Making Use of the Big Data: Next Generation of Algorithm Trading

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Abstract. Algorithm trading is using computer programs to automate trading actions without much human intervention. Algorithm trading has been adopted by institutional investors and individual investors and made profit in practice. The soul of algorithm trading is the trading strategies, which are built upon technical analysis rules, statistical methods, and machine learning techniques. Big data era is coming, although making use of the big data in algorithm trading is a challenging task, when the treasures buried in the data is dug out and used, there is a huge potential that one can take the lead and make a great profit.

Keywords: Algorithm Trading, Technical Analysis, Statistical Methods, Machine Learning, Big Data.

1 Introduction to Algorithm Trading

Application of computer and communication techniques has stimulated the rise of algorithm trading. Algorithm trading is the use of computer programs for entering trading orders, in which computer programs decide on almost every aspect of the order, including the timing, price, and quantity of the order etc. In certain cases, computer can even start the execution of the order without any human intervention. Algorithm trading has been used in stock, futures and other financial markets by institutional and individual investors. [1]

There are many success stories of algorithm trading, the most noticeable one is James Simons and his company – Renaissance Technologies [2]. According to the Wiki page, Renaissance was started in 1982 by James Simons, it currently has more than $23 billion of assets under management. Since it’s founding, Renaissance Technologies hedge fund has traded in financial markets around the world. The fund employed mathematical models to analyze data and execute trades. Most of trades are automated. The Medallion Fund of the company has averaged 35 percent returns annually since 1989 after paying the fees. Renaissance uses complex computer-based models to predict price movements of easy-to-trade financial assets. These models are based on analyzing as much data as can be collected, then searching for price moving patterns to make profitable predictions. By the end of 1999, cumulative returns of the fund were 2,478.6 percent [2], really high ones.
2 Architecture of an Algorithm Trading System

Figure 1 shows the data flow of a typical algorithm trading system. Firstly the trading system collects price data from the exchange (for cross market arbitrage, the system needs to collect price data from more than one exchange), news data from news companies such as Reuters, Bloomberg. Some algorithm trading systems may also collect data from the web for deep analysis such as sentiment analysis. While the data is being collected, the system performs some complicated analysis on the data to look for profitable chances with the expectation of making profit. Sometimes the trading system conducts a simulation to see what the actions may result in. Finally, the system decides on the buy/sell/hold actions, the quantity of order, and the time to trade, it then generates some trading signals. The signals can be directly transmitted to the exchanges using a predefined data format, and trading orders are executed immediately through an API exposed by the exchange without any human intervention. Some investors may like to take a look at what signals the algorithm trading system have generated, and he can initiate the trading action manually or simply ignore the signals. Human intervention is a double blade sword, on one hand it can screen away some unprofitable signals according to the experience of human, on the other hand human being is likely to make mistakes, they cannot trade in a consistent manner, because they will be tired, be over pessimistic or be over optimistic, one’s mood will greatly affect the trading. In the author’s opinion, if the algorithm trading is properly designed and thoroughly verified, it is better to let the system do the whole thing, from data analysis, to deciding on trading actions, and initiating the execution of trading orders.

![Fig. 1. Data Flows of an Algorithm Trading System](image)

3 Trading Strategy – The Soul of Algorithm Trading

There are several standard modules in a proprietary algorithm trading system, including trading strategies, order execution, cash management and risk management. Trading strategies are the core of an automated trading system. Complex algorithms [3] are used to analyze data (price data and news data) to capture anomalies in market, to identify profitable patterns, or to detect the strategies of rivals and take advantages of the information. Various techniques are used in trading strategies to extract actionable information from the data, including rules, fuzzy rules, statistical methods, time series...