Research and Analysis of Data Modeling in Financial Management Based on the Context of Artificial Intelligence Technology

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Abstract. By building a supply chain finance platform based on the Internet, informatizing and networking the financial chain business and realizing network-based supply chain business management with the help of information technology, it can greatly promote the efficiency of supply chain-related business management. In addition, the Internet-based supply chain platform also helps different enterprises in different regions to interact with information, which greatly reduces the management cost and difficulty of cross-regional management. From a macro perspective, the establishment of a supply chain finance platform helps integrate and allocate resources, and has a positive impact on improving economic and social benefits. With the support of the supply chain finance platform, the credit behavior of marketing companies in the supply chain is effectively curbed, which plays an important role in improving the capital turnover rate and reducing the business risks of enterprises. After the capital turnover is guaranteed, enterprises can invest more energy in product development and sales channel expansion, which is of great significance to improve their market competitiveness and economic benefits. This paper studies and analyzes the big data model of financial management based on the big data foundation of the Internet platform.

Keywords: Artificial intelligence · Financial management · Data modeling · Analysis of financial dynamics

1 Introduction

It is a fundamental conclusion of modern economic theory and practice that economic growth generates demand for labor through the activities of various sectors of the national economy, which leads to employment growth, and this conclusion is applicable in China as well [1, 2]. Under the stage of high quality development, new technological revolution and industrial changes provide more opportunities for employment, while new towns and rural revitalization provide more growth points for employment, and the improvement of labor market and overall education level provide highly skilled and high quality labor for employment [3].

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2 Single-Output Subnet Model for Incomplete Data

It is known that the essence of neural network parameter learning is the optimization problem of the model error function [4]. The error generated by the pth dimensional output of a multi-output neural network is:

$$E_p = \frac{1}{2}\sum_{i=1}^{t}(\widehat{y_{ip}} - y_{ip})^2$$

t denotes the number of training samples, $\widehat{y_{ip}}$ denotes the desired output, and y_{ip} denotes the actual output [5]. The total error of the multi-output neural network is expressed as: The output error of the pth subnet of the subnet group is:

$$E^p = \frac{1}{2}\sum_{i=1}^{t}(\widehat{y_i}^p - y_i{}^p)^2$$

t denotes the number of training samples, $\widehat{y_i}^p$ denotes the desired output, and $y_i{}^p$ denotes the actual output [6]. The total error of the output of the subnet group can be found according to the following equation [7]:

$$E_{sub} = \frac{1}{n}\sum_{p=1}^{n}E^p$$

In summary, the subnet group structure is consistent with the error function of the multi-output neural network, and the subnet group structure can be used instead of the multi-output network to solve the multi-dimensional output problem [8].

The objective of multi-output neural networks based on gradient descent algorithm for solving network parameters is:

$$\frac{\partial E_{more}}{\partial w_{ij}^{(l)}} = 0$$

where $\partial w_{ij}^{(l)}$ denotes the connection weights between the i-th neuron in layer l-1 of the multi-output network to the j-th neuron in layer l.

3 Experiments and Analysis of Results

3.1 Experimental Protocol

(1) Comparison experiment between single output subnet method and linear regression method
(2) Results of comparison experiments of neural network methods

Five different incomplete datasets were randomly generated for each dataset at each missing rate, and the average of the filling error MAPE of these five datasets was taken as the final experimental result [9]. As shown in Table 1.

Table 1. Experimental results on the Iris dataset

	AE	SONN	AE + IL	SONN + IL
5%	0.214	0.123	0.093	**0.092**
10%	0.246	0.162	0.117	**0.114**
15%	0.277	0.178	0.123	**0.115**
20%	0.311	0.199	0.145	**0.128**
25%	0.321	0.234	0.185	**0.149**
30%	0.328	0.277	0.214	**0.156**

3.2 Analysis of Results

(1) Convergence analysis of iterative learning modeling methods for single-output subnets

The Iris dataset and Stock dataset are used as examples to analyze the convergence of the single-output subnetwork iterative learning modeling approach for each missing rate of the dataset. As shown in Fig. 1 and 2.

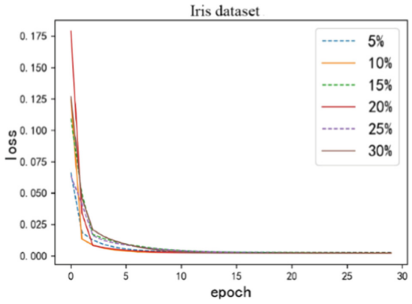


Fig. 1. Convergence of the subnet iterative learning method on the Iris dataset.

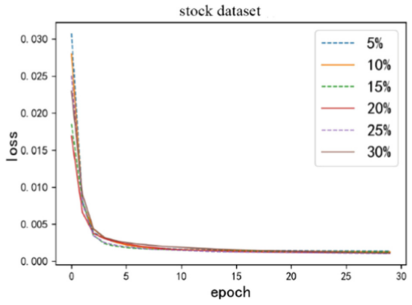


Fig. 2. Convergence of the subnet iterative learning method on the Stock dataset

Table 2. Experimental results on the Iris dataset

	AE	**SONN**	**AE + IL**	**SONN + IL**
5%	0.214	0.123	0.093	0.092
10%	0.246	0.162	0.117	0.114
15%	0.277	0.178	0.127	0.115
20%	0.311	0.199	0.145	0.128
25%	0.321	0.234	0.185	0.149
30%	0.328	0.277	0.214	0.156

As shown in Figs. 2 and 3, the loss function of the single-output subnetwork decreases rapidly in the first few iterations and then plateaus [10]. The loss function converges relatively quickly when the single-output subnet iterative learning method constructs the model at each missing rate for the Iris and Stock datasets, indicating that the single-output subnet based on iterative learning has a more desirable convergence.

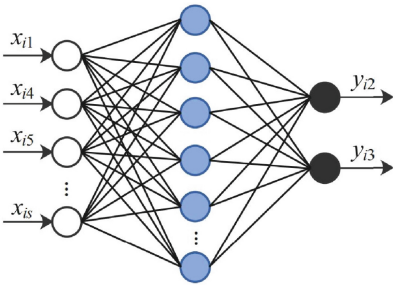
(2) Results of comparison experiments of neural network methods

Four neural network modeling approaches were obtained on the experimental dataset to fill the results as follows Table 2 Optimal results are indicated by bold and underlined, and suboptimal results are indicated by underlined.

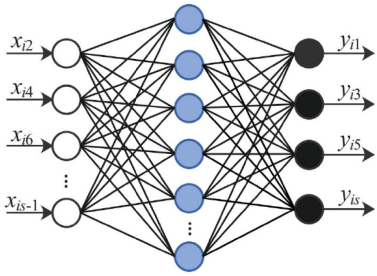
(1) Parameter selection

To ensure the fairness of the experiments, so that the model approximation performance and filling accuracy are only related to the choice of network structure and training scheme, the neural networks in each group of experiments are chosen for their respective optimal hyperparameter combinations. As shown in Fig. 3.

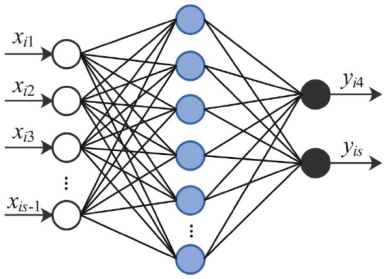
Suppose the number of attributes of an incomplete dataset is 4. In the worst case it will have 14 combinations of missing attributes, i.e. $\{a_1\}, \{a_2\}, \{a_3\}, \{a_4\}, \{a_1, a_2\}, \{a_1, a_3\}, \{a_1, a_4\}, \{a_2, a_3\}, \{a_2, a_4\}, \{a_3, a_4\}, \{a_1, a_2, a_3\}, \{a_1, a_2, a_4\}, \{a_1, a_3, a_4\}, \{a_2, a_3, a_4\}$ Even in the case where the missing rate per sample is not exceeded, there will be at most one possible combination of deletions.



(a) The model corresponding to the missing combination of attributes {2,3}



(b) The model corresponding to the missing combination of attributes {1,3,5,s}



(c) The model corresponding to the missing combination of attributes {4,s}

Fig. 3. Regression model set of incomplete data attributes based on multilayer perceptron

4 Conclusion

It is a good support for the daily financial management of relevant personnel and has great significance for improving the efficiency and effectiveness of financing and fund flow. In order to facilitate the further provision of subsequent financing, lending and other financial services after this subject development system is put into application, data mining, decision support and other technical means can be used to analyze the supply chain data stored in the system for risk analysis and decision support, and establish credit rating models and risk management mechanisms based on the analysis results.

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