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Using intelligent computing and data stream mining for behavioral finance associated with market profile and financial physics

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ABSTRACT

Day trading has become an important topic of discussion in the last decades, especially with regard to computer program trading or the increasing trend of high-frequency transactions. However, due to the high level of complexity regarding the forecasting of day trading trends, the use of traditional financial analysis or technical indicators for the forecasting of short-term market trends is often ineffective. The main reason is that in addition to the technical analysis of market physical trends, financial market trading behaviors are also often affected by psychological factors such as greed and fear, which are emotions displayed by investors during the transaction process. For this reason, this study will use the neural network to integrate into the financial engineering technology analysis of the physical momentum behavior and market profile theory to quantify controlled learning. The goal is to be able to provide an empirical explanation of the discoveries related to trading behaviors by using trading strategies. Our experiments showed that trading behaviors in the financial market could be explained by the physical trends of a quantitative and technical analysis of the market profile theory. It has also been proven that the financial trading market follows the existence of a certain trading logic.

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1. Introduction

In the past, most studies on instant financial transaction behaviors had often focused on changes in technical parameters or types of changes in behavior or innovation behavior analysis. As for the research tools, the supervised learning for neural networks was often used for the performance studies of learning under single or multiple technical indicators [16–19]. This study, which is more concerned with financial engineering physics, suggests a dynamic inertia behavior tracking and supervised learning of the eigenvalues of technical indicators by using the idea of occurrence and change of inertia momentum during the changes in eigenvalues following a certain timeline. And this can be further Newton's first law of motion which, assuming the absence of any external forces, states that a body at rest will remain at rest" while "a body in motion will remain in motion." It also has something to do with the Taylor expansion, which says that the change in a result is often influenced by the first order, second order, and nth order influence of all relevant characteristic factors.

These two theories take into account the formation of the momentum generated by the inertia and changes in eigenvalues in the time axis; they also made a strong assumption about the inevitable inertia of the direction of stock price movements. Because the focus of neural networks learning in the past was on the discovery and consistency of eigenvalues, it failed to take into account the physical changes in these eigenvalues. In fact every change in the result has something to do with those physical changes. Under this concept, each of which we believe is a non-linear relationship, only using a simple Taylor series expansion does not lead to a linear expansion of the first-order and second-order variables. Therefore, we used all the dependent variables of the neural network to learn about the result changes. We refer to all of that collectively as financial engineering physics learning.

Secondly, intraday trading behaviors are often influenced by such human emotional feelings as greed and fear. These factors cannot be described by technical indicators. Greed and fear as critical elements of the market profile theory. That is, the psychological and mobile behaviors of suppliers (and other time frame traders). Under an initial aggressive situation, the market tends to form a band trend, going up or down. On the contrary, if it is a defensive (response) on the part of the trader, then the market tends to display a series of stride intervals. Because these eigenvalues are often presented in the form of physical forces, this pattern is diffi-

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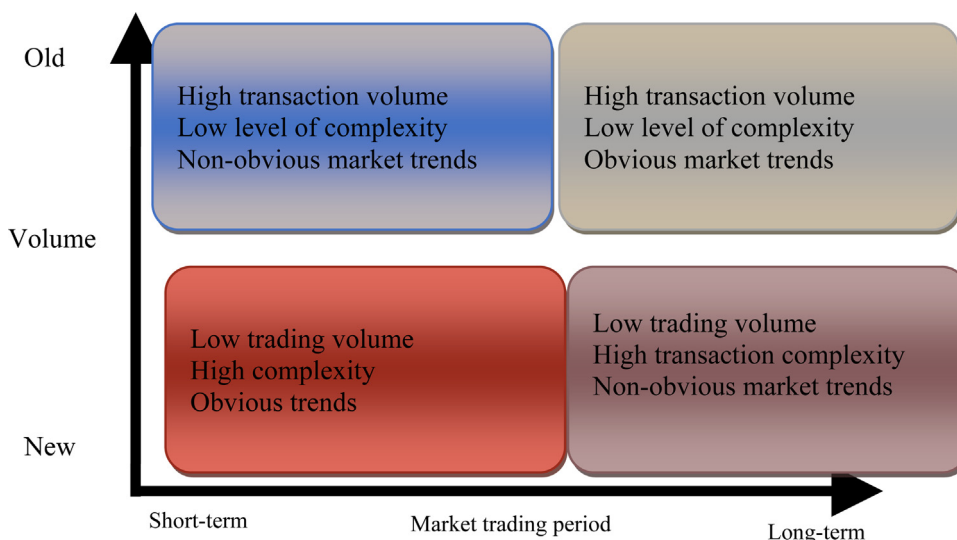
Fig. 1. Analysis of Transactional Roles and Trend Complexity.

cult to quantify. For this reason, this study suggests the use of the market profile theory for the trading market because during the process of obtaining the difference between the market price and value differences, a quantitative study is needed to understand the prices created by these psychological behaviors known as greed, fear, aggressiveness, and defensiveness.

Therefore, based on the above-mentioned argument needs, if the use of mathematical and statistical quantitative analysis is not easy, we hope that resorting to neural network learning will help find out the main characteristics of the market trend to determine whether the state of the movement is caused by result of suppliers' aggressive or defensive behaviors. If a clear distinction can be made, then the use of the neural network will make a great contribution to the future movement of the stock price. So we believe the fact that we can still highlight the trend directions of the market even in times of uncertain fluctuations is because these learning's help achieve better results compared to using the traditional methods. And the results of this study showed that after considering these two factors, the accuracy level for the short-term trend behavior forecasting was improved 20–30% compared to the traditional method.

Section 2 offers a review and summary of the literature, including the concepts of neural networks and market profile theory. Section 3 describes the research methods, sources, pretreatment, experimental model design, and performance evaluation. Section 4 compares the experimental results of different models and then analyzes their level of efficiency. Section 5 offers an analysis of the experimental results and goes on to offer a few suggestions for future research.

2. Literature review

2.1. Market profile

The Market Profile Theory was developed by Steidlmayer [23] as a mainstream market analysis that refutes both the Efficient-market Theory and the Random Walk Theory. Participants at different time intervals will always have different reactions to prices and values, which in turn will lead to the development of non-random price movements. Also, different participants have different opinions and behaviors with regard to the same price. As a result it impossible for the market to meet the individual needs of all participants at the same time. The Market Profile Theory claims that lengthening trading hours and enlarging trading volume can help provide a clear roadmap from which it is possible to see the entire trend of the market [27]. Using the trading role and complexity analysis chart, and taking into account the gradual change in trading time and volume, the market profile roadmap can be divided into four major parts. One of the most complex and difficult things to predict in day-trading is comprehending the trend of short-swing trading. To avoid the risks associated with overnight positions, we have deemed it important to conduct an in-depth analysis of day traders' trading patterns (Figs. 1–2).

By using a statistical bell curve, the Market Profile Theory found out that the majority of a day's total transactions occur in the middle of the curve, while the extremes of the curve in question account for only a small number of transactions that took place that same day. The widest part (the middle) of the bell curve represents the price region where the trader spent most of his time. It also represents the value range (Value = Price * Time) recognized by the trader. Market participants can be divided into the following two categories: (1) Day Traders (also called risk arbitrage): These include general market brokers. Their main objective is to engage in quick buy and sell transactions to obtain small profits. (2) Long-term traders (including other timeframe traders): These are participants whose transactions last more than one day. Long-term traders are the key players when it comes to controlling the market. They will usually enter the market only when the price deviates from the value zone, and respond rapidly to price changes. It is the sum of all the roles played in the market that represents the trend of the market transactions.

The basic framework of the Market Profile Theory – referred to as the TPO (Time Price Opportunities) – is expressed as an English letter every half hour on a trading day. If a price is traded at a certain time, the price is marked on the corresponding letters, each letter will be stacked up to form a complete market profile (Fig. 3).

In any given trading day, the market structure can lead to a certain pattern or form. And the importance of this form is decided by the behavior of the long-term participants. The correct analysis of this form can help understand the direction of the market trends and increase the chances of success in the market [28]. The importance of having different market patterns lies in the fact that they can lead to better judgment with regard to trend development. In this study, we expect to know more about pattern-related changes so we can use them to forecast the market trends.