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Research Article

Nonlinear Hypothesis Generation Strategy of Management Accounting Data Mining

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Management accounting plays a greater role in providing business decisions for enterprises. As the core technology of big data processing, data mining technology can process a large amount of complex, structured, and unstructured information very efficiently. In this paper, the nonlinear system is taken as the research object, and the obtained system data is directly used. In the framework of divide and conquer strategy, multi-model method is combined with data clustering and a local modeling algorithm to study the nonlinearity of management accounting data mining. Through online adaptive estimation of parameters, aiming at the zero dynamic problem of the non-minimum phase system, through the decoupling matrix analysis of the nonlinear system, the state of the original strategy is dynamically extended to make the estimated parameters asymptotically approach the true value. The estimated parameters are applied to the nonlinear hypothesis strategy to achieve the goal of linearization control. It is assumed that the generation strategy is applied to the mining of different related types of rules without manually setting parameters, which greatly improves the efficiency of rule discovery. Through case analysis, this paper demonstrates the feasibility of applying nonlinear hypothesis strategy of data mining technology to management accounting and puts forward the relevant application process framework. The validity and feasibility of nonlinear hypothesis strategy data mining technology in management accounting are verified.

1. Introduction

The goal of management accounting is to make full use of relevant information by management accounting, to play the role of management accounting in analyzing the past, controlling the present, and planning the future, providing strong support for enterprise-related decision-making and improving the management system and control framework of the enterprise [1]. In order to effectively realize the corporate strategy, this means that management accounting will play a greater role in enhancing the core competitiveness and value creativity of the enterprise and injecting new vitality into the enterprise in the current economic downturn [2].

In the era of big data, management accounting needs to perform the function of providing decision-making information for business management [3]. One of the most important professional differences between management accounting and strategic management, human resource management, marketing management, and so on is "measurement," otherwise, management accounting will be mixed with other management. For example, although the concept of "customer value" commonly used in marketing management is very useful for marketing management, it is difficult to measure customer value in practice, and few or even no enterprises can calculate customer value. [4]. As the core technology of the big data era, data mining technology is to mine data through new systems, new tools, and new models, and extract data from massive data to support their own decisions [5]. Using data mining technology to effectively and accurately discover key data in the field of management accounting can help enterprises reduce cost management, improve product quality and service quality and seek and discover more information about upstream and downstream industry chains and markets [6]. Providing a more comprehensive and effective decision-making basis

for decision-makers of enterprises has very important practical significance for enterprises to improve their strategic competitiveness and complete industrial upgrading and strategic transformation [7].

This paper uses data mining to study the related theory of management accounting, analyzes the current situation, some problems and future developments, decoupling the nonlinear hypothesis generation strategy and adopts linear algebra theory and dynamic expansion algorithm [8]. Combining analysis, the use of the dynamic expansion algorithm is to construct a nonlinear hypothesis generation strategy to achieve the purpose of mining management accounting data [9]. This paper studies the impact of data mining on management accounting and the application of data mining technology in management accounting [10]. The impact of data mining on management accounting function in the big data era includes that data mining technology can effectively improve the cost control of management accounting. The core function of management accounting in functional enterprises is to control the cost effectively. In the enterprise's business activities, every link is closely related to cost control. The enterprise prepares the implementation plan or annual budget to effectively control the enterprise's cost. The case analysis demonstrates the feasibility of applying data mining technology to management accounting and proposes a relevant application process framework [11, 12].

A large number of data are quickly integrated and summarized to find the most accurate data information. For users of data mining technology, it saves a lot of time. It reduces the intermediate links of data processing, so that relevant personnel of the enterprise can extract and use data information more quickly. At the same time, the application of data mining technology can also process and analyze accounting data in real time, thus, making it easier for enterprise managers to make better use of accounting related information. For example, for the inventory management of an enterprise, relevant custodians can regularly study and analyze the past inventory quantity and market demand. Then through the use of data mining technology, we can accurately analyze it and roughly determine the inventory quantity of the enterprise. Try to avoid inventory squeeze and reduce the economic loss to the enterprise. In the era of big data, in order to achieve more stable development and improve their competitiveness, enterprises need to define the market.

2. Management Accounting and Data Mining

2.1. Theoretical Analysis of Management Accounting. Management accounting is an important branch of accounting. It mainly serves the internal management needs of enterprises. It aims to improve the economic benefits of enterprises [13]. Through the use of relevant information, organic integration of financial and business activities plays an important role in enterprise planning, decision-making, control, and evaluation [14]. Management accounting is an important part of corporate accounting, and its role in business management activities is more and more important [15]. It is the most effective tool for strategic, business, and financial integration. Moreover, as management accounting is increasingly valued by management, its role has not been limited to the financial field. The management of procurement, sales, production, and even the planning of the entire enterprise process belongs to the scope of management accounting [6, 16]. The improvement of cost control function of management accounting is promoted. The most important function of management accounting in enterprises is to control the cost effectively and accurately. And in the business activities of enterprises, every link is closely related to the cost control of enterprises. At the same time, in the process of preparing the implementation plan or preparing the annual budget, the enterprise aims to better control the enterprise cost. Based on the big data era, if the cost is controlled only through planning or budget, it will not fully meet the needs of enterprise cost control. Therefore, enterprises can make full use of the data mining technology to mine and analyze a large amount of data information, thus, making the conclusions more accurate and reasonable. And learn more experience and lessons from them and lay a good foundation for the smooth development of cost control.

Management accounting can provide comprehensive and effective business information to the decision-making level so that enterprises can use the limited resources to maximize the value of the enterprise [17]. This requires not only the daily financial information of the enterprise but also the internal comprehensive management information that suits the characteristics of the enterprise and the development of the industry [18, 19]. They behave in a variety of ways, with financial and nonfinancial information, quantitative and nonquantitative information, actual and projected information, historical and future information, structured and unstructured information, internal and external information, tangible and intangible, and other information [20]. Figure 1 shows the theoretical analysis framework of management accounting.

Management accounting is the business management service for enterprises. Its main role is to provide managers with comprehensive and effective information for them to make optimal decisions. It is another important factor in management accounting to study important indicators and their changes in relevant information. To calculate function through the relevant data model, to obtain the relevant business data of the enterprise under the existing conditions and predict the future business conditions, mainly including the financial status forecast, cost forecast, profit forecast, operational benefit forecast, cash flow of the enterprise forecasting, and other aspects, so as to provide effective and reliable information for business decision-making, management decision-making is correct or not, need to be judged through continuous feedback, management accounting through regular and irregular assessment, and evaluation of business conditions for managers provide appropriate feedback.

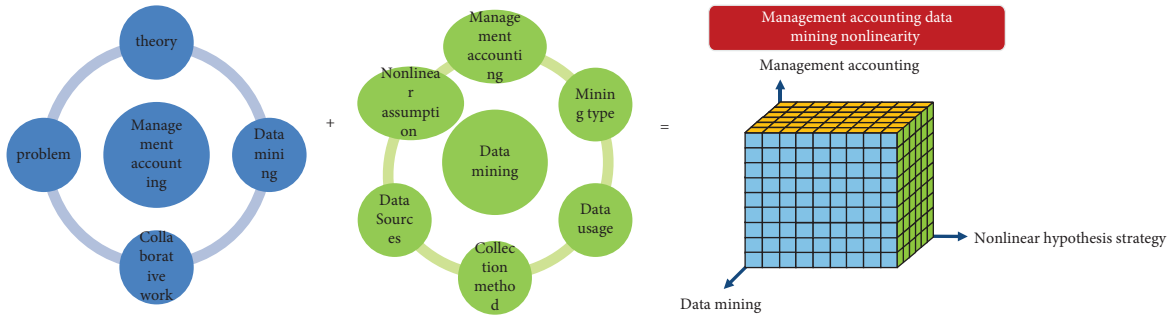

Figure 1: Management accounting theory analysis framework.

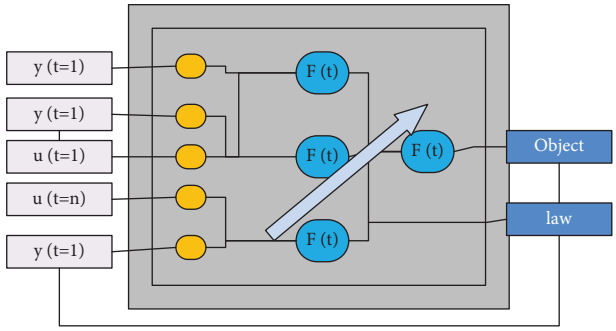

Figure 2: Data mining management accounting adaptive control system block diagram.

2.2. Application of Data Mining in Management Accounting. The impact of big data on management accounting is profound and huge. In the face of the current massive data, traditional management accounting often adopts a single processing method, and it has not been able to fully exert its important role in business decision-making. Data mining uses integrated technology to play a very important role in various disciplines such as database processing, mathematical statistics, and artificial intelligence. The technology will be managed in terms of data search, processing, analysis, and utilization. Accounting provides effective data, enabling management accounting to make powerful decisions in corporate forecasting, decision making, budgeting, accounting, control, analysis, and assessment. Figure 2 shows the block diagram of data mining management accounting adaptive control system.

Process-based, total, real-time data processing has become a core requirement for data value mining. If you want to get this data, you need to use data analysis tools, such as commonly used attribution analysis, regression analysis, trend analysis, fuzzy matching, decision tree, and so on. The algorithm used for mining analysis tools is more complicated. The amount of data and calculation involved in the analysis is generally large. The establishment of big data warehouse is conducive to the realization of enterprise information sharing.

Data mining technology can be applied to many aspects of management accounting, so that management accounting can cover more business information, so that it can reflect the business situation objectively and multi-dimensionally. At the same time, the information provided by management accounting is no longer limited to financial information, but also includes the information needed for internal management, which helps the internal and external management of the enterprise, promotes strategic management and carries out strategic management of business operations and business structure. Analyze and realize the improvement of value chain management in combination of "control management before event analysis and post-event accounting evaluation" to realize the combination of management accounting and economic benefits the way it is. This is the impact of data mining on management accounting in terms of data storage, either through cloud storage or remotely. Based on the cloud storage service, the data informatization platform is built and can be customized on demand to meet the needs of management accounting for data storage and reading in the era of big data.

2.3. Nonlinear Adaptive Control. The feedback linearization control of nonlinear systems is to achieve complete linearization or precise linearization of affine nonlinear systems through differential homeomorphic transformation (i.e., nonlinear coordinate transformation) and nonlinear state feedback which is one of the best options for linear control. Due to the generation and application of feedback linearization theory, the nonlinear system control theory has been greatly developed. Some conclusions about the geometrical description of linear control systems have been promoted in parallel in nonlinear system control. In essence, the linearization control of affine nonlinear systems rely on the exact cancellation of nonlinear terms in nonlinear systems known to mathematical models. However, for an actual system, it is often difficult to obtain an accurate mathematical model of the system due to modeling errors or different ways of operating the system. If a nonlinear system that fails to accurately know the mathematical model directly implements linearization control using nonlinear state feedback, the abovementioned exact cancellation cannot be established, which may lead to the failure of the nonlinear control strategy. Therefore, for a non-linear system that does not accurately know the mathematical model, it is necessary to design a robust control scheme to deal with the parameter uncertainty in the mathematical model of the nonlinear system. Because the mathematical modeling of the system is not accurate or the parameters change during the operation of the system, there are many uncertain factors in the

nonlinear system. Therefore, when designing the controller for the nonlinear system, the uncertainties of the system and the external interference must be considered. Robust control has been widely used in linear systems. It can also overcome the uncertainty of nonlinear systems and ensure that nonlinear closed-loop systems have good dynamic quality and strong robustness. When the nonlinear system is uncertain or subject to external disturbances, the performance index of the nonlinear system can be analyzed by the robust control theory. In addition, in the case of considering uncertainties or external disturbances, according to the Lyapunov function, the nonlinear robust controller can also be designed using the robust control theory. Because the robust control can deal with the uncertainty of the nonlinear system and restrain the external disturbance of the system well, the robust control is widely used in various research fields and has achieved good results.

3. Nonlinear Hypothesis Strategy of Management Accounting

3.1. Nonlinear Adaptive Control. The nonlinear hypothesis is often the smallest phase system. Because the minimum phase system has many excellent properties, one of them is that it can be calmed by feedback. The so-called minimum phase system is that the zero dynamic of the system is an asymptotically stable system. Consider a single-input and single-output nonlinear system with a relative order r.

$$\left\{\begin{array}{c} \widehat{x} = f(x) + g(x)u \\ y = h(x) \end{array}\right\}. \tag{1}$$

Coordinate transformation is written as

$$\widehat{z} = \vartheta(x) = L_f h(x), \quad i = 1, r. \tag{2}$$

It can be written as

$$\left\{\begin{array}{l} \widehat{z_i} = z_{i+1}, \quad i = 1 \ldots r, \\ \widehat{z_r} = b(z) + a(z)u, \\ \widehat{z_{r+1}} = q_{r+1}(z) + p_{r+1}(z), \\ \ldots\ldots \\ y = z_i. \end{array}\right. \tag{3}$$

If the system is zero dynamic, then we get

$$\eta_i = q_0(\eta) - \frac{b(0,\eta)}{a(0,\eta)} p(0,\eta). \tag{4}$$

If it is locally asymptotically stable, the strategy is called a nonlinear minimum phase strategy.

But in actual engineering, the nonlinear hypothesis strategies we encounter are not all minimum phase systems but most of the points are non-minimum phase systems. This section presents a control strategy for non-minimum phase hypotheses based on state feedback methods.

3.2. Nonlinear Hypothesis Strategy. For block decoupling problems with some nonlinear strategies, regular static state feedback cannot be used to achieve decoupling purposes. This also shows the importance of using the differential geometry method, especially the geometric infinite structure to study the static decoupling problem of nonlinear systems, and the algebraic infinite structure is still not an effective tool for the static decoupling problem. However, the algebraic method is more suitable for the dynamic feedback problem of nonlinear systems, namely the dynamic block decoupling problem.

The minimum-order dynamic decoupling feedback problem can be discussed by constructing the root of the nonlinear hypothesis strategy. The dynamic expansion algorithm or the Singh algorithm can be used to construct the root of the nonlinear system. The root of the nonlinear system can be used to achieve the dynamics of the nonlinear hypothesis strategy.

Feedback decoupling is proposed. The dynamic expansion algorithm is used below to construct the root of the nonlinear hypothesis strategy.

From the analysis of the previous dynamic expansion algorithm, the strategy has been constructed in step k.

$$\left\{\begin{array}{l} x_k = f_k(x_k) + g_k(x_k)u_k, \\ y = h(x_k). \end{array}\right. \tag{5}$$

The state of the integrator added at each step is

$$A_{\text{ij}} = \sum_h \text{span}_x \left\{ d_x \sum_{i=1}^{k} \sum_{i \neq j} \frac{\partial y_k}{\partial z_i} dz_i \right\}. \tag{6}$$

Then

$$A^K \subset \sum_{J=1}^{K} E_k^j \cap \sum_{i \neq j} E_k^j. \tag{7}$$

The decoupling problem of nonlinear hypothesis strategies is discussed by using the dynamic expansion algorithm and linear algebra theory. The dynamic expansion theory is used to construct the subspace of the vector space E in the nonlinear hypothesis strategy. From the perspective of linear algebra, the dynamic expansion algorithm is essentially a construction method of the subspace E base. The dynamic expansion algorithm and linear algebra theory are used to construct the root of the nonlinear system. The dynamic decoupling feedback problem is discussed by constructing the root. The process of finding the root of the nonlinear system is to decouple the nonlinear system in the dynamic state feedback. The process can find those input partitions that only affect the current output.

3.3. Management Hypothesis Nonlinear Hypothesis Strategy Model Framework. According to the basic principles of management accounting, the application of nonlinear hypothesis strategy in data management technology in enterprise management accounting is used to construct a process framework based on data mining. The construction of the process framework aims to achieve the following

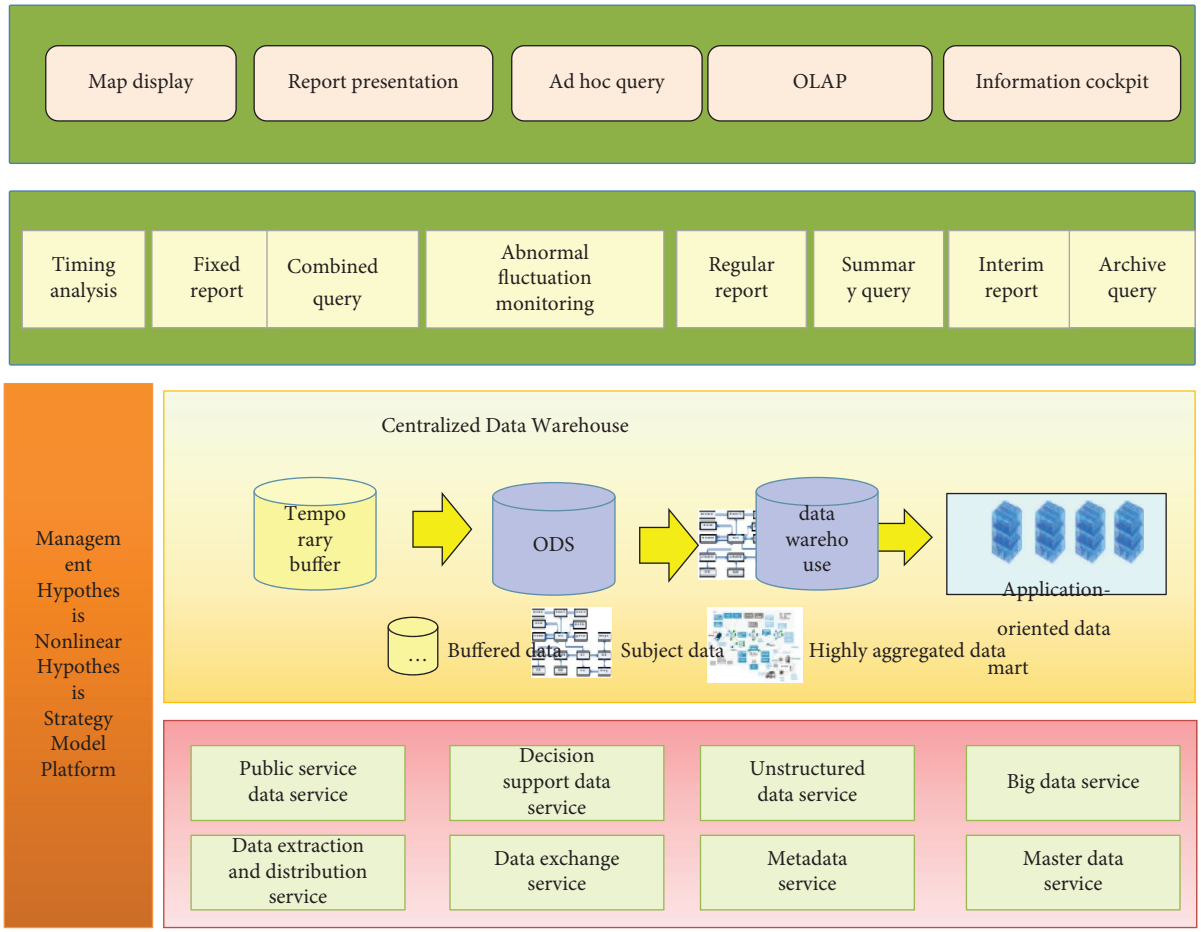

Figure 3: Management hypothesis of the hypothetical strategy model framework.

objectives: to explore effective ways for enterprises to make full use of information in the era of the knowledge economy, to deepen the understanding of data and information; to guide the application of data mining technology in management accounting and to improve the decision-making relevance of management accounting. To enhance the competition of enterprises Figure 3 shows the management assumptions of the hypothetical strategic model framework.

3.3.1. Define the Problem. Defining the problem reveals problems encountered in business management and conducts in-depth analysis. For example, why income will decline, what methods can be used to increase income, what factors are involved in improving income, how competitors do, and they have no similar problems. After analyzing the problem, understanding the problem will be more profound, the collection of information will be more systematic and the source will be more effective.

3.3.2. Identify the Source of Information. After clarifying the above issues, you can determine what information you need to look for from those aspects. For information sources, it can be roughly divided into two categories: internal information and external information.

3.3.3. Data Collection and Organization. Through the abovementioned information source, data collection can be performed, but the collected information is often fragmented and scattered information, and there will be a lot of noise, which requires the use of information sorting techniques, such as typical data cleaning.

3.3.4. Data Mining. After the process, data mining can be performed. The commonly used algorithms for data mining are described in the foregoing and will not be repeated here. However, it should be noted that data mining must be closely related to the basic principles of management accounting and the purpose of solving the problem. It cannot be mined for data. After all, the amount of data is very large, and each time it is mined, it will generate quite a lot of information. The initial digging target will lose the direction of decision-making because of too much data.

3.3.5. Analysis and Expression of Results. Data mining leads to corresponding data, and in the face of problems that need to be solved, it needs to be combined with the characteristics of the enterprise and the business environment for analysis to arrive at a more reasonable

Table 1: Business scale list.

Project	Number of people	Deposit size	Loan size	Number of public settlement accounts	Per capita water flow	Financial accounting customer
End of 2013	26	80673 ten thousand	3500 ten thousand	1367 household	651	1220 household
End of 2015	19	163199 ten thousand	27049 ten thousand	1886 household	1251	2770 household

Table 2: List of job configurations.

Post setting	year 2013	year 2015
Front desk teller	Private counter	Cash business counter
	Full-time cash teller	Cancel
	Public counter	Non-cash counter
Mid-stage teller	For public accountants	Maintenance of public account and product maintenance
	Signing a contract for public products	
	Management of public foreign exchange business	International business executive
	Reviewing the public account	Cancel
	Review of public foreign exchange business	Cancel
	Review the public front office business	Cancel
	Exchange of posts	Increase the number of hits, transfer business
	Fight against the public	Cancel
	Business trip	Cancel
	Public finance payment business	Cancel
	Print the classification of public customers	Cancel
Lobby manager	1 person	1 person

solution. The results of data mining can be data or presented in clear charts or tables.

4. Instance Verification

4.1. Instance Data. Table 1 shows the share of branch business departments at the end of 2013 and the scientific theory and relevant data at the end of 2015. A branch of China Construction Bank Beijing Branch has 68 employees and has 8 business outlets. At the end of 2015, the personal deposit scale of the branch business department reached 163.199 million yuan, the scale of public deposits broke 10 billion, and the number of public settlement accounts was more than 2,000. In recent years, a branch has focused on the development goals of "comprehensive outlets, integrated tellers, and integrated marketing teams," constantly improving service quality, and under the concept of service-driven efficiency, highlighting the assessment of individual employees' comprehensive contributions and giving play to everyone's advantages and characteristics, forming a distinct team characteristics.

In 2013, the branch combined with the characteristics of its own business and personnel characteristics, through the scientific theory of relevant data, on the premise of ensuring that the accounting business is not affected, actively explore the "lower and lower, process reengineering" program to reposition the post. Reengineering, that is, reducing the fixed cost of counter accounting personnel, digging deeper customers who contribute value, reallocating resources, placing more costs on valuable customers, increasing revenue, and making 20% more customers create 80% of their profits. With the help of data mining technology, through a large number of research and analysis of all the data of this branch in recent years, a set of effective programs has been proposed (see Table 2).

Therefore, the sub-branch cooperated with relevant departments to use data mining technology to mine relevant data, mainly through the following and the steps are taken as follows:

(1) Business understanding: Business understanding is primarily about diagnosing the bank's current business conditions in order to determine what data is needed, which businesses will generate revenue, which customers will create profits, and which will not

(2) Data acquisition: Bank customers are divided into public customers and private customers. For public customers, they refer to corporate customers. For private customers, they refer to personal customers. Therefore, the data obtained is divided into public and private.

(3) Data preprocessing: Data mining requires a lot of data processing, so data quality is particularly important. Data preprocessing is a preparation work before data mining, which plays a vital role in the quality of data mining. The object of data mining includes not only some financial data of customers, such as asset size, credit status, and profitability, but also some non-financial data, such as the frequency of business transactions, whether it is the card-issuing households, complaint rate, and satisfaction.

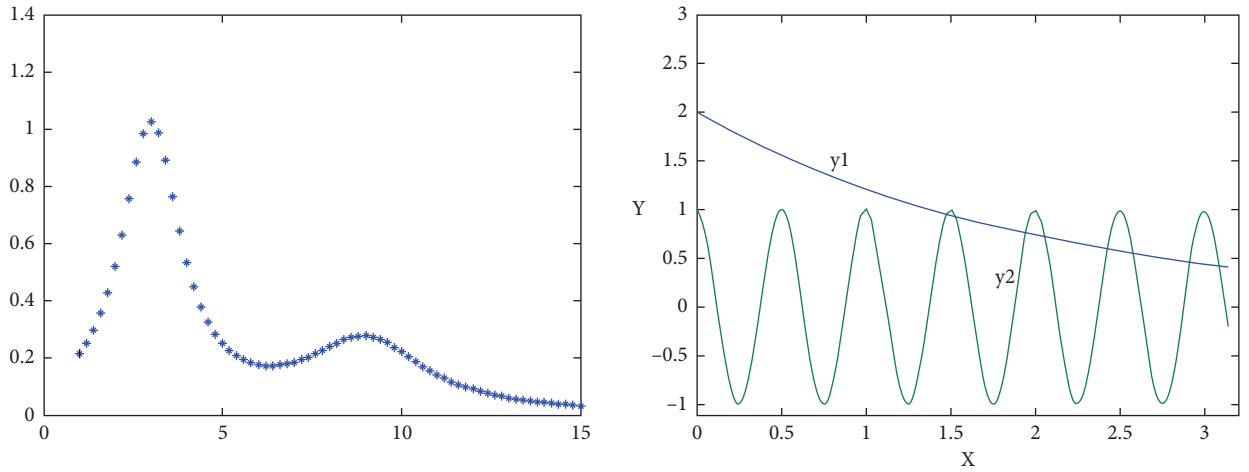

Figure 4: Nonlinear hypothesis strategy verification process diagram.

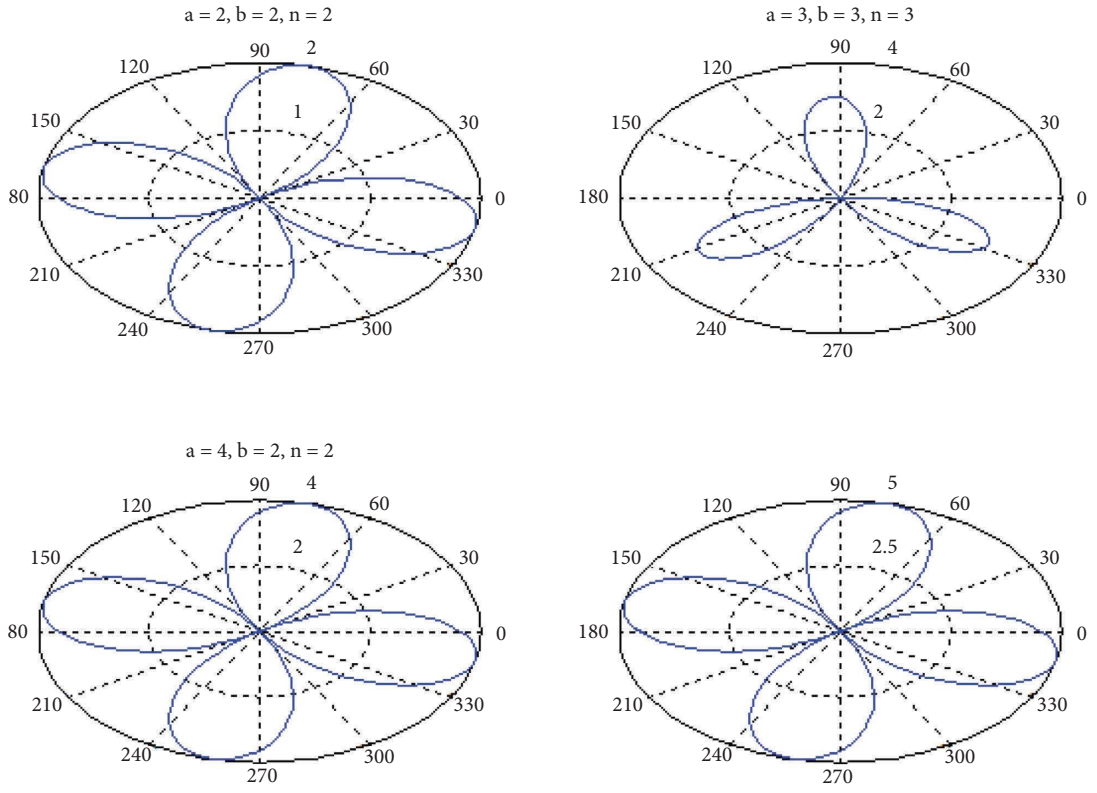

Figure 5: Control chart of the nonlinear hypothesis strategy model in management accounting data mining.

These data are not only complex and large but may also contain a lot of repetitive and useless information, so it is important to clean, integrate, and convert the data into a standardized process.

(4) Data mining: The non-linear hypothesis strategy is used for data mining. Through data mining technology, data is collected and organized to form a huge database. According to many factors affecting cost and income in management accounting, customers are classified according to different contribution values, and different customer groups are obtained. Different marketing strategies stimulate potential consumption; at the same time, different cost allocations are made according to different levels of customers, and income is increased under effective cost control, which increases profits and enhances its core competitiveness.

Among them, the nonlinear hypothesis strategy verification process is as follows.

It can be seen from Figure 4 and Figure 5 that the estimated parameter asymptotically tends to the true value through the nonlinear hypothesis estimation of the parameter, thus completing the complete linearization hypothesis control based on the nonlinear state feedback, realizing the rotational speed and the rotor. Both theoretical derivation and computer simulation prove the feasibility and effectiveness of this method in managing accounting data mining applications.

5. Conclusion

In this paper, state feedback is given, and an adaptive control scheme based on linearization is developed. Through online adaptive estimation of parameters, aiming at the zero dynamic problem of the non-minimum phase system, through the decoupling matrix analysis of the nonlinear system, the state of the original strategy is dynamically extended to make the estimated parameters asymptotically approach the true value. The estimated parameters are applied to the nonlinear hypothesis strategy to achieve the goal of linearization control. Through case analysis, this paper demonstrates the feasibility of applying the nonlinear hypothesis strategy of data mining technology to management accounting and puts forward the relevant application process framework. The validity and feasibility of the nonlinear hypothesis strategy data mining technology in management accounting are verified. Through the nonlinear hypothesis estimation of the parameters, the estimated parameters asymptotically approach the true value. Thus, the complete linearization assumption control based on nonlinear state feedback is completed, and the speed and rotor are realized. Theoretical derivation and computer simulation have proved the feasibility and effectiveness of this method in the application of management accounting data mining. However, the study still has some limitations. The research lacks the establishment of sales, cost, and capital prediction models. In future research, it is necessary to scientifically and accurately predict various indicators of the enterprise as the basis for decision-making.

Data Availability

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

Conflicts of Interest

The author declares no conflicts of interest regarding this work.

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