

Safety Stock Prediction System And Its Application In Chemical Fiber Enterprises

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Abstract : *Accurate and timely prediction of the safety stock of enterprises is of great significance for reducing the cost and improving the economic benefit, which is the urgent problem to be solved in the current manufacturing industry. Because of the complex nonlinear relationship between factors which affecting safety stock, it is difficult to get better decision results by traditional methods. This project first studies the intelligent prediction system of safety stock based on synergetic neural network, and applies it to inventory management of Quanzhou chemical fiber enterprise. The research is of great theoretical and practical significance for chemical fiber enterprises and even for private enterprises.*

Keywords : *Safety stock, Synergetic neural network, Prediction system*

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I. Introduction

Since the reform and opening up, Quanzhou private enterprises relying on overseas Chinese investment and good market environment, have quickly completed the stage of accumulation of primitive capital, became the most dynamic source of economic development. In recent years, with the continuous development of the economy, the competition among enterprises is becoming more and more intense, and the enterprises are constantly seeking ways to reduce the cost, increase the efficiency and improve the competitiveness of the market. How to maintain a safe stock is a key problem. Safety stock refers to the estimated insurance reserve taking into account the relationship between product supply and marketing and various uncertainties in the supply chain. Improper increase of safety stock will increase the cost of enterprises, affect capital turnover and bring losses to enterprises. Therefore, accurate prediction of safety stock level is very important for enterprises [1-2].

At present, the safety stock is usually determined by experience and statistic technology. Because there are many factors affecting inventory, and there is a complex nonlinear relationship between these factors and decision results, the statistical mathematical model established by traditional methods is very difficult to get better decision results. It is necessary to build an effective safety stock prediction model, so as to improve the accuracy of prediction. Synergetic neural network is a widely used artificial intelligence technology which has great advantages in dealing with nonlinear problems and has been successfully applied to various fields. In this paper, intelligent security inventory based on synergetic neural network [3-4] is proposed in this paper. Through the competition of order parameters, the optimal safety stock prediction is finally exported. With the increasingly fierce competition, private entrepreneurs have begun to think about how to adjust the supply relationship to adapt to changes in the economic environment. The study of intelligent safety stock forecasting system has important theoretical and practical significance for the development of chemical fiber enterprises and even for private enterprises.

The safety inventory is usually determined by experience and through simple statistical methods. At present, the research on intelligent safety inventory prediction is still in the beginning stage, and the research results are relatively few. At present, neural network [5-6], genetic algorithm [7-8] and dynamic programming algorithms [9] are used to determine the safety stock, but these methods are not good to distinguish the many factors that affect the stock. Synergistic neural network has been successfully applied to handwriting recognition [10] and network anomaly detection. The determination of security inventory can also be considered as a synergistic analysis of each factor in essence, so it is also possible to use this method to solve it. At present, the research of synergistic neural network mainly focuses on the optimization of network parameters and the selection of prototype vectors.

The rest of this paper is organized as follows. In section 2, synergetic neural network theory is introduced. A safety stock prediction system based on synergetic neural network is proposed and implemented in section 3. Finally, some experimental tests, results and conclusions are given on the systems.

II. Synergetic Neural Network Theory

Haken puts forward a new theory of applying synergetic principle to pattern recognition: a certain number of order parameters are constructed according to the test pattern and prototype model, and the evolution is carried out by the kinetic equation. The dynamic equations for pattern recognition are as follows:

$$\dot{q} = \sum_{k=1}^M \lambda_k (v_k^+ q) v_k - B \sum_{k' \neq k} v_k (v_{k'}^+ q)^2 (v_k^+ q) - Cq(q^+ q) + F(t) \quad (1)$$

The initial value of the model is $q(0)$, λ_k is the attention parameter and the prototype mode vector is v_k , where $v_k = (v_{k1}, v_{k2}, \dots, v_{kN})'$. The adjoint vector is v_k^+ . The normalization and zero mean conditions must be satisfied:

$$\sum_l v_{kl} = 0, \|v_k\| = \left(\sum_{l=1}^N v_{kl}^2 \right)^{\frac{1}{2}} = 1 \quad (2)$$

The adjoint vector must satisfy: $(v_k^+ v_{k'}) = v_k^+ v_{k'} = \delta_{kk'}$ (3)

$$\delta_{kk'} = \begin{cases} 1, & k = k' \\ 0, & k \neq k' \end{cases}$$

When the kinetic energy of the order parameter is exhausted, that is

$$\dot{\xi}_k = 0, \quad 1 \leq k \leq M \quad (4)$$

The system will be in a stable state.

III. Safety Stock Prediction System Based On Synergetic Neural Network

The inventory forecasting system is shown in Figure 1.

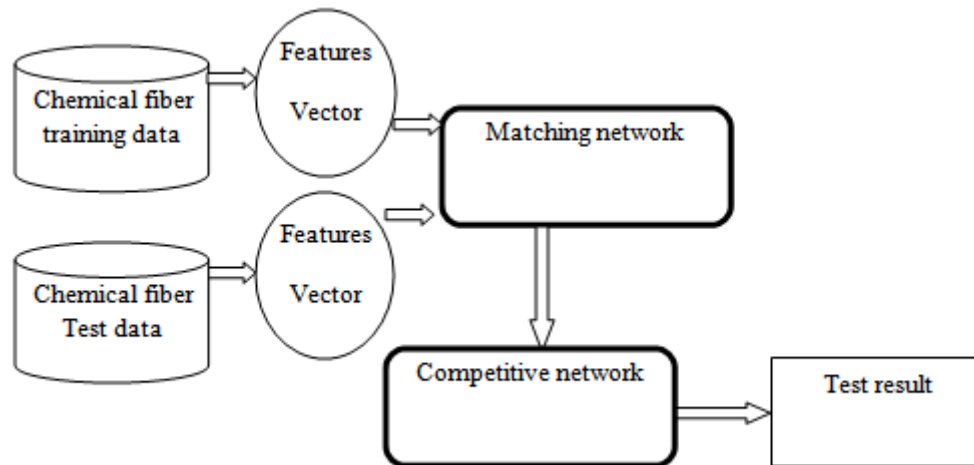


Fig.1. The inventory forecasting system based on synergetic neural network

First, the training data and the test data are transformed into feature vectors, and then the prediction model is obtained by training in the matching network. Finally, the competition in the competitive network is carried out to obtain the final order parameter.

On the other hand, the variation of the parameters of the synergetic neural network will lead to the difference of the attracting domain, thus affecting the prediction performance of the system. At present, there is no mature research theory to control network parameters in the prediction process. In recent years, intelligent optimization algorithm has become the main method to solve nonlinear optimization problems. We can regard the learning process of intelligent prediction system as the process of searching the optimal parameter set in parameter space.

In this paper, we selected the sales data from chemical fiber enterprises, and the related data in January 2017 - January 2018. The initial data are normalized, and the experimental training data are obtained.

The predicted value of February 2018 was 6.37, which was basically identical with the actual value of 6.56. It can realize the accurate forecast of the safety stock of the enterprise.

IV. Conclusion

The intelligent safety stock prediction system proposed in this paper can be applied to the supply chain inventory management of private enterprises, and has a good industrial application prospect. Intelligent prediction system for safety stock is of great significance for reducing company cost and promoting business development. The standardization and industrialization of inventory management is an irresistible trend. It is necessary to increase the research of intelligent inventory management and maximize the application of AI technology in manufacturing industry.

The intelligent prediction system proposed by this paper can also be used in the financial risk assessment and credit risk assessment of private enterprises which can achieve better economic and social benefits in these directions. 1) Financial risk assessment of private enterprises When enterprises enter the stage of growth, they often face financial risks with insufficient funds. Some private enterprises only pay attention to profits and sales growth, ignoring cash management and blind expansion. The intelligent prediction system proposed in this paper can carry out collaborative risk assessment for the factors that affect financial risk and provide reference for enterprise management. 2) Credit risk assessment of private enterprises Clearing up the credit channels of commercial banks and private enterprises is still the main way to ease the financing difficulties of private enterprises in a long period of time. The optimized intelligent forecasting system can evaluate the evaluation factors comprehensively, and has a positive significance for improving the financing environment of private enterprises.

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