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Active Learning and Deep Learning in Financial Big Data Mining and Predictive Modeling

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Introduction

Financial big data mining mainly uses data mining techniques to obtain valuable information from large-scale financial data, which usually includes stock data, transaction records, customer behavior records, and macroeconomic indicators. Currently, artificial intelligence technologies such as machine learning and deep learning are rapidly developing, providing strong technical support for financial big data mining and prediction. This article aims to achieve accurate prediction of financial big data by utilizing active learning and deep learning technologies, providing effective support for scientific management decisions of enterprise managers.

This article analyzes the operation principle of deep learning, realizes mining and prediction for financial big data, then analyzes the advantages and training process of active learning models, and combines them with deep learning models. By automatically annotating a small portion of data with higher value, the efficiency of model training and performance optimization can be improved.

Research objectives

- To use active learning techniques to help deep learning models focus more on the data that is most critical to improving performance
- To reduce dependence on a large amount of annotated data and achieve efficient learning and prediction capabilities of the model

Methods

Application of deep learning in financial data prediction

This composite model decomposes the original financial time series data by VMD to obtain a temporal filtering layer and an LSTM layer, and after the temporal filtering layer, it obtains an FM (Factorization Machine) layer. After connecting these layers and performing convolutional fusion, a dense layer is ultimately obtained. The LSTM layer is used to obtain the temporal features of the data, while the FM layer is used to obtain the filtering layer after filtering three-dimensional data into two-dimensional data. Ultimately, the model can simultaneously express the temporal and interactive features of the data.

$$RMSE = \sqrt{\frac{1}{T}\sum_{t=1}^{T}(y_t' - y_t)^2} \quad (1)$$

$$MAE = \frac{1}{T}\sum_{t=1}^{T}\left|y_t' - y_t\right| \quad (2)$$

Training and application of active learning models

Firstly, data input is required, and the annotation set needs to be updated for training using a classification model. Afterwards, the model will make predictions on the unlabeled set. If the iteration conditions are met, the results will be directly output. If not, the active learning sampling algorithm will be used for calculation. This algorithm includes classification distance estimation, similarity estimation, and sorting selection, and ultimately updates the annotation set through manual annotation.

$$Ds(x) = p(\bar{x}_1|x) - p(\bar{x}_2|x) \quad (1)$$

$$Ss(x) = \frac{d(x,y)}{1+d(x,y)} \quad (2)$$

Comparative experiment on enterprise revenue forecast

The experimental results of predicting the operating revenue of the experimental group and the control group are shown in Figure 1. The average prediction accuracy of the experimental group is higher than that of the control group. In terms of prediction error, the average RMSE of the experimental group is 0.576, while the average RMSE of the control group is 0.591. The average RMSE of the experimental group is lower than that of the control group, indicating that the average prediction error of the experimental group is smaller. Compared to the control group, the experimental group performs better in terms of average prediction accuracy and average RMSE.

This indicates that the method proposed in this article can effectively improve the predictive ability of enterprise operational perforn

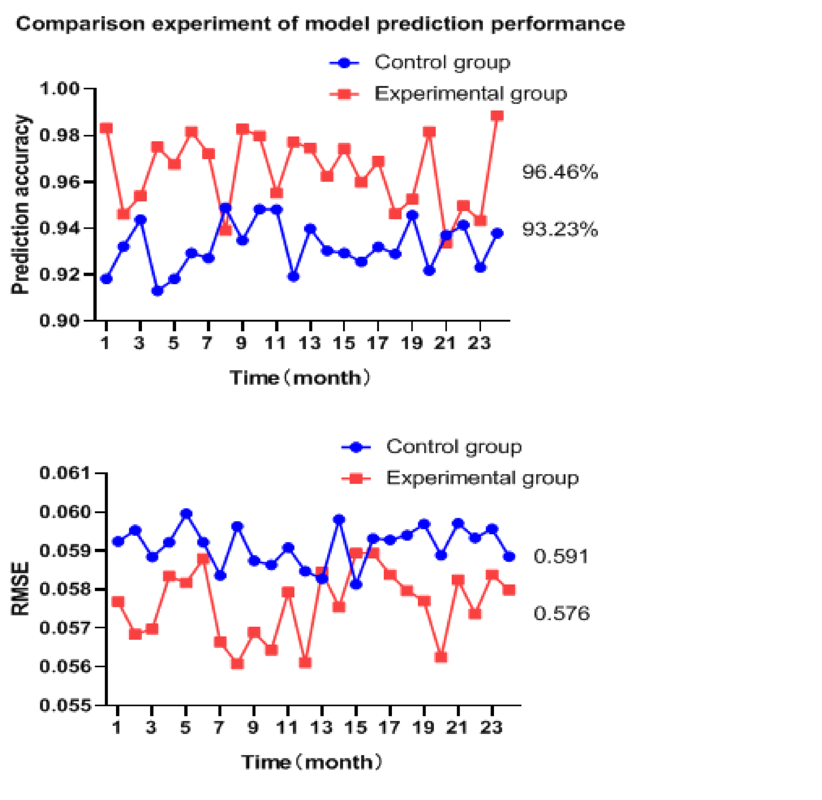

Figure 1. Experimental results of enterprise revenue prediction

Results

Comparative experiment on customer comment classification

The comparison of price, quality, and service between the experimental group and the control group is shown in Figure 2.

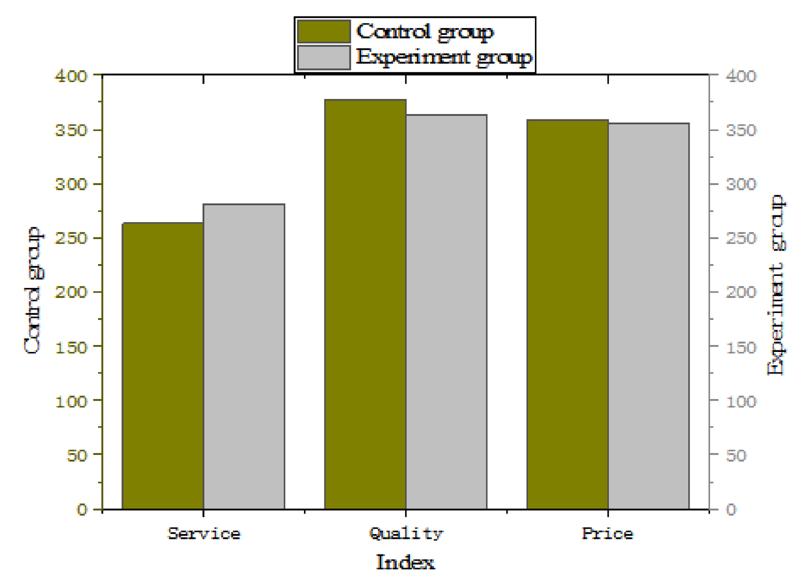

Figure 2. The comparison of price, quality, and service between the experimental group and the control group

The effect comparison of active learning in the credit scoring model is shown in Figure 3.

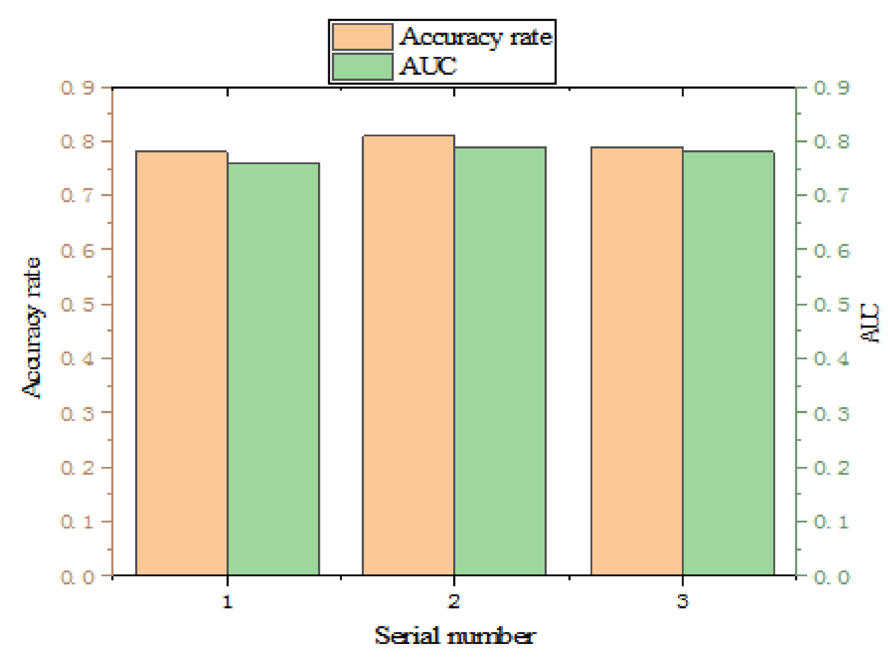

Figure 3. Effect comparison of active learning in credit scoring model

Conclusions

- This study combines active learning and deep learning methods to construct a financial big data prediction model with better performance compared to traditional methods.
- The results of two comparative experiments also effectively validate this method.

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