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FORECASTING FINANCIAL TIME SERIES BASED ON ARTIFICIAL NEURAL NETWORKS

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ABSTRACT

The main objective of this research paper is to highlight the global implications arising in financial modeling modern paradigms. Reliable conceptual arguments and significant empirical evidence suggest the ability of artificial neural networks to predict future behavioral patterns. Moreover, forecasting noisy financial time series based on artificial neural networks lead to more satisfactory results compared to classical statistical methods. In recent past, the seemingly symbiotic relationship between financial theory and practice emphasizes more effective econometric tools for achieving high accuracy results. The analysis of predictive accuracy of artificial neural networks in the field of financial time series constitutes a real challenge in the context of globalization. This particular form of artificial intelligence represent one of the most important issue for further investigation in terms of computational finance.

KEYWORDS: Artificial Neural Networks, Financial Prediction, Financial Markets, Investment Patterns, Investment Behavior, Time Series Forecasting, Volatility

INTRODUCTION

The main motivation of this study is to highlight the forecasting process of financial time series based on artificial neural networks. A conceptual framework is necessary in order to capture fundamental characteristics. Technically, artificial neural networks have been applied to financial time series forecasting in order to significantly improve prediction performance. Furthermore, currently dynamic financial decision have significant implications in terms of investment strategies, portfolio analysis and capital management processes. Artificial neural networks represent one of the most prominent and increasingly popular technique used in modern quantitative finance.

Artificial neural networks are powerful tools designed in order to provide high accuracy solutions to real-world modeling problems. In this respect, the general area of applicability of artificial neural networks is extremely broad. This includes among others, areas such as : computer science, medical diagnosis, robotics and heavy industry, quantitative finance, astronomy, physical science, quantum mechanics. Artificial neural networks, for instance, have been used for a wide range of purposes such as : data processing, filtering, clustering, adaptive control, data mining, algorithm optimisation, systems engineering, data classification, pattern and sequence recognition.

Artificial neural networks are being used increasingly in the field of computational finance. Moreover, an important factor is their ability to provide an extension of generalized linear models which are widely used in conventional statistical analysis. Nevertheless, artificial neural networks are being used extensively for financial time series modeling and forecasting. Numerous recent empirical studies have demonstrated very high accuracy of the prediction results. Modeling and forecasting financial markets using neural networks plays a essential role in the present economic context.

ARTIFICIAL NEURAL NETWORKS GENERIC FRAMEWORK

Biological neurons and artificial neural networks have various common features. Moreover, biological nervous systems were a source of inspiration for artificial neural network models. In other words, biological neuron was a model for the artificial neuron. The neural network of the human brain has the ability to learn. The essential unit of the biological nervous system is the neuron. In addition, the terminology artificial itself is built on the idea that neural networks are basically implemented in computer programs, programs that are able to cope with the large number of complexe calculations required during the learning process.

Currently, theoretical and practical studies on artificial intelligence and neural computation play an important role in scientific research. The concept of artificial neural network disseminates multidisciplinary research so generates a very high interest. A computational perspective suggests significant impact of recent research efforts in order to achieve increasingly precise results. Artificial neural network can actually be treated as information processing systems with a very high capacity.

The analysis of financial time series implies the existence of certain intrinsic characteristics known in the literature as stylized facts. High dimensional financial data have very unpredictable and deterministically chaotic behavior. Thus, behavioral traits such as conditional heteroscedasticity and serial correlations significant influence the idea of obtaining financial market predictions by a very high accuracy. Tsay (2005) suggested that artificial neural networks have also been applied to explore the nonlinearity in a time series based on nonparametric methods. Moreover, an aspect empirically demonstrated is that asset volatility, ie in the case of stock market return series, is not straightforwardly perceivable such as the issuance of this observation is quite complicated.

In recent past, particular multi-disciplinary and interdisciplinary research are included increasingly more often in financial approach based on complex methodology able to provide improved accuracy results. Traditional paradigms are rather unsuitable regarding decisions making process based on noisy data requiring intensive computing such as pattern recognition. Therefore, the artificial neural networks field has expanded considerably and developed quite relevant practicability in financial modeling and forecasting (Birău, Ehsanifar and Mohammadi, 2013).

According to Eluyode and Akomolafe (2013) artificial neural networks establish an alternative computability paradigm and it consist of multitudinous interconnected processing elements that simultaneously function in order to provide a solution for specific problems. Furthermore, from a conceptual point of view, artificial neural networks are characterized by the fact that can cover very large database, simultaneously process it and after that provide accurate output such as the human brain mechanisms.

In an attempt to further dissemination, the practical procedure of forecasting financial time series involves the use of econometric software. The Matlab (Matrix Laboratory) provides a variety of programs designed to create artificial neural networks, ie Matlab's Neural Network Toolbox. According to MathWorks, Inc. (official web site) Neural Network Toolbox™ provides functions and apps for modeling complex nonlinear systems that are not easily modeled with a closed-form equation. Moreover, Neural Network Toolbox supports supervised learning with feedforward, radial basis, and dynamic networks. It also supports unsupervised learning with self-organizing maps and competitive layers. The applicability of these tools is very wide and includes data fitting, pattern recognition, clustering, time-series prediction, and dynamic system modeling and control.

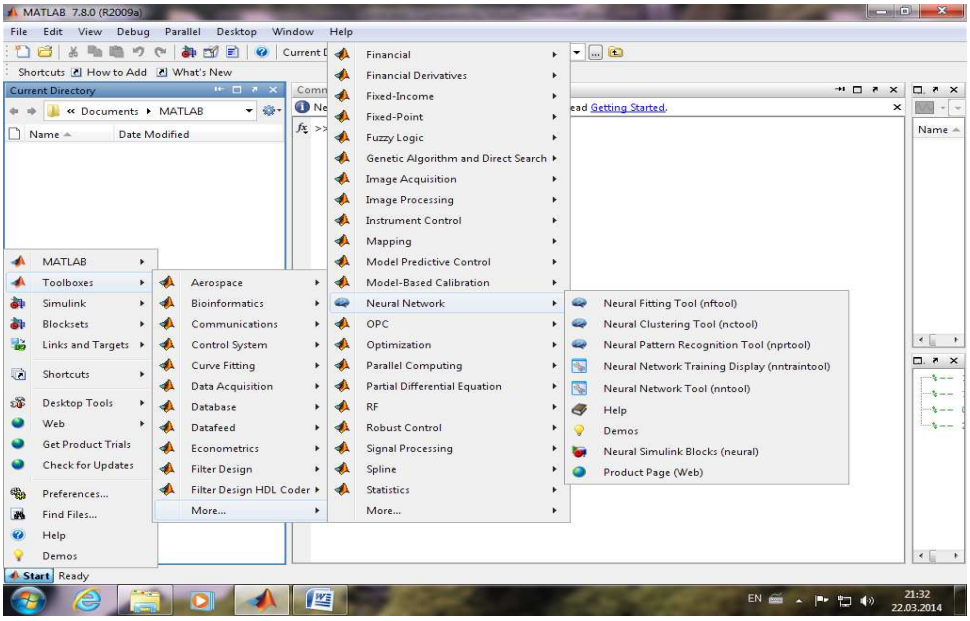

Figure 1: MATLAB Neural Networks Toolbox

CONCLUSIONS

Financial time series analysis is a highly empirical discipline which offered an interdisciplinary approach to modern finance. Artificial neural networks have a outstanding ability to process and obtain conclusive information based on rather complicated or imprecise financial data series. Conventional statistical methods and artificial neural networks are commonly used for financial time series prediction. Consistent empirical evidence highlighted the fact that classical statistical models are quite inaccurate and imprecise than modern methods such as neural computation based on artificial intelligence. Artificial neural networks represent non-linear models that can be trained in order to identify and extract information on financial patterns based on selected data series.

REFERENCES

1. Birău, R. Ehsanifar, M. Mohammadi, H. Forecasting the Bucharest Stock Exchange BET-C Index based on Artificial Neural Network and Multiple Linear Regressions, Proceedings of the 1st WSEAS International Conference on Mathematics, Statistics & Computer Engineering, Dubrovnik, ISI - Thomson Reuters proceedings, Croatia, 25-27 June, 2013, ISBN: 978-960-474-305-6, pp. 140-145.
2. Eluyode, O.S Akomolafe, D.T. Comparative study of biological and artificial neural networks, Scholars Research Library, European Journal of Applied Engineering and Scientific Research, 2 (1), pp.36-46, 2013, ISSN: 2278 – 0041.
3. Tsay, R.S. Analysis of Financial Time Series, Second Edition, University of Chicago, A John Wiley & Sons, Inc., Publication, 2005, ISBN-13 978-0-471-69074-0.
4. *** http://www.mathworks.com/products/neural-network/