Comparison of Stock Prediction Using Different Neural Network Types

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***Abstract* -- This paper describes the comparison of different Neural Network types for stock prediction. The prediction was carried out by Modular Neural Networks, ARIMA-based Neural Networks, Genetic algorithm, Amnestic Neural Network, Multi-Branch Neural Networks etc. Comparative analysis of all these types of Neural Networks is performed in this paper, as well as future work.**

***Keywords*— Modular Neural Networks, ARIMA-based Neural Networks, Genetic algorithm, Amnestic Neural Network, Multi-Branch Neural Networks**

I. INTRODUCTION

Prediction of financial market has long been an attraction for equity investors. Technical analysis [1] for stock exchange provides a framework for studying investor's behavior, and generally focuses only on price and volume data. Typically, traders using this type of approach are unaware of a company's financial health. Traders using this approach have short term investment horizons, and access to only price and exchange data. With the advent of powerful computers stock prediction field has become important.

The Neural Network has been applied to a range trading market. Neural Network ability to deal with uncertain fuzzy or insufficient data, which fluctuate rapidly in very short periods of time, have become very important method for stock market prediction.[2]

Numerous research and application of neural network in solving problem has proven their advantage in relation to classical methods that do not include artificial intelligence. According to Wong, Bodnovich and Selvi [3], the most frequent areas of Neural Network applications are production/operations (53.5%) and finance (25.4%). The network inputs used in the work have been confined to readily available quantitative data.

A type of security that signifies ownership in a corporation and represents a claim on part of the corporation's assets and earning. There are two type of stock i.e. common and preferred. Common stock usually entitles the owner the right to vote at shareholder meeting and to receive dividends that the company has declared. Preferred stock generally does not have voting rights, but has a higher claim on assets and earning than the common shares. Stocks are also known as shares or equity.

Most stocks are traded on exchanges, which are places where buyers and sellers meet and decide on a price. The other type of exchange is a virtual kind, composed of a network of computers where trades are made electronically.The primary market is where securities are created while in the secondary market, investor's trade previously issued securities without the involvement of the issuing companies. The trading of a company's stock does not directly involve that company

Before the age of computers, people traded stock and commodities primarily on intuition. As the level of investing and trading grew, people searched for tools and methods that would increase their gains while minimizing their risks. The techniques like statistics, technical analysis, fundamental analysis and linear regression are all used to attempt, to predict and benefit from the market's direction. [3] None of the techniques gives the consistently correct prediction and many analysts argue the usefulness of many of the approaches. However these methods are commonly used in practice and represent a base level standard for which neural network should outperform

II. INTRODUCTION TO NEURAL NETWORK

Neural networks, also called artificial or simulated neural network, are composed by computing units (artificial neuron) interconnected so that each neuron can send and receive signals to or from others (See figure 1).

Either human or other computer techniques can use Neural Network, with their remarkable ability to derive meaning from complicated or imprecise data, to extract patterns and detect trends that are too complex to be noticed. A trained Neural Network can be thought of as an" expert" in the category of information it has been given to analyze. Neural Network can be applied in signal processing, speech recognition, financial forecasting, condition monitoring, process monitoring and control, pattern analysis.

As their design is based on the human brain, they were made to obtain knowledge through learning. The process of learning for a neural network consists in regulating the weights of each of its nodes considering the input of the neural network and its expected output. This process requires the availability of a set of input data, stock quotes in this case.

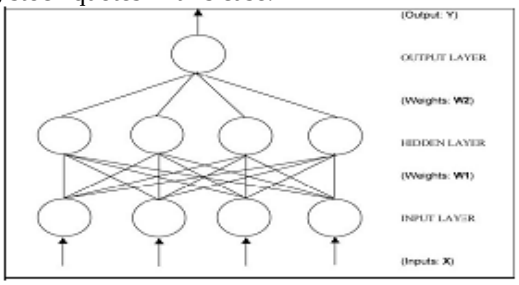

Fig. 1. A Typical Feed-forward Neural Network [12]

III COMPARISON OF STOCK PREDICTION USING DIFFERENT NEURAL NETWORK TYPES

TABLE 1 COMPARISON OF STOCK PREDICTION USING DIFFERENT NEURAL NETWORK TYPES

1	**Title : Stock Market Prediction System with Modular Neural Networks** (TOPIX- Tokyo Stock Exchange Prices Indexes)					
	Description	**Main features**	**Outcome**	**Author**	**Future work**	**Ref**
	This paper discusses a buying and selling timing prediction system for stocks on the Tokyo Stock Exchange and analysis of internal representation	It is based on modular neural network. The input consist of several technical and economic indexes. It converts the technical indexes and economic indexes into a space pattern to input to the NN .For high speed learning with a large volume of data they developed method called supplementary learning	The prediction system achieved accurate predictions and the simulation on stocks trading showed an excellent profit. The rules of stock price fluctuations were extracted by cluster analysis.	Takashi Kimoto and Kazuo Asakawa Computer-based Systems Laboratory FUJITSU LABORATORIES LTD., KAWASAKI	This system uses future returns to generate teaching data. A system in which a teaching data can be generated in combination with a statistical method can be developed	[4
2	**Title : A Stock Market Trend Prediction Using ARIMA-based Neural Networks** (Taiwan stock exchange weighted stock index, abbreviated as TSEWSI).					
	Description	**Main features**	**Outcome**	**Author**	**Future work**	**Ref**
	develops a prediction system useful in forecasting mid-term price trend in Taiwan stock market	They developed a ARIMA based prediction system that uses the recurrent NN and proposed modified back propagation training algorithm. ARIMA is autoregressive integrated moving average, linear non stationary model. The autocorrelation function (ACF) is used to determine whether a series stationary or non stationary	ARIMA based recurrent NN with 7 hidden nodes is trained results shows that the networks trained using 4-year weekly data is capable of predicting up to 6 weeks market trend with acceptable accuracy.	Jung-Hua Wang and Jia-Yann Leu Department of Electrical Engineering National Taiwan Ocean University	The prediction accuracy can be improved by adding other feature data such as trading volume, interest rates etc	[5]
3	**Title : Neuro-evolutionary approach to stock market prediction** The data is gathered from the German Stock Exchange(GSE) (the target market) and two other markets (Tokyo Stock Exchange and New York Stock Exchange)together with EUR/USD and USD/JPY exchange rates					
	Description	**Main features**	**Outcome**	**Author**	**Future work**	**Ref**
	A neuro-evolutionary method for a short-term stock index prediction is presented. The goal is to predict the change of closing value of GSE index for the next day	This paper relies on technical analysis of the stock market. Genetic Algorithm (GA) are used as the prediction engine. The standard GA procedure is enhanced by adding a new type of crossover operator.	Simulation results of the proposed neuro-evolutionary system applied to prediction of the percentage change of closing value of DAX index are very promising and competitive to the ones obtained by the three other heuristical models implemented and tested for comparison.	Jacek Ma´ndziuk and Marcin Jaruszewicz	Due to high volatility of mutual relations between input variables, a particular choice of input variables found by the GA is valid for short period of time and a new set of input is generated every 5 days. In future a system can be developed for generating input for long period.	[6]
4	**Title : Stock price pattern reorganization: A recurrent neural network approach**					
	Description	**Main features**	**Outcome**	**Author**	**Future work**	**Ref**
	The purpose of this study is to propose a recurrent neural network model for stock price pattern recognition, and to develop a new method for evaluating a new network.	In this paper a recurrent neural network model was applied to triangle recognition. Test triangles were appropriately recognized. A new method for examining recurrent networks was established. The model is effective in partial elimination of mismatching patterns	A new method for examining recurrent network was established by searching for the temporal latent state transition. A transition chart for context reorganization was obtained for each pattern sequence, the finishing categories for context vector in the chart are effective in triangles classification and partial elimination of	Ken-ichi Kamijo and Tetsuji Tanigawa C & C information technology research laboratories, NEC Corporation	The method for determining the triangle period and to refine the method for eliminating mismatching patterns.	[7]

			mismatching patterns			
5	**Title : Market Index prediction using fuzzy Boolean Nets** **This work is partially supported by FCT project POSI/SRI/47188/2002 Forecast of the Nasdaq Market Index**					
	Description	**Main features**	**Outcome**	**Author**	**Future work**	**Ref**
	In this paper a new prediction model based on fuzzy Boolean neural networks was introduced	Teaching data set had selected from available daily data from Nasdaq Market Index. The FBN i.e. Black box forecast system was used.	It seems that the behavior of non trivial problems can be acquired by the intrinsic qualitative rules of the FBN's. The high percentage of correct direction prediction was very encouraging for the use of FBN's. Achieved quite acceptable error rates.	Relatively low numbers of rules were used in this research. A work can be done using high numbers of rules.	Jose A.B. Tome and Joao Paulo Carvalho INESC-id, Rua Alves Redol,5 1000 Lisboa	[8]
6	**Title : Amnestic Neural Network for Classification: Application on Stock Trend Prediction** **(**Stock market of China.**)**					
	Description	**Main features**	**Outcome**	**Author**	**Future work**	**Ref**
	this paper presents an improved neural network model, Amnestic Neural Network, which simulates human cognitive behavior of forgetting, to solve the Problem of cross-temporal data selection.	In order to process time variant data, this paper presents an improved model - Amnestic Neural Network model. The aim is to address the stochastic time variation problem in customer's behavior. This paper introduced the psychological notion of 'forgetting'	The effective of Amnestic Neural Network was tested by the application on stock price prediction experiment in the stock market of China.	Qiang Ye', Bing Liang, Yijun Li' School of Management, Harbin Institute of Technology Harbin, China 150001 School of Management, Shanghai Jiao Tong University, Shanghai, China 200052	The ratio of the right classified stock is very slow in this experiment and further research should be done on this.	[9]
7	**Title : Branch Neural Networks (**MBNNs**) to Stock Market Prediction** **(**TOPIX- Tokyo Stock Exchange Prices Indexes)					
	Description	**Main features**	**Outcome**	**Author**	**Future work**	**Ref**
	In this paper, investigate the accuracy of prediction of TOPIX (Tokyo Stock Exchange Prices Indexes) using MBNNs.	MBNNs are constructed using multi-branches between nodes, which adds additional nonlinear functions to the branches of the networks. A benefit of MBNNs is gained by the smaller network size with smaller number of hidden nodes	The result shows that MBBNs could have better accuracy stably with fewer parameters than conventional NNs when predicting TOPIX at t+1	Takashi Yamashita, Kotaro Hirasawa, Jinglu Hu Graduate School of Information, Production and Systems, Waseda University, Kitakyushu, Japan	Construction of dealing system- the prediction itself could be useful for dealing the stock.	[10]
8	**Title : Forecasting closing price indices using neural networks(ANN)**.					
	Description	**Main features**	**Outcome**	**Author**	**Future work**	**Ref**
	The aim of this research is to develop a prediction application, using computational intelligent methods, which could assist investors in making financial decisions	This paper proposes an application, which employs artificial neural networks that could be used to assist investors in making financial decisions. The Multi-layer perception as well as Radial Basis Function neural network architectures are implemented as classifiers to forecast the closing index price performance	Moving average s were introduced as inputs to the networks to reduce the noise in the data. The univariate approach of the forecasting of indices is relevant and can results in highly accurate solutions	P. B. Patel, Member, IEEE and T. Marwala,, Member, IEEE.	The accuracy of these performance classifications could be improved by using complex committee of classifiers. It could also be improved by employing a GA to create optimal ANN architecture. The GA could also be used to optimize the appropriate numbers of closing prices of the indices for the previous days as inputs to the networks	[11]

IV CONCLUSIONS

The problem of stock index prediction is one of the most popular targets for various prediction methods in the area of finance and economics. In the past many Computational Intelligence techniques have been applied to this task including neural networks, fuzzy and hybrid models or genetically developed prediction rules. Despite enormous previous efforts and a wide range of methods applied to this problem, efficient stock market prediction remains a difficult task mainly due to complex and varying in time dependencies between factors affecting the price.

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