

Research on the Application of Time Convolution Series in Futures Price Forecasting

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Abstract. Aiming at the problem of anomaly detection of time series data with unbalanced distribution among classes, a detection method based on depth convolution neural network is proposed. With the increasing trading scale of the futures market, it covers more and more economic and financial fields, and the volatility of the futures market is more and more intense, which constantly presents many complex phenomena that cannot be explained by other classical financial theories. Investors predict stock prices based on statistical analysis or simple machine learning methods, but because the stock market is a complex nonlinear dynamic system, these methods have huge limitations. By using the existing data and the chart obtained by the game master software for prediction analysis, the advantages of several technical indicators have been effectively complemented, and the accuracy of prediction has been improved. On the basis of the concept of attribute set and attribute measure, aiming at the problem of pattern recognition, this paper proposes a recognition method, establishes an attribute mathematical model, and combines it with other methods, which has been gradually applied to artificial intelligence, neural network and other fields. It has been successfully applied in the prediction of futures price trend. Building a futures price forecasting model to reveal the inherent law implied in futures market price index and show its evolution mechanism can improve the control ability to deal with economic and financial risks, and provide an objective and rigorous basis for regulatory authorities to formulate relevant policies, which is also the significance of this study.

Keywords: Time convolution sequence, Futures price forecast, Self-coding network.

1. Introduction.

With the development of information technology, time series data is being produced in almost every application field in real life at an amazing speed [1]. The futures price is considered as an authoritative indicator that can reflect the market situation. A reasonable and effective futures price forecast can help relevant enterprises to provide effective measures and guarantees in terms of avoiding price risks, increasing returns and stabilizing futures prices [2]. Identify potential risk problems in time. It is realized by establishing and simulating the mechanism of human brain to process information, and the feature learning of data is realized by transferring data layer by layer from low level to high level in a data-driven way [3]. Its core idea is to minimize the difference in the number of normal and abnormal samples in the unbalanced data set through data processing [4]. The attribute recognition method is a supervised pattern method. Its main feature is that it reflects the importance of each pattern index and plays an important role in pattern recognition [5]. The typical unbalanced data processing method is sampling method [6].

However, with the development of the futures market, the volatility in the futures market is becoming more and more intense, and the futures data show the characteristics of high intelligence, strong correlation, tight coupling, etc. More futures indicators have been proposed to help investors and managers study and judge the futures development trend. Many time series data sets produced in actual projects are unbalanced data sets, that is, the number of normal signals in the series is far greater than the number of abnormal signals, This unbalanced distribution of data will reduce the performance of machine learning methods, and there are many restrictions on learning the nonlinear relationship between various indicators of the futures market [7]. Originating from the abstraction and simulation of human brain, time convolution sequence has a very strong ability to fit nonlinear mapping, is a very strong supervised learning algorithm, and has made certain achievements in futures forecasting [8]. The predictive value of futures market technical analysis lies in taking necessary

preventive measures in advance, which is of great significance to the development of the national futures industry [9].

2. Time convolution sequence

2.1 Convolutional Neural Network

Convolutional neural network, or convolutional network for short, is a network structure used to process grid structured data. It perfectly solved the recognition of handwritten numerals, which was the beginning of convolutional neural network from theory to practical application. However, due to the lack of training samples and computing ability at that time, convolutional neural network did not become popular. Instead, manual design features such as support vector machine achieved good results on small sample sets and became the mainstream. Time series data is usually considered as one-dimensional data format, while pictures are considered as two-dimensional data format. Convolutional neural network has achieved great success in processing data with this two-dimensional structure. At the same time, it can automatically combine and filter low-level features to obtain the characteristics of high-level semantic features at different abstract levels and the mechanism of sharing weight. As shown in Figure 1, the time series model:

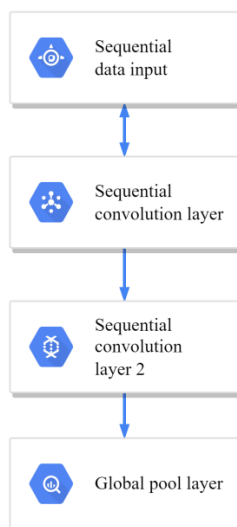


Figure 1. Time series model

The actual time series data are long sequences with time stamps. In order to better learn the data characteristics, the original signal must be created as a fixed size segment. The main structure of convolution network is convolution layer, pooling layer, full connection layer, and innovative expansion convolution for increasing receptive field. A data processing algorithm is proposed for time series data, which increases the representative data of minority samples and improves the feature learning ability of the classifier for minority samples. The convolution layer is mainly used for feature extraction of input data, including multiple convolution kernels. Each element of the convolution kernel corresponds to a weight coefficient and a deviation, similar to the neuron of a feedforward neural network.

2.2 Time series representation method

An effective time series representation method can not only make similarity comparison and classification between sequences, but also be well applied to other data mining tasks. In the representation of time series, each method emphasizes the above basic features from different aspects. According to the transformation mode, the time series representation methods are classified into three types: non data adaptive, data adaptive and model-based. In the non data adaptive representation method, the conversion parameters of each time series are consistent, and there is a unified data

processing flow for different time series. Data adaptive representation means that during data conversion, conversion parameters will change according to the characteristics of time series data. The model-based representation assumes that a time series is an observation of the underlying model. It can solve the problem of time migration in time domain similarity. As shown in Figure 2, the timing classification framework:

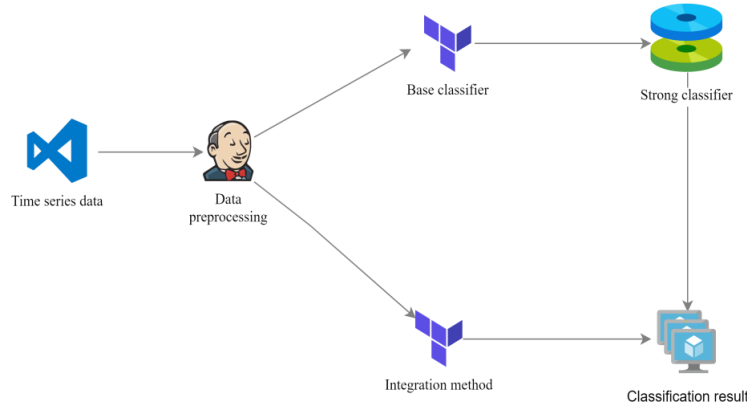


Figure 2. Time sequence classification framework

The sum autoregressive moving average model can succinctly represent the time series, and can be classified by efficient similarity measurement. The generation motivation expressed by time series is to highlight the main characteristics of data in a concise way, which is exactly consistent with the motivation expressed by time series. Numeric high-dimensional time series have significant computational complexity. Time series analysis can make the problem easier to solve by representing them as symbolic sequences rather than real value sequences. The time convolution network, which combines the advantages of convolutional neural network and cyclic neural network, has achieved good results in many time sequential tasks.

3. Futures price forecast

3.1 Forecasting principle of futures price

Futures price is a high-dimensional and complex time series, which is vulnerable to economic, political and other uncertainties. Because futures prices are affected by such factors as supply and demand, economic cycle, national policy, price index, and the status of trading varieties, these factors are highly nonlinear with futures prices, so traditional methods cannot accurately predict such complex data series as futures prices, resulting in low prediction accuracy. Futures prices are determined by changes in demand and supply, and the balance of supply and demand forces forms the market price of commodities. Economic statistics are usually some time ago. It is also impossible for ordinary market participants to keep the particle swarm with strong vitality and escape from local extreme points, so that the algorithm can maintain fast convergence speed and find the optimal solution. As shown in Figure 3, the futures price forecast chart:

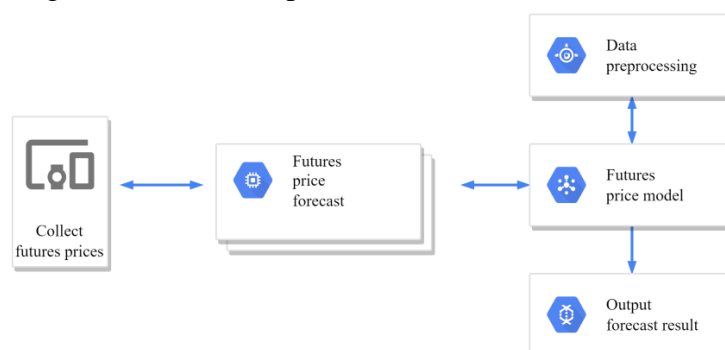


Figure 3. Futures Price Forecast

Use the model to forecast the futures price. In the process of building the model, build the influencing factor system of futures price forecast, and then use the time network to forecast the futures price. The basic principle of futures price prediction is to use past and present futures prices to predict the future price trend with certain methods, so as to provide reference for investors. Through the analysis of the market itself, we can predict several change directions, mainly drawing graphs or charts in chronological order for the price, trading volume and position information of futures varieties. The signals sent by time series can mislead traders. It is of little use to the short-term market, but can play a big role in the long-term market.

3.2 Futures price forecasting model

There are three futures price forecasting models. The basic idea of particle swarm optimization algorithm is to first call each solution of the optimization problem a particle, and then define an fitness function to measure the superiority of futures prices. The particle swarm optimization algorithm is improved and interacts with each other. The particles themselves do not have the ability to mutate. As a result, in the later stage of the algorithm, the diversity of the particle swarm is gradually lost because all particles converge to the global minimum or local minimum. As the speed of the particles also tends to zero, the market progress is slow. Activate the deactivated particles to disturb the particles at the current position, and unconditionally accept the disturbed or mutated results, so as to enhance the global search capability and accelerate the convergence speed and search accuracy of futures. The time series network is a typical multi-layer feedforward network. The neurons of each layer of the neural network can be set freely according to the actual situation. The research shows that the three-layer feedforward neural network can realize nonlinear mapping with arbitrary accuracy. The feature extraction method based on statistical model can solve the problem of time offset in time domain similarity. The sum autoregressive moving average model can succinctly represent the time series, and can be classified by efficient similarity measurement. The abundant liquidity of the market, the continuous depreciation of the US dollar, the overall recovery of major western economies and the expectation of inflation jointly led to the rise of futures prices. The essence of the network algorithm is to find the minimum value of the error function. The steepest descent method in nonlinear programming is used to modify the weight according to the negative gradient direction of the error function.

4. Conclusions

With the advent of the information age, time series data analysis has attracted extensive attention. In practical projects, most of the time series data sets have data skew. This paper presents an anomaly detection method for skewed time series data based on depth convolution neural network. This paper introduces the time series and summarizes its application rules. These indicators are comprehensively applied to optimize the combination and analyze the futures price. In the establishment of anomaly detection model based on time series, the hidden layer structure adopts the structure of the intersection of convolution layer and pooling layer. The advantage of this structure is that after the feature vector is extracted, the dimension of the feature vector is always kept within the appropriate range to avoid over fitting. A self normalized neural network activation function is proposed, which is combined with the parameter initialization method to train the model. The forecasting methods of futures market are constantly emerging, and these research results provide a certain reference value for investors. Generally, the market behavior of futures is more speculative than that of stocks and bonds, so some common forecasting methods often fail to predict the price of futures. We mainly forecast the rise and fall of the closing price. Because the futures settlement is marked to the market day by day, the daily closing price is more important for traders. There are many factors influencing futures prices, which are known for their large fluctuations, especially for the late comers such as countries in the capital markets of modern countries. The model innovation of time convolution network in this paper has achieved some results in futures price forecasting.

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