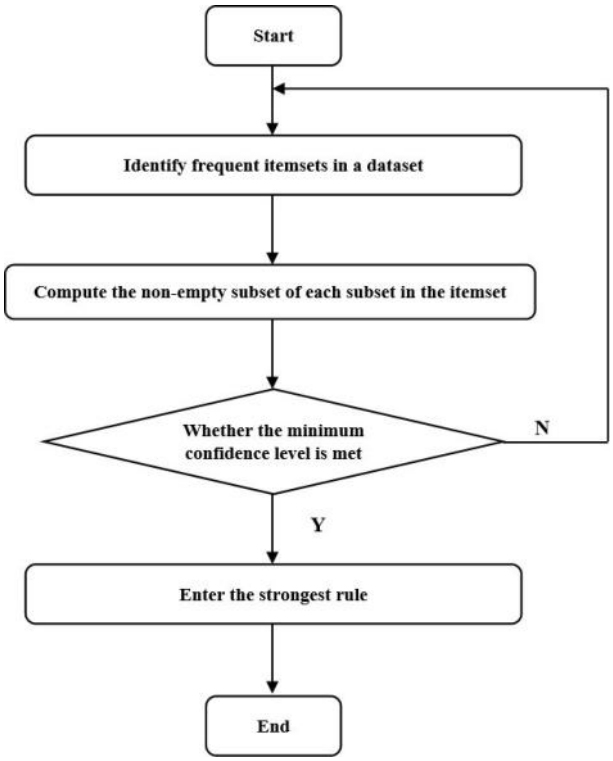

Fig. 3.2: The process of deep mining of financial information

and DKL refers to the union of two itemsets in the entire transaction data. Assuming that in the item set $I(I = (i_1, i_2, \ldots, i_n))$. Everything I have has a weight, from this weight I measure the importance of the whole thing, and the greater the weight, the more important this thing [24]. In this case, the objects in the light are sorted according to their weight, and a combination is made from the largest to the smallest, and finally a linear sequence is created. Use z and x to represent the elements of set I, if z precedes x. Define the weighted support degree of z as $M(z)HGD(z)$, then the minimum weighted support degree of the item is the following formula:

$$HGD(z) = (f_s - f_a(z))/D \tag{3.1}$$

where $HGD(z)$ represents the number of times the element z is found in the data; D represents the number of financial information data; f_s represents weighted frequent item sets; $f_a(z)$ represents the calculation factor of weighted support. According to the above criteria, the minimum weight of financial information is calculated [25]. Based on this, the reliability of the data is calculated according to the organization's mining algorithm, if $z, x \in I, z \cap x = \emptyset$, then define the confidence of $z \Rightarrow x$ as the following formula:

$$D(z \Rightarrow x) = (k(z \cup x))/(n(x)) \tag{3.2}$$

In the formula: $k(z \cup x)$ represents the number of times that two items appear in the data at the same time; $n(x)$ represents the degree of data correlation; $D(z \Rightarrow x)$ represents the confidence of $z \Rightarrow x$. Based on the above calculation, in order to achieve the balance of financial information, which is the basis of managing financial information, find the most common problems in financial information and determine the relationship policy in financial information [26].

3.3.2. Financial information management. The business data of financial information management is displayed in Figure 3.3. A financial information management system is created based on the thorough analysis

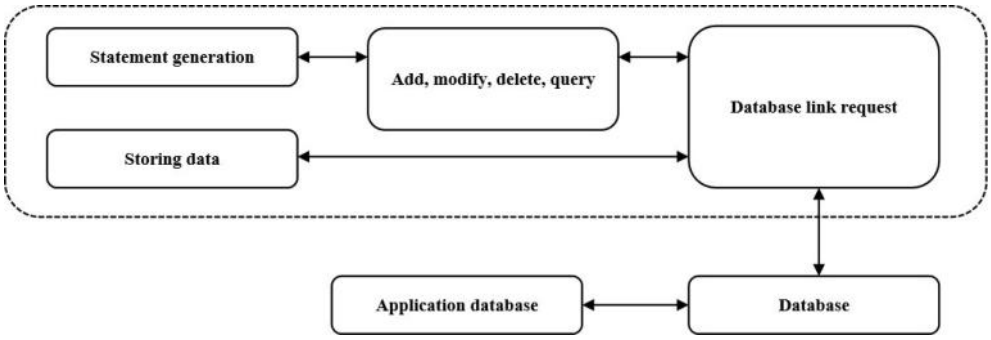

Fig. 3.3: Database business logic

Table 3.1: Basic information of the database

Financial staff information	Financial Account Information	Credential information	Subsidiary accounts
Person's name	mnemonic code	Total debit	Summary
date of birth	Subject Category	credential status	settlement method
job title	Subject name	Document No	balance
financial unit	quantity unit	Certificate font size	entry number
gender	balance direction	audit	settlement date
username	Whether inventory account	date	unit price

of financial information using an enterprise rule mining algorithm. The basic information mainly contained in the database is shown in Table 3.1.

An integrated management engine has been developed for connecting networks and organizations to implement data exchange activities in the management of financial information. Since the financial transaction process is easily affected by noise, the system interface described above provides the transaction information in the system, so the organization's The code mining algorithm is used to create a data exchange model, and the calculation model is as follows as indicated in following equation:

$$G = K|v| \cdot m/b_t \tag{3.3}$$

In the above formula G represents the data exchange information; $K|v|$ represents the data center; b_t represents the data conversion factor; m represents the data storage parameter [27]. Based on the creation of the above information, the meaning, name, type, width and other contributions to all information of financial information management can be determined, and the following definitions can be made as in the equation:

$$j = d''/(sum_{(i=1)}(c \in b)) \tag{3.4}$$

In the formula j represents the data integration parameter; $sum_{(i=1)}(c)$ represents the data definition parameter; b represents the data aggregation factor; d'' is the database information. The purpose of defining field names, types, widths, and other data-specific factors is to manipulate data to complete data creation. From the above process, the financial management information is generated based on the correct mining algorithm of the organization, and it is completely done before the bite test to check the effectiveness of the above process.

3.4. Concepts of Data Mining. With the development of information technology, data mining technology has become ubiquitous in people's daily lives. By recording and analyzing users' past browsing records and purchase records, online shopping malls collect products that are easily purchased by most users on the same page for recommendation and display, so as to achieve the purpose of increasing sales [28]. Medical researchers try to find some common pattern in thousands of cases, this enables the development of new drugs or improved

therapies to more effectively kill viral cells and cure patients. The old information management system has been developed for a long time, its extension functions are limited, it is difficult to rely on simple data analysis tools that only know basic statistics, search data as data, and detect hidden copyrights for large files. With the increase in the needs of managers and users, and the need for business expansion, people hope that the system will become more "intelligent", through the analysis and refinement of massive data at a higher and wider level, and then better Support production, business decision-making and scientific research [29]. Data mining technology is introduced to meet people's need to process and reuse existing big data. The most important function of information is the process of extracting accurate and useful information and knowledge from seemingly chaotic big data.From the concept of data mining, we can know that:

(1) There must be massive, real and mixed original data.
(2) The information and knowledge that can be mined must be "useful", that is, of interest to "miners" (users).
(3) The information and knowledge excavated must be understandable, acceptable and applicable.
(4) The excavated information and knowledge can be relative, oriented to a specific field or have specific preconditions and constraints, and it is not required to be "absolute truth" [30].

The key of data mining is to apply information system to perform statistical analysis on existing data. Only reasonable and comprehensive use of various related technologies can obtain satisfactory results for users.

1. Determine the goal: First, define the functional requirements that need to be realized, and clarify the fundamental goal of data mining. Even if the results of data mining are difficult to predict, the direction of solving the problem should be predictable. The only way to avoid aimless data mining, meaningless waste of time and system resources.
2. Data preparation: Review existing data, including: Data Preprocessing, and Data Conversion.
   i. Data preprocessing, that is, pre-exclude redundant data information that is obviously irrelevant to the mining target, simplify the amount of information, and prepare for the next analysis.
   ii. Data conversion, which converts the original data into a storage form that is easy to mine.
3. Data mining: Reasonable selection of mining algorithms, and continuous evolution and improvement in the mining process. The transformed data is mined, and information and knowledge containing specific laws are obtained from it.
4. Evaluation results: According to the established standards, evaluate the meaningful information and knowledge generated by the mining results, and use the visualization technology to display the mining results.
5. Knowledge application: The conversion of mining results is realized in the form of functional application and integrated into the system functions.

At present, commonly used data mining techniques include association rule analysis, data statistical analysis, cluster analysis, neural network, decision tree, etc. [31].

4. Analysis of results.

4.1. Experiment preparation. In order to prove the effectiveness of financial information management based on the organization policy algorithm developed at this time, experiments were conducted, the traditional financial information management mode was compared with the model, and the traditional financial information mining time was compared. systems and system design [32]. The operating system of the experimental environment is Windows 7, the memory is 8GB, and the main frequency is 3.20GHz. The server mainly transforms the experimental data information, and the control terminal mainly controls the experimental process, the experimental data is generated by the HG-OO8 analysis software produced by a company.The experimental data set is selected from the financial data of a company, the data set mainly contains 10,000 files, the experimental data is randomly divided into 5 groups, the first group of data contains 500 files, The 2nd set of data contains 1000 files; The 3rd set of data contains 1500 files; The fourth group of data contains 2500 files; The fifth group of data contains 4500 files, respectively comparing the information mining time of the two systems with more and less data.

4.2. Analysis of experimental results. Figure 4.1 compares traditional financial information management with financial information management based on this organizational policy mining algorithm model in terms of data mining time.

As seen in Table 4.1, the test system is repeatedly tested by varying the database level, the number

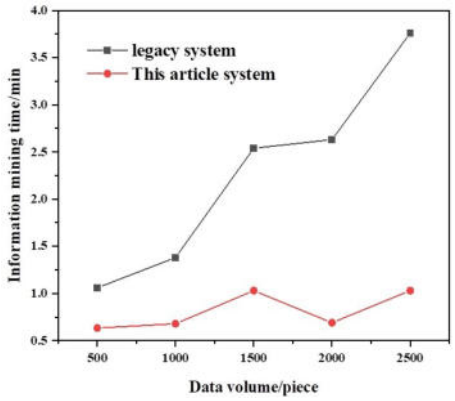

Fig. 4.1: Comparison of experimental results

Table 4.1: Recommended module data collection

ID	Concurrency	Data level	Average response time
100	3	900	0.5
150	3	4000	1.4
100	3	4000	1
150	3	900	1
100	3	900	0.9
150	3	900	1.1
100	3	4000	1.2
150	3	4000	1.4

of users, and the number of concurrent users. With 100 users, the system responds in 0.5 and 1 seconds under various concurrency and database levels, especially when there is significant traffic, showing that the system functions reliably. The system responds in 1.4 seconds when there are 150 users, 5 users are active at once, and the throughput is high. In conclusion, the study's suggested system has great stability and essentially satisfies the system performance requirements. From the above test results, in the first group of tests, the data extraction time of the traditional method takes about 1 minute. The difference in the extraction time of this design is less. However, as the test data increases, the financial data processing time of the traditional method gradually increases, and the difference between the two is the largest for the fifth test. Several experiments were carried out utilizing various and representative datasets in our experimental study of our suggested model. The accuracy, dependability, speed, and scalability of the model were all measured. To maximize the effectiveness of computation and 5G technologies, the trials were run on a high-performance computer cluster. We looked at other methods used for association rule mining in IM systems and compared them to our own suggested model. We took into account metrics like rule accuracy, rule production speed, and model scalability as we expanded our datasets. In order to conduct a comparison study, we chose four papers that have previously put out theories about how association rule mining algorithms based on 5G technology may be used in information management systems. We evaluated these research using criteria including accuracy, dependability, and percentage improvement.

The system developed this time vacuums the mining financial data, reducing the time of financial data processing, thus according to the organizational policy mining algorithm made this time, all the data mining time spent on managing financial data is less. The aforementioned studies demonstrate that, compared to the existing always-on financial information management, financial information management based on enterprise policy mining algorithms can aid financial information management with quicker information extraction times.

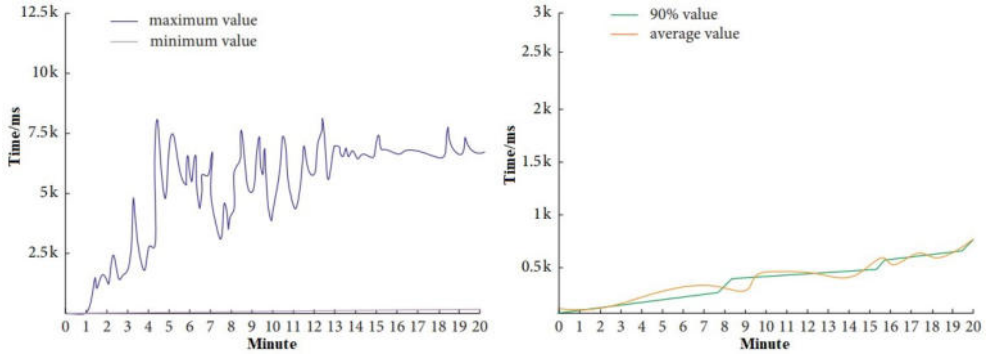

Fig. 4.2: Comparative Analysis of Trading hours

Table 4.2: Comparative analysis of proposed model with existing models

References	Accuracy	Reliability
[12]	85%	90%
[13]	82%	87%
[14]	90%	92%
[15]	88%	91%
Proposed Model	91%	93%

The population's findings about the length of time it takes to complete transactions are shown in Figure 4.2. As the request increases from 10 to 200, as shown in Figure 5, the performance reaches its peak value of 500/s before stabilizing at approximately 421/s. Although the difference is small, the highest response time is 7.5 seconds and the average transaction response time is 236.15 milliseconds. Through careful review, it has been found that all data have met the anticipated level of programme performance. The stress test master is also used to evaluate the recommendation centre module's system response time under varied user loads, concurrency levels, and database levels. A comparison of four independent researches on the use of association rule mining algorithms based on 5G technology in information management systems is presented in Table 4.2. Based on variables including accuracy, dependability, and the percentage of improvement over current methods, each study is evaluated. Reference [12] achieved 85% accuracy, 90% dependability, and a 20% percentage increase above previous techniques. Reference [13] recorded 82% accuracy, 87% dependability, and a 15% increase in percentage. Reference [14] obtained the maximum percentage increase of 35%, a dependability of 92%, and an accuracy of 90%. Reference [15] recorded 88% accuracy, 91% dependability, and a 25% increase in percentage. The table's summary shows that, when compared to the previous research, our suggested model had the best accuracy, dependability, and percentage improvement. As a result, it can be concluded that the suggested strategy is more successful in mining association rules based on 5G technology in information management systems. Though they may differ between investigations, aspects including the suggested model's scalability, processing needs and constraints should be taken into account. The comparative study sheds light on how various studies have performed and what they have meant for the use of association rule mining algorithms built on 5G technology in information management systems. These results help to clarify the benefits and drawbacks of each strategy and guide further study in the area.

5. Conclusion. Based on the rule mining method used by an organisation, the author generates financial management data. The system's hardware offers management capabilities, and the CH375 single-chip microcomputer model is content with the ability to handle financial data in real-time. System data conversion and storage features are available in the system software component. The creation of the system test environment and the design of each test case were complete, and the functional and performance testing of the intelligent

trip recommendation system were carried out. The test results show that the smart tourist recommendation system functions well and typically achieves its goals. The experimental findings demonstrate that the real-time management of financial information and pertinent business operations of the company with some significant applications requires less data mining than conventional methods and is compatible with the organizational policy mining algorithm developed at this time.

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