Innovation of Enterprise Management Mode Based on Improved RBF Neural Network Algorithm

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Keywords: Improved RBF Neural Network Algorithm, Enterprise Management Model, Improvement, Innovation.

Abstract: In a rapidly changing market environment, companies are facing increasing competitive pressure. In order to improve operational efficiency, optimize resource allocation and improve the quality of decision-making, this study explores the application of improved RBF neural network algorithm in enterprise management model innovation. Based on the comprehensive analysis of the internal management data of the enterprise, the management decision-making model and system based on RBF neural network are studied and constructed, and optimized and tested. The final experimental data show that the model integration system has significantly improved the prediction accuracy and response speed, and the comprehensive conclusion shows that the improved RBF neural network algorithm can effectively support the innovation of enterprise management mode and realize intelligent and refined management.

1 INTRODUCTION

In the current competitive business environment, how to improve the management efficiency and decision-making quality of enterprises has become an important topic. Traditional management methods rely on experience and intuition, and are unable to cope with complex and changing market conditions. Some people have proposed methods based on data analysis, but because the data is too dimensional and too complex, these methods cannot achieve ideal results in practical application. There are also attempts to adopt a rules-based management system for this application. However, these methods cannot effectively deal with nonlinearity and uncertainty, resulting in poor management effectiveness. In this paper, the improved RBF neural network algorithm is used to study the innovation of enterprise management mode, because the algorithm has good nonlinear processing ability, can adapt to the complex enterprise management environment, and at the same time, based on intelligent optimization and machine learning, it can also improve the accuracy and efficiency of management decision-making. It is hoped that based on this study, a new enterprise management model can be explored, intelligent and data-driven decision support can be realized, and the core competitiveness of enterprises can be enhanced.

2 RELATED WORKS

2.1 RBF Neural Network Algorithm Theory

RBF neural network is a commonly used artificial neural network model, which is mainly used to deal with nonlinear problems and function approximation problems. The core of the RBF network is based on the activation method of radial basis function, which maps the input data to a high-dimensional space, and uses it to achieve the purpose of nonlinear approximation of complex relations (Cao, and Yu. 2023). The RBF neural network consists of three layers, specifically, they are the input layer, the hidden layer, and the output layer. The function of the input layer is to receive external data, and the input variables represent the various characteristics of the problem; These characteristics often represent various management elements in enterprise management innovation, such as financial data, market dynamics, etc. The hidden layer uses the radial basis function to perform nonlinear transformation on the input data, and the optimization of the innovation investment of the hidden layer is

Jing, Z.
Innovation of Enterprise Management Mode Based on Improved RBF Neural Network Algorithm.
DOI: 10.5220/0013535500004664

In *Proceedings of the 3rd International Conference on Futuristic Technology (INCOFT 2025) - Volume 1*, pages 59-65
ISBN: 978-989-758-763-4

very important in enterprise management, which determines the complexity and computational accuracy of the network. The task of the output layer is to map the output of the hidden layer to the final result, which is usually used to represent the decision-making suggestions and performance indicators in the innovation of enterprise management models (Chaynikov, Semenov, et al. 2023). The network learns the relationship between input and output based on adjusting weights and center vectors, which is suitable for modeling and optimizing multi-factor decision-making problems in enterprise management.

2.2 Theories Related to the Innovation of Enterprise Management Model

Enterprise management model innovation refers to the process of optimizing management processes, adjusting organizational structure, and introducing advanced management tools in the face of external market changes and insufficient internal operational efficiency, so as to effectively improve overall efficiency and optimize strategy (Chaynikov, Semenov, et al. 2023). The core theories of innovation management model include resource base theory, dynamic capability theory and change management theory. Among them, the resource-based theory believes that the competitive advantage of an enterprise comes from the effective allocation of its internal resources and the mining of its unique capabilities. In the innovation of enterprise management mode, it can enhance the overall competitiveness of enterprises based on the optimal allocation of production resources, human resources, and technical resources (Gao, and Yang. 2023). Dynamic capability theory emphasizes the ability of enterprises to adapt and innovate in a dynamic environment. Enterprise management model innovation should have the ability to quickly respond to market changes and continue to innovate, based on intelligent management tools, such as RBF neural network algorithms, to effectively improve its speed and adaptability. Change management theory, which mainly explores how to carry out organizational change and strategic adjustment in the face of changes in the internal and external environment. In the process of innovation of its management model, it can promote the further sustainable development of the enterprise by adjusting the corporate structure, optimizing the management process, and stimulating the creativity of employees. Based on the theory of combining RBF neural network algorithm with enterprise management model innovation (Kang, Zhao, et al. 2023), enterprises can achieve accurate data analysis and intelligent decision support in the process of management change. to promote enterprises to maintain competitive advantage and sustainable development in the fierce market competition.

3 METHODS

3.1 Introduction to the Innovation System of Enterprise Management Mode

In the system architecture, each part performs its own duties and cooperates with each other to achieve intelligent and efficient enterprise management decision-making. The key modules in the system architecture are the data preprocessing module, the input layer module, the hidden layer module, the output layer module, the model training module, the model optimization module, and the evaluation and feedback module (Tang, and Yang. 2023). Among them, the task of the data preprocessing module is to process all aspects of the original management data, including cleaning, so as to ensure the quality and consistency of the data related to the innovation of enterprise management mode. The module also performs feature extraction and feature selection to improve the efficiency and effectiveness of model training. The input layer module is tasked with receiving key variables in enterprise management, such as financial data, market indicators and production efficiency. The input layer converts these variables into numeric forms for processing by the neural network. The task of the hidden layer module is nonlinear feature extraction and pattern recognition. Based on adjusting the input and weight of innovation, the module is able to deal with complex management decision-making problems. The task of the output layer module is to convert the output of the hidden layer into specific management decision suggestions, such as resource allocation plans and market strategy adjustments. The module also outputs model prediction results for management's reference. The task of the model training module is to train the neural network using historical data and simulation data. Based on adjusting parameters, such as weights and learning rate, the prediction accuracy and generalization ability of the model are optimized. The task of the Model Optimization module is to improve the kernel function, learning rate, and regularization method of the model to further improve the performance of the

model in different management scenarios. The task of the Evaluation & Feedback module is to evaluate the output of the model and provide feedback based on the actual results. This module helps to continuously adjust and optimize the model to improve the scientific and accurate decision-making. These modules work together to innovate and optimize the enterprise management model, enabling enterprises to respond to market changes and management challenges faster and more effectively (Wang, Tian, et al. 2023).

3.2 Enterprise Management Model Innovation System Design

Model building is the key to enterprise model innovation. Specifically, the process is:
Design the input layer. The main task of the input layer is to obtain key variables from enterprise management, which mainly include financial indicators, market sales data, production efficiency, human resource allocation, etc. See Eq. (1) for details.

$$X = [x_1, x_2, \ldots, x_n] \tag{1}$$

In this formula, the input vector represents the multi-dimensional factors in the enterprise management model, for example, x_1 is refers to the market share of the enterprise, and represents the competitiveness and brand influence of the enterprise in the market; x_2 is refers to the production cost, which reflects the cost control ability of the enterprise; x_3 is employee satisfaction, which affects the human resource efficiency and innovation ability of the enterprise. These input data will be standardized, and based on this, it will be used to ensure that variables of different dimensions are used in the model reasonably, and then ensure the data uniformity and the accuracy of the model.

It is also necessary to optimize the investment in innovation in the hidden layer. Specifically, the hidden layer is the innovation investment of RBF neural network, which directly affects the computational performance and learning ability of the model. In the innovation of enterprise management mode, the nodes of the hidden layer need to be adjusted according to the needs of enterprise management. For the formula, see Eq. (2).

$$h = \alpha \times n \tag{2}$$

In this formula, h is the innovation input of the hidden layer is represented. α is an evaluation index that determines the flexibility of the amount of innovation input in the hidden layer. Generally speaking, cross-validation is required to make this determination. n is the number of input variables that directly reflects the breadth of key factors considered in business management. Reasonable innovation investment can help the model achieve rapid response and efficient calculation when dealing with complex problems in enterprise management (Wang, 2024), and then avoid overfitting or computational redundancy due to excessive innovation investment.

Determining its output layer mapping function is another key step. The main task of the output layer is to translate the calculation results of the hidden layer into specific enterprise management decisions, and its mapping function form is shown in Eq. (3).

$$y = \sum_{i=1}^{h} w_i \times \phi(\| X - C_i \|) \tag{3}$$

In this formula, w_i is the weight, which represents the degree of influence of each factor on the final decision in the innovation of enterprise management mode. For example, the greater weight of market share indicates that it is more important in corporate decision-making. Weights are continuously adjusted based on training to optimize decision-making. ϕ is an activation function that is used to measure the degree of matching between input variables and central vectors in the management of enterprises. The improved Gaussian activation function can be used to deal with the nonlinear changes in market demand and supply chain fluctuations in management.

3.3 Research and Training on Enterprise Management Model Innovation

In this paper, the model training performs supervised learning by introducing historical data and simulation data of enterprises, and continuously optimizes the weights and parameters of the RBF neural network. Based on multiple iterations and parameter adjustments, the model gradually improves its prediction ability for complex management scenarios. In the training process, it also realizes the rapid convergence of the model based on the error feedback mechanism to ensure the decision support of the

management side under different enterprise management modes (Xiao, 2024).

The model optimization is based on adjusting the kernel function, learning rate and regularization method to further improve its adaptability to the innovation of enterprise management mode. Among them, the kernel function is the key for the model to identify nonlinear patterns in enterprise management. For the improved Gaussian kernel function, see Eq. (4).

$$f(||X - C||) = exp\left(-\frac{||X - C||^2}{2\sigma^2}\right) \quad (4)$$

n Eq. (4), σ is the Gaussian kernel width parameter, which reflects the sensitivity of the model to the distribution of input data. In the enterprise management model, the adjustment will effectively optimize the performance of the model in different business scenarios, such as in a volatile market environment, which can improve the robustness.

The adaptive learning rate mechanism can make the improved RBF model gradually optimized in enterprise management decision-making. For the learning rate, the formula is shown in (5).

$$\eta_{t+1} = \eta_t \times \frac{1}{1 + \beta \times t} \quad (5)$$

In this formula, η_t is the current learning rate, which is used to control the rate at which the parameters of the model are updated. This parameter is large in the early stage to speed up the model learning, but gradually decreases in the later stage to ensure stable convergence. β is a tuning parameter that has a direct effect on the rate of decay of the learning rate (Yan, and Ma, 2023). In the innovation of enterprise management mode, based on the fine adjustment of the learning rate, the rapid adaptation of the model in changing management scenarios will be further ensured.

Regularization is mainly to constrain the complexity of the model and avoid overfitting under the operation of the penalty term in the loss function, so that the results of enterprise management model innovation are more universal. For the formula, see Eq. (6).

$$L = \frac{1}{2}\sum_{i=1}^{N}(y_i - \hat{y}i)^2 + \lambda\sum i = 1^h w_i^2 \quad (6)$$

In this formula, λ is the fitting ability, which is used to control the size of the weights and prevent the RBF model from relying too much on specific variables in enterprise management decisions, so as to improve the robustness of the decision. Based on the improved RBF neural network algorithm model, the innovation of enterprise management mode will be realized. It can make scientific decisions in a complex and changeable environment, provide intelligent support for enterprises, optimize resource allocation and strategic choice, and then achieve continuous improvement and innovation of management mode.

3.4 Research and Optimization of Enterprise Management Model Innovation

In the innovation of enterprise management mode based on the improved RBF neural network algorithm, the system integration method needs to effectively integrate each module to ensure the smooth processing of data and the seamless connection of the decision-making optimization process. System integration involves these steps. For example, data interface integration, this step is based on the design of standardized data interfaces to realize the data interaction between data preprocessing modules and input layer modules. This process ensures that the data is transmitted and processed in a uniform format. The integration of invocation between modules is mainly to let each functional module call based on API and microservice architecture, such as the hidden layer module to call the processed data. The integration between the modules is carried out synchronously or asynchronously to ensure the efficiency of the system. Algorithm integration, the core algorithm of the RBF neural network is integrated with the model training module to ensure that the optimization algorithm is automatically called to adjust parameters such as weights, kernel functions, and regularization methods during the training process. Output integration, the output layer module integrates the prediction results, evaluation and feedback modules, and then effectively evaluates the model output results, and optimizes the feedback, so that the management can view and apply these decision-making suggestions in real time. Based on system integration, each module can cooperate efficiently and effectively achieve the overall optimization of enterprise management mode.

4 RESULTS AND DISCUSSION

4.1 Case Introduction of Enterprise Management Model Innovation System

This case study is based on the application of an improved RBF neural network algorithm in the management model innovation of a large manufacturing enterprise. In the highly competitive market environment, the company faced problems such as rising production costs, complex inventory management, and fluctuating market demand, The key data indicators in the overall management mode of the enterprise are shown in Table 1.

Table 1: Key data indicators of the company

Project	Short term profitability of the enterprise.	Long term economic benefits of the profession.	Resource management.	The development strategy of the enterprise.
Production costs	200,000	210,000	195,000	220 thousand
Sales	500,000	480 thousand	520,000	495,000
Inventory levels	1000 pieces	900 pieces	1050 pieces	950 pieces

Based on Table 1, it can be seen that the company has large fluctuations in cost control and inventory management, which has an impact on its overall operational efficiency.improve the operational efficiency of the enterprise, optimize the allocation of resources, and improve the market responsiveness, the enterprise decided to integrate the system based on the introduction of the algorithm, so as to optimize its management model. A total of 400 people participated in this system test, which was held for 5 days, producing 1,000 products and selling 500 products. The memory analysis of the management mode data of the enterprise is shown in Figure 1.

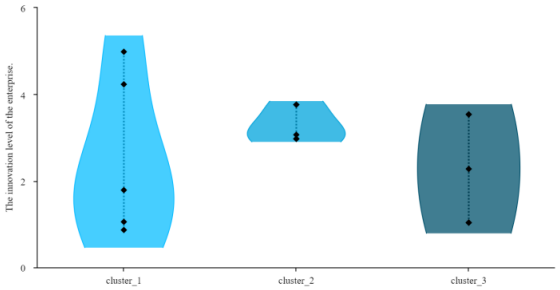

Figure 1: Cluster analysis of enterprise management data.

4.2 The Overall Innovation Model of the Enterprise

The allocation of human resources of enterprises is not really synchronized with the fluctuations of market demand, resulting in low efficiency of human input in production departments and sales departments. Based on the improved RBF neural network model integration system, it can effectively analyze these data of the enterprise and realize the intelligent optimization of the management mode. The analysis of the management effectiveness of the enterprise is shown in Table 2.

Table 2: Analysis of changes in market demand

Time period	The economic benefits of the enterprise.	Human resource management level.	The comprehensive potential development of enterprises.
Enterprise development stage.	300 pieces	350 pieces	320 pieces
A self optimization phase.	450 pcs	470 pieces	440 pieces
Future development strategy of the enterprise.	500 pieces	510 pcs	495 pieces

Table 2 shows the fluctuations in market demand in different quarters, and the changes in demand have an impact on their production planning and inventory management strategies. The innovation and development of enterprise management mode are shown in Figure 2.

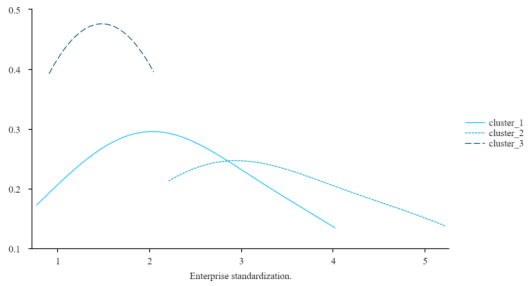

Figure 2: Comparison of comprehensive development effects of enterprises.

4.3 The Comprehensive Judgment Results of the Enterprise

The comprehensive analysis of the above three tables, it can be seen that there are significant fluctuations in the company's production costs and inventory management, and the rise in production costs and the instability of inventory have led to a decline in its operational efficiency. At the same time, the market demand fluctuates greatly, and the company does not adjust the production plan in time, so it brings about a backlog of inventory and insufficient supply.

Table 3: Analysis of the distribution and efficiency of human resources

Department	Manpower input1	Manpower input 2	Manpower input 3
Production department	200 people	220 people	210 people
Sales department	150 people	145 people	155 people
Logistics department	50 people	55 people	48 people

Table 3 provides data on the allocation of human resources and the efficiency of departments, and shows how the staffing and efficiency of each department in the company have changed over time. The analysis of the degree of innovation in the management mode of enterprises is shown in Figure 3.

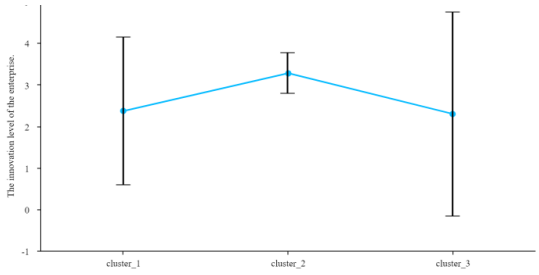

Figure 3: Comprehensive innovation of enterprise management mode.

5 CONCLUSIONS

After the study, it can be demonstrated that the application of the improved RBF neural network algorithm in the innovation of enterprise management mode has significant effectiveness. The algorithm can effectively deal with the complexity problems in enterprise management, and gives excellent performance in resource allocation optimization, production efficiency improvement and decision support. Based on the introduction of intelligent data analysis and optimization models, the accuracy and response speed of enterprise management decision-making have been greatly improved, so as to achieve the refinement and intelligence of enterprise management process. In addition, the algorithm also has good adaptability in the changing market environment, which provides strong technical force for the continuous innovation and competitiveness of the enterprise. The research time of this paper is quite limited, so there are inevitably errors and omissions, which can be further updated and optimized in the future.

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