Investment using technical analysis and fuzzy logic

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Abstract

Deploy fuzzy logic engineering tools in the finance arena, specifically in the technical analysis field. Since technical analysis theory consists of indicators used by experts to evaluate stock prices, the new proposed method maps these indicators into new inputs that can be fed into a fuzzy logic system. The only required inputs to these indicators are past sequence of stock prices. This method relies on fuzzy logic to formulate a decision making when certain price movements or certain price formations occur. The success of the system is measured by comparing system output versus stock price movement. The new stock evaluation method is proven to exceed market performance and it can be an excellent tool in the technical analysis field. The flexibility of the system is also demonstrated. © 2002 Elsevier Science B.V. All rights reserved.

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1. Introduction

Technical analysis is an attempt to predict future stock price movements by analyzing the past sequence of stock prices. Technical analysis dismisses such factors as the fiscal policy of the government, economic environment, industry trends and political events as being irrelevant in attempting to predict future stock prices. The concern in technical analysis is the historical movement of prices and forces of supply and demand that affect those prices.

Technical analysis relies on charts and look for particular configurations that are supposed to have predictive value. Analysts focus on the investor psychology and investor response to certain price formation and price movements. The price at which an investor is willing to buy or sell depends on his or her expectation. If he or she expects the security price to rise, he or she will buy it; if the investor expects the security price to fall, he or she will sell it. These simple statements are the cause for a major challenge in setting security prices, because they refer to human expectations and attitudes [15]. As some people say securities never sell for what they are worth but for what people think they are worth. It is very important to understand that market participants anticipate future development and take action now and their action

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drive the price movement. Since stock market processes are highly nonlinear, many researchers have been focusing on technical analysis to improve the investment return [3,10,17,21,4,18]. This paper describes a methodology using fuzzy logic and technical analysis, which can be used to build an investment model system.

2. Using fuzzy logic in technical analysis

There are many technical analysis indicators and theories. The most difficult part of technical analysis is to decide which indicator to use. Technical analysis deals with probability and therefore multiple indicators can be used to improve the result. In most cases, the answer by each indicator is not a definite yes or no answer. Based on this, the opportunity to improve stock price evaluation by using the advancement of mathematics and sciences through fuzzy logic, neural network, artificial intelligence and others can be very useful. Using fuzzy logic techniques, we can create an optimum computerized model to evaluate stock price movement. Our plan is to map many different technical analysis chart indicators into new inputs that can be fed to a fuzzy system. Each of these inputs does not output a Yes–No answer, this implies yes–no logic stops being helpful. Fuzzy reasoning is very effective in such environments. Managers perceive technical indicators differently and their answers to these indicators are not obvious and surely they are not true or false answers but some where in between. In fuzzy logic, the truth of any statement becomes a matter of degree. In our opinion, fuzzy logic blends very well with technical analysis process. Many systems using neural networks are used to predict stock prices [3,10,17,21]. The problem with these systems can be summarized as follows:

- Neural-fuzzy systems lack perceived reliability. There is no way to determine if a training set is adequate or not.
- The knowledge contained in a network is not easily understood and available (although there are some work trying to extract information in the input/output relationship).
- The neural/fuzzy technique is strictly quantitative and generalized to the point where human
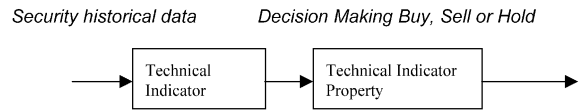

Fig. 1. Current process in technical analysis field.

qualitative judgments are completely removed from the predictions.

We believe fuzzy logic systems are easier to comprehend and modify [4]. Few fuzzy systems have been created to forecast market activities using fundamental indicators [8,9,12,14,18–20]. Our proposal is to use technical indicators with fuzzy logic to create a fuzzy indicator that recommends sell, buy and hold position. This method avoids over-reliance on quantitative data. It consists of few inputs (e.g. rate of change (ROC), stochastic and support/resistance indicators), one output variable (e.g. level of confidence to take a certain action), and a few fuzzy rules expressing the relationships among the financial indicators. Our plan can be summarized as follows:

- To map many different financial indicators into new inputs that can be "fuzzified". Use fundamental indicators with fuzzy logic to set up long-term investment plans and use technical indicators with fuzzy logic to set up short-term investment plans.
- To create membership functions; to associate between inputs and outputs via fuzzy rules.
- To translate the fuzzy output into a crisp trading recommendations.

Based on all of the above, we believe our proposed fuzzy logic system is very flexible, modular and easy to comprehend.

3. Stock evaluation process

The process used in technical analysis field is shown in Fig. 1. Analysts in this field use wide varieties of indicators to analyze individual stock markets. Each indicator has properties and interpretation. Market indicators typically fall into three categories: monetary, sentiment, and momentum.

Monetary indicators concentrate on economic data such as interest rate. They give an indication of the economic environment in which businesses operate.