**Time Series Analysis on Stock Market Data –** **ARIMA model**

Predicting Stock Market Price Using ARIMA Model

**Abstract: 300 to 400 words**

### Introduction

Nowadays, the most significant challenges in the stock market is to predict the stock prices. The stock price data represents a financial time series data which becomes more difficult to predict due to its characteristics and dynamic nature.

### Case description

Support Vector Machines (SVM) and Artificial Neural Networks (ANN) are widely used for prediction of stock prices and its movements. Every algorithm has its way of learning patterns and then predicting. Artificial Neural Network (ANN) is a popular method which also incorporate technical analysis for making predictions in financial markets.

### Discussion and evaluation

Most common techniques used in the forecasting of financial time series are Support Vector Machine (SVM), Support Vector Regression (SVR) and Back Propagation Neural Network (BPNN). In this article, we use neural networks based on three different learning algorithms, i.e., Levenberg-Marquardt, Scaled Conjugate Gradient and Bayesian Regularization for stock market prediction based on tick data as well as 15-min data of an Indian company and their results compared.

### Conclusion

All three algorithms provide an accuracy of 99.9% using tick data. The accuracy over 15-min dataset drops to 96.2%, 97.0% and 98.9% for LM, SCG and Bayesian Regularization respectively which is significantly poor in comparison with that of results obtained using tick data.

In this study, support vector regression (SVR) analysis is used as a machine learning technique in order to predict the stock market price as well as to predict stock market trend. Moreover, different types of windowing operators are used as data preprocess or input selection technique for SVR models. This is a new approach which uses different types of windowing functions as data preprocess for predicting time series data. Support vector regression is a useful and powerful machine learning technique to recognize pattern of time series dataset. It can produce good prediction result if the value of important parameters can be determined properly. Different kinds of Windowing operators are used in this experiment in order to feed more reliable inputs into regression models. This study is done on a well-known company of Dhaka stock exchange (DSE), named ACI group of company Limited. Four year’s historical time series dataset are collected from the DSE from 2009 to 2012, as daily basis for experimentations. Finally, predicted results from Win-SVR models are compared with actual price values of DSE to evaluate the model prediction performance.

We analyzed the possibility of predicting stock prices on a short-term, day-to-day basis with help of neural networks by studying three important German stocks chosen at random (BASF, COMMERZBANK, MERCEDES). We examined the use of PERCEPTRON, ADALINE, MADALINE and BACK-PROPAGATION networks.

The results were encouraging. Within short prediction time spans (10 days), we achieved a very hight degree of accuracy of up to 90%. With a BACK-PROPAGATION network we carried out an absolute-value prediction. The network was thereby able to recognize on its own an obvious heuristic and showed a behaviour similar to the exponential smoothing algorithm.

The results we achieved led us to expect that neural network could considerably improve the prognosis of stock prices (and more generally, the prognosis of semi-chaotic time series) in the future.

Nevertheless, considerable improvements are needed in the theory of neural networks, as practicable methods to support the design of neural networks for specific applications are not available yet.

Support Vector Machine is a machine learning technique used in recent studies to forecast stock prices. This study uses daily closing prices for 34 technology stocks to calculate price volatility and momentum for individual stocks and for the overall sector. These are used as parameters to the SVM model. The model attempts to predict whether a stock price sometime in the future will be higher or lower than it is on a given day. We find little predictive ability in the short-run but definite predictive ability in the long-run.

This paper is a survey on the application of neural networks in forecasting stock market prices. With their ability to discover patterns in nonlinear and chaotic systems, neural networks offer the ability to predict market directions more accurately than current techniques. Common market analysis techniques such as technical analysis, fundamental analysis, and regression are discussed and compared with neural network performance. Also, the Efficient Market Hypothesis (EMH) is presented and contrasted with chaos theory and neural networks. This paper refutes the EMH based on previous neural network work. Finally, future directions for applying neural networks to the financial markets are discussed.

**Introduction**

The introduction of your review should accomplish three things:

* **Introduce your topic: time series analysis**
  + It may sound redundant to "introduce" your topic in the introduction, but often times writer's fail to do so. Let the reader in on background information specific to the topic, define terms that may be unfamiliar to them, explain the scope of the discussion, and your purpose for writing the review.
* **State your topic's relevance: usage od ARIMA and other time series forecasting algorithms**
  + Think of your review paper as a statement in the larger conversation of your academic community. Your review is your way of entering into that conversation and it is important to briefly address why your review is relevant to the discussion. You may feel the relevance is obvious because you are so familiar with the topic, but your readers have not yet established that familiarity.
* **Reveal your thesis to the reader: plot of the best algorithm to be used**
  + The thesis is the main idea that you want to get across to your reader. your thesis should be a clear statement of what you intend to prove or illustrate by your review. By revealing your thesis in the introduction the reader knows what to expect in the rest of the paper.

Stock price prediction is one of the most widely studied and challenging problems, attracting researchers from many fields including economics, history, finance, mathematics, and computer science. The volatile nature of the stock market makes it difficult to apply simple time-series or regression techniques. Financial institutions and traders have created various proprietary models to try and beat the market for themselves or their clients, but rarely has anyone achieved consistently higher-than-average returns on investment. Nevertheless, the challenge of stock forecasting is so appealing because an improvement of just a few percentage points can increase profit by millions of dollars for these institutions. Traditionally, many prediction models have focused on linear statistical time series models such as ARIMA [7]. However, the variance underlying the movement of stocks and other assets makes linear techniques suboptimal, and non-linear models like ARCH tend to have lower predictive error [17]. Recently, researchers have turned to techniques in the computer science fields of big data and machine learning for stock price forecasting. These apply computational power to extend theories in mathematics and statistics. Machine learning algorithms use given data to “figure out” the solution to a given problem. Big data and machine learning techniques are also the basis for algorithmic and high-frequency trading routines used by financial institutions. In this paper we focus on a specific machine learning technique known as Support Vector Machines (SVM). Our goal is to use SVM at time t to predict whether a given stock’s price is higher or lower on day t +m. We look at the technology sector and 34 technology stocks in particular. We input four parameters to the model - the recent price volatility and momentum of the individual stock and of the technology sector. These parameters are calculated using daily closing prices for each stock from the years 2007 through 2014. We analyze whether this historical data can help us predict price direction. If the Efficient Markets Hypothesis (EMH) holds true, prices should follow a random walk and be unpredictable based on historical data. We find that in the short-term this holds true, but in the long-term we are able to reach prediction accuracies between 55% and 60%. We conclude that our model is able to achieve significant prediction accuracies with some parameters in the long-term, but that we must look at more granular intra-day trading data to achieve prediction accuracies in the short-term. The code written can be found at https://github.com/SaahilMadge/Spring-2015-IW.

**Discussion**

The discussion section is the body of your paper. The discussion section contains information that develops and supports your thesis. While there is no particular form that a discussion section must take there are several considerations that a writer must follow when building a discussion.

* **Don't summarize!**
  + A review paper is not simply a summary of literature you have reviewed. Be careful not to leave out your own analysis of the ideas presented in the literature. Synthesize the material from all the works—what are the connections you see, or the connections you are trying to illustrate, among your readings.
* **Analyze, Synthesize, Interpret.**
  + A review paper is not a pure summary of the information you read for your review. You are required to analyze, synthesize, and interpret the information you read in some meaningful way. It is not enough to simply present the material you have found, you must go beyond that and explain its relevance and significance to the topic at hand. Establish a clear thesis from the onset of your writing and examine which pieces of your reading help you in developing and supporting the ideas in your thesis.
* **Stay focused.**
  + Keep your discussion focused on your topic and more importantly your thesis. Don't let tangents or extraneous material get in the way of a concise, coherent discussion. A well focused paper is crucial in getting your message across to your reader.
* **Organize your points.**
  + Keeping your points organized makes it easier for the reader to follow along and make sense of your review. Start each paragraph with a topic sentence that relates back to your thesis. The headings used for this guide give you some idea of how to organize the overall paper, but as far as the discussion section goes use meaningful subheadings that relate to your content to organize your points.
* **Relate the discussion to your thesis.**
  + Your thesis should illustrate your objectives in writing the review and your discussion should serve to accomplish your objectives. Make sure your keep your discussion related to the thesis in order to meet your objectives. If you find that your discussion does not relate so much to your thesis, don't panic, you might want to revise your thesis instead of reworking the discussion.

**Conclusions**

Because the conclusions section often gets left for last it is often the weakest part of a student review paper. It is as crucial a part of the paper as any and should be treated as such.

A good conclusion should illustrate the key connections between your major points and your thesis as well as they key connections between your thesis and the broader discussion—what is the significance of your paper in a larger context? Make some *conclusions*—where have you arrived as a result of writing this paper?

Be careful not to present any new information in the conclusion section.

**References**

Here you report all the works you have cited in your paper. The format for a references page varies by discipline as does how you should cite your references within the paper.