FIT5190 Assignment 3

Incorporating Financial Indices into Neural Networks to Predict the Stock Trend in China

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Abstract

China has a large scale of stock market and lots of people investing in the stock since both Shanghai and Shenzhen establish stock exchange centres, thus many researchers showed a great interest in predicting the stock trend. In this paper, we try to develop a more accurate prediction model by adding some special indexes of the stock into the parameters rather than using ordinary opening prices and closing prices. Basically, the model is based on Neural Networks (NN), and several different architectures and groups of input parameters will be tested in order to pick up the best model. With the excellent ability of figuring out the inner connection of multiple factors in a model in NN, we can verify whether the specific stock indexes that summarized by the experience of experts and economists do affect the trend of stock price, and it helps to reveal the factors which will affect the stock price.

Key Words: Neural Networks, Financial Indices, Stock Prediction

Introduction

The forecasting of the stock price is one of the most challenging tasks due to its uncertainty in the market, and so many potential factors which have hidden inner connections with each other will influence the price [1]. At this moment, most studies have been done are more concentrated on the methodology, researchers want to use various prediction models and technologies to get a more precise result. Hadavandi, et al. [2] took fuzzy system and artificial neural networks as their prediction methods; Cao, et al. [3] used dynamic versions of a single-factor CAPM-based model and Fama and French's three-factor model; also, rough set theory which can overcome some inherent drawbacks in neural networks may be another useful tool to implement stock price prediction [4]. In this paper, we focus more on the input parameters choosing which is adding more stock indexes into consideration, because as the stock market developing such a long time, many patterns and indicators which are very valuable for predicting the stock trend have been discovered by experts and researchers, and they are proved to be useful to some degree but never be applied in any NN models. Furthermore, theses information is widely used among the stock holders to make decisions related buying and selling [5].

Objectives

This paper aims at developing a more precise prediction model to forecast the stock trend by using some extra specific stock indexes as the input based on traditional NN models. In details, we hope to have two types of prediction, one is the trend in three days, the other is the exact price of the second day, and a better result could happened with the help of some specific financial indices. We try to summarize the inner links among different factors which will affect the stock price the second day using these two types of prediction, if the result is accurate enough, it can offer investors rational advices for buying or selling to avoid great losses.

Methodology

Neural Networks are good at finding out the inner relations among factors inside a model, so in this stock forecasting situation, NN is a very powerful tool. A large number of studies have shown that time-series prediction methods based on multilayered Feed-forward Neural Networks has a relatively high capability to solve this kind of problems [1]. Therefore, we choose some typical architectures of NN to do the prediction.

1. Standard 3-layer backpropagation neural networks. This is the simplest one but it's easy to use and sometimes very practical.
2. Recurrent networks with dampened feedback. This is a good architecture when dealing with time series data.
3. Ward networks with multiple hidden slabs. Because the existence of different hidden slabs, we can provide different view of the input data by assigning different activation function to them.
4. Kohonen Self Organizing Map (SOM) network is one type of unsupervised network, which is used to divide the input data into categories.
5. Probabilistic Neural Networks is a powerful model to categorize the input data especially applying genetic adaptive algorithm to it.
6. General Regression Neural Networks. It has a great capability to do a prediction on continuous values.

Besides the variety of architecture we use in the experiment, not only the normal prices but also some special terms in the stock market are chosen to be parts of the input parameters which will significantly affect the stock price hopefully.

1. Moving Average (MA). Moving average of the stock price on different period of time can reflect the trend of the stock in short, middle, or long term, it's a very commonly used index.
2. Turnover. It's another commonly used indicator which shows the total exchange volume of one stock share in one day. Usually, the stock that is going up will have a relatively large number of turnovers.
3. Moving Average Convergence/Divergence (MACD). This is actually the difference of two moving average, but it has a stronger tolerance with noise data.

It is also an important variable to indicate when to buy and when to sell.

4. Earnings per Share (EPS). This is an index showing if the company is making profit or losing money.

The data samples we collect are from a stock analysis software in real time, so the quality of the data is guaranteed. We gathered two pieces of records, one is the data of every stock in Shanghai Stock Exchange which has a symbol sequence ends up with a number 6 in March 2014; the other is one specific stock share whose symbol is 600757 from 11th May 2009 to 14th May 2014. We want to compare the result get from these two groups of data to see which one has a better performance using NN models.

Novelty

Compared to traditional stock prediction with NN models, we pay more attention to choose appropriate input parameters. Current studies focus more on finding a model that suit the stock market well in order to get a more accurate prediction result, but not consider too much about what kind of factors will affect the price more, for example, a study conducted in 2010 use both NN and pattern matching techniques to forecast the stock market [6], fuzzy system, rough set theory and some other methodology have been tried by many researchers, too [2, 4].

To create a new angle to this problem, we decide to incorporate some specific financial indices into the NN model, try to increase the accuracy of prediction by choosing parameters with stronger inner connections between each other and with more significant influence to the stock trend.

Another novel and innovative idea is to preprocess the data by clustering them with Kohenon SOM techniques. SOM will recognize the feature inside the stock data and categorize the stock into several classes, and then we build up a specific model for each class. Hopefully, it will result in less noise during the training because only samples with some similarity to some extend need to be adapted in a model which will extremely lower the difficulty of learning.

Conclusion and Significance

After hundreds of experiments, we find that even use the simplest 3-layer backpropagation NN model we can produce a relatively precise result with a well-organized input pattern. Choosing a better model do increase the accuracy of the predictive result, however, using more professional indexes as inputs parameters can also increase the quality of the prediction, especially MACD and EPS which turn out to have a great influence on the stock price.

Using NN model to find the inner relation of the financial indices which is taken as the input helps us to know the nature of the where stock prices go, and also, it verifies whether the indexes summarized from people's experience works well. It has been man's common goal to make lives easier, with the help of this model, maybe it could make a rational decision for you about buying or selling in order to avoid a great loss of money which is the key to an easy, comfortable and luxurious life.

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