

## Chapter 67

# Applying Neural Networks for Modeling of Financial Assets

**Dmitry Averchenko**

*Southern Federal University, Russia*

**Artem Aldyrev**

*Southern Federal University, Russia*

### ABSTRACT

*The purpose of this chapter is to develop an analytical system for forecasting prices of financial assets with the use of artificial neural networks technology. Proposed by the authors, the analytical system consists of several neural networks, each of which makes the forecast of financial assets prices. The system includes recurrence (with feedback) neural networks with sigmoidal activation formula. This allows the networks to “remember” a sequence of reactions to the same stimulus. The learning process of neural networks is performed using an algorithm of back propagation of error. The key parameters of forecast for this analytical system are the indicators presented by the terminal MetaTrader 4-broker Forex Club: Average Directional u Movement Index; Bollinger Bands; Envelopes; Ichimoku Kinko Hyo; Moving Average; Parabolic SAR; Standard Deviation; Average True Range; and others.*

### INTRODUCTION

The main task of the investor is to buy cheaper and to sell more expensively. The higher the asset price variability, the more opportunities to conduct winning trading strategies, even when considering transaction costs. Unfortunately, what appears to be a simple and obvious hindsight is not at all obvious. All forecasting methods and techniques of financial assets prices can be divided on two large groups: fundamental and technical. The concept of fundamental analysis is based primarily on prediction of price behavior as a result of the influence of those or other events in the world economy. The basic methods of fundamental analysis include: benchmarking method, deduction and induction, correlation, grouping and generalization, macroeconomic analysis, industry method, as well as the method of financial coefficients (Schwager & Turner, 1995; Kalmykova, 2007; Chirkova, 2014).

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Technical analysis is based on three postulates: “the market price takes everything into account”, “the market follows the trend”, and “the market is the pattern”. Technical analysis methods include technical indicators, wave and candle analysis, price charts, and methods of artificial intelligence (neural networks). (Murphy, 1999; Schwager, 1997; Elder, 2007; Kovel, 2007; Nison, 2003). We focus our attention in this chapter on the last method of artificial neural networks.

Neural networks are a class of powerful machine learning algorithms based on statistical methods of analysis. They have been successfully applied for many years in the development of trading strategies and financial models: tasks are determined for developing their own approaches to forecasting the financial market and designing profitable trading systems (Laletina, 2015). New methods and models are being explored to improve the accuracy of forecasts and solve the problems of approximation and classification (Vladimirova, 2014). Despite this situation, neural networks do not have a very good reputation due to frequent failures of their practical application. In most cases, the reasons for failure lie in inadequate design decisions and a general lack of understanding of how they work.

The novelty and relevance of this study is due to the combination of classical approaches of technical analysis and automatic optimization of this model through a neuron network. This excludes cases of inadequacy of the model, and not allowing for the situation of the “black box”. The study describes the construction of a neuron network cluster using four networks through which the authors of the study will determine the current phase of the market - trend / flat. Subsequently, the model will use those indicators and approaches that are used for this phase of the market - trend / flat indicators.

The practical significance of the study is to develop a new approach for forecasting prices of financial assets and adopting appropriate investment decisions by combining the classical approaches of the technical analysis and the artificial intelligence. The main target audience of this research can be traders, investors with different investment horizons, and scientists with a similar sphere of scientific interests. We believe the fractal (the neuron analog) is the price of a financial asset, and neural networks are one of the most promising methods of fractal analysis. The key question here is whether it is possible to determine the direction, magnitude, and volatility of future asset price changes by extrapolating the available past data. Adaptive nonlinear systems can be trained to perform technical analysis with minimum possible assumptions.

Lately, the hypothesis of an effective market (EMH) developed by Eugene Fama is seriously criticized as unscientific literature. In its weak form, this hypothesis asserts that the investor cannot receive abnormal rate of return via technical analysis rules, which are based solely on past prices. In other words, information about past prices cannot be useful for extracting abnormal income (Baestaens, Van Den Berg, & Wood D., 1997).

Simultaneously, EMH does not specify the nature and manner of obtaining such information through past prices. Should the simple time-series autocorrelation, methods of Box-Jenkins or Fourier analysis, or many others filtering methods be used? Moreover, EMH is a combined hypothesis.

This means that EMH verification requires preliminary pricing model formation, which in turn depends on the degree of predictability. This circumstance makes the matter even more complicated. The main reason that does not allow the possibility to reject EMH is the presence of the market Index funds (the following strategies of passive management), which are very popular among pension funds. However, recently in the scientific literature there are assumptions that financial markets have some features of predictability (Peters, 1994). However, it should be remembered that the success in applying technical analysis depends entirely on the quality of the optimization method.

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