
SOUTHEAST UNIVERSITY & MONASH UNIVERSITY JOINT GRADUATE SCHOOL

Combining Neural Networks and Financial Indices to Predict the Stock Trend in China

FIT5190 Assignment 3

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Abstract

Predicting the trend of the stock market more accurately has gained its popularity with the development of the stock market while traditional financial methods of the prediction are usually subjected to large errors and inefficiency. In this paper, we build up several Neural Networks (NN) models incorporating some financial indices to predict the stock trend in Shanghai Stock Exchange. How to promise a more accurate prediction by combining NN models and financial indices is the main research problem to be addressed in this paper. Various NN models, such as the Back-Propagation model and the Probabilistic Neural Networks model, are applied by taking financial indices of the stock market such as the moving average of the stock price as parameters. This paper makes significant methodological and practical contribution to the stock price prediction by largely improving the accuracy compared with traditional financial methods.

Key words: stock trend, prediction, Neural Networks, financial indices

Introduction (Background)

The prediction of the stock price is one of the most challenging tasks in the field of economy because of the nature of uncertainty and inner connected factors of the stock market which will influence the price level. NN models have the capacity of mining and discovering the inner relationship of features in a dataset, which is particularly suitable for the stock price prediction. Recent studies have shown that time-series prediction methods based on multilayered Feed-Forward Neural Networks have a

relatively high capability to solve this kind of problems [1].

At this moment, most researches have been done about stock price prediction are more concentrated on various prediction methods and models to get a more precise result. The Research conducted by Hadavandi, Shavandi and Ghanbari took fuzzy system and artificial neural Networks as their prediction methods [3]. Another research used dynamic versions of a single-factor CAPM-based model and Fama and French's three-factor model [2]. 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 try to conduct experiments to examine whether the result will be improved to be more accurate if we take financial indices into consideration by making them part of parameters of NN models.

We aim to build up various NN models on different types of data sets by incorporating some professional financial indices to acquire more precise results. Accuracy of both the prediction the trend of the stock market as well as the prediction of the exact level of a certain stock share brought up by various NN models can be further compared.

Objectives

We intend to acquire significantly improved prediction results, at least a 10 percent increase in accuracy, by applying various NN models by incorporating some specific financial indices to predict both the trend and the exact price of a specific stock share. More specifically, we aim to bring out the most suitable NN model(s) as well as the most significant financial factor of the stock price by applying various NN models, altering parameters of NN models and changing financial indices on different types of data sets.

Methodology

We first get raw data of the stock market by a software called TongHuaShun and then execute the preprocessing by removing irrelevant attributes as well as appending additional attributes by calculation.

To represent the accuracy of the prediction, we use the concept of R square. The R square criterion is the coefficient of determination and indicates how well data points fit a statistical model, which can be simply a line or a curve. It provides a measure of how well observed outcomes are replicated by the model and ranges from 0 to 1 numerically. Data sets with the R square value closer to 1 fit better to a statistical model. A higher R square value does not necessarily promise a higher accuracy of the prediction nor a lower error rate of the prediction.

To represent whether the stock market is on its increase or decrease, we classify the trend of a stock share into three categories: The first category is that the price will increase more than 5% in three days; The second category is that the price will decrease more than 5% in three days; The third category is that the price will hold steady, neither increase more than 5% nor decrease 5% in three days. Better prediction results can be brought out, hopefully, by combining various NN models with financial indices.

We conduct experiments in three stages. In the first stage, we try to apply different NN models, such as the Back-Propagation (BP) model, the Probabilistic Neural Networks (PNN) model and the General Regression Neural Networks (GRNN) model with same financial indices (such as the moving average of the closing price and the total amount of money in a day) on same data sets. In the second stage, we use a kind of unsupervised learning methods, the Kohonen Self Organizing Map Networks, to cluster data into two categories, and then use methods in stage1 to conduct the prediction on each clustered data set. In the third stage, we try to alter different kinds

of financial indices as part of parameters and use same NN models on same data sets to find out the most significant financial factors. Comparisons are made among prediction results to acquire the most suitable NN model(s) as well as the most significant financial factors of the stock price.

Too complex NN models and some far too professional financial factors are beyond our consideration because of the limitation of the data scale and attributes of data.

Novelty

Our research objectives and concepts are novel and innovative because of the combination of NN models and financial indices in the field of stock price prediction, while previous researches mainly consider only financial factors or only using NN models in prediction.

Traditional financial methods used to predict the stock price mainly focus on how various financial indices will influence the stock market and what are major factors contributing to the increase or the decrease of the stock price. A research conducted in 2010 indicated that the moving average closing price and the total amount of money in a day are major financial indices influencing the trend of the stock price [1]. These methods, however, can only conduct simple prediction and have very limited flexibility and adaptation.

The Neural Networks technology has shown its capability of prediction and classification as well as digging out the inner relationship of attributes of data. Studies have shown that time-series prediction methods based on multilayered Feed-Forward Neural Networks are more capable and suitable to solve the problem of prediction [2]. Researches of building up NN models to predict the stock price are more concentrated on how to get a more accurate result using various methods and models. NN models have improved the prediction accuracy, but not significantly.

We use novel and innovative methods by building up various NN models (the BP model, the PNN mode and the GRNN model) and incorporate financial indices (the moving average of the closing price and the total amount of money in a day) to promise a significant increase in the prediction accuracy. We also use unsupervised NN models (the Kohonen Self Organizing Map Networks) to cluster stock data into two categories, and then use NN models to conduct the prediction for each category.

Conclusion and Significance

By applying various NN models and taking financial indices as parameters to predict the stock price, we have found a significant improvement in the accuracy of prediction compared with traditional methods, which consider only about the choice of financial factors or the choice of NN models.

Applying the same NN model (For example, the BP model) on data of all stocks, data of a specific stock and clustered data, we have found that clustered stock data and data of all stocks, generally speaking, have a higher prediction accuracy compared with that of one specific stock data. Applying the same NN model (For example, the BP model) on the same data set (data of all stocks), and changing parameters of the BP model, we have found that different parameters, such as the number of neurons in the hidden layer and the number of hidden layers, have influence on the accuracy of prediction. The PNN model and the GRNN model perform much better than the BP model given that all other conditions are the same (including common parameters of models and financial indices). Professional financial indices such as the moving average closing price and the total amount of money in a day are major factors influencing the trend of stock price in all of NN models on all three data sets.

How to promise a more accurate prediction of the trend of the stock market has gained its popularity and significance with the development of the economy and the

NN technology. Methods we have mentioned in this paper, which mainly focus on combining NN models and financial indices, make significant methodological and practical contributions to the stock price prediction by largely improving the accuracy compared with traditional financial methods. Further investigation to bring out more accurate prediction can be conducted based on methods we have proposed in this paper.

References

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