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I-Search

Four trillion dollars change hands each day in the foreign exchange market (Forex). The desire to be part of that motivated my research. Unfortunately there few things blocked me. The market is/was extremely volatile; consequently to trade optimally is nearly impossible without a computer. Also, I have to write a research paper for English and would like to publish something in the field of CS. Finally, I didn’t/don’t have the money to invest. To solve all of the aforementioned problems I decided I would research, develop, and publish what is called an algorithmic trader.

To begin I developed a question “How to program a computer to forecast and effectively trade instruments?” After my initial research I discovered the primary problem when predicting the market is that it is a dynamical chaotic system (a system who’s underlying function is in flux and seemingly unpredictable) (Iokibe et al.) consequently forecasting the market is nearly impossible. With a more formal perspective I was able to rephrase my question obtaining a more specific direction.

Completing my initial research I came up with a hypothesis: To forecast and effectively trade instruments in a dynamical chaotic system, incorporate the current state of the market that by training multiple agents (instances of the algorithm) with different evolutionary parameters and triggers (systems to detect when a trade should be made) that are mutated with the other said agents (they mix their properties) to better dynamically model market. Where possible, decrease the amount of chaos that each agent has to deal with by splitting situations that an agent has to evaluate into roughly statistically similar situations (probably a pattern is repeating) continually optimizing what “roughly statistically similar” means then making a market action.

To come to this conclusion I examined research on a variety of topics including Neural Networks (ANNs), Genetic Algorithms (GP), and Statistical Analysis (SA) as they related to algorithmic trading. All of my references are academic journal articles that were published in peer reviewed journals. Furthermore, every one of these journals are sanctioned IEEE (IEEE is known as “the largest professional association for the advancement of technology”, and is regarded as one of the most discerning and reputable technology communities). Additionally, all of the articles cited have experimental evidence or have cited articles which do, to support any claims made. Put simply each of the articles cited are accurate.

One of the articles "Comparative Study of Stock Trend Prediction using Time Delay, Recurrent and Probabilistic Neural Networks” by Saad et al. I studied about ANNs included the basic model for and relative advantages and disadvantages of three major ANNs. First, TDNNs recognize patterns over the period distance between data. TDNNs are simple to implement. Second, RNNs feedback into themselves to find deeply hidden patterns but are extremely difficult to implement and expensive to run. Last, SNNs use statistics inside the ANN to better recognize patterns (Saad et al.). Additionally, citations lead to articles on implementing each ANN in detail.

I reviewed Hayward’s article on finding the optimal predictor to find what would be some critical concepts, hybrid methods and the basic form of an agent. In the article GP is used to try to find an optimal predictor alongside an ANN (Hayward). The basic idea lead to Hybrid algorithms in the context of my work being algorithms using GP for the construction, training, use, and acquisitions of ANNs that function as triggers. From the same paper I uncovered some critical facts about algorithmic traders. First, The general form of an agent is a trigger and a broker, the component that determines trade volume.

The last article I reviewed about ANNs was “Stock Market Prediction using Neural Networks: Does Trading Volume Help in Short-Term Prediction?” by Wang, Phua, and Lin. Here I learned about the phenomenon of trade volume (TV) (described as a “fundamental variable” (Wang, Phua, and Lin)). Trade volume has been the subject of multiple papers because (TV) has a measurable and somewhat predictable effect on the market when observed in retrospect (Wang, Phua, and Lin). Unfortunately the effect is chaotic and does not predict changes any better than any other statistic. The worst case of an ANN trained on it even resulting in worse predictions as a result of over specialization.

After ANNs I decided to move to GP. I learned that one way to classify GP algorithms was by how they adapted to their environment. When the GP’s primary method is to construct new rules for new situations it is classified as a SFI GP, when the GP’s primary method is to find new applications for old rules and cannot construct new rules it is called a N-Type model. This is an important distinction to me because SFI algorithms perform significantly better in the long run due to the changing nature of the market (Kampouridis, Chen, and Tsang).

While researching GPs I came over what would be the crux of my hypothesis, “Social Learning” as described in “Learning with Imperfections - a Multi-Agent Neural-Genetic Trading System with Differing Levels of Social Learning” (Kendall, Su, & Kendali, 2004). This article described a system that allowed agents to trade triggers with each other. Trading caused a more diverse environment and allowed agents that hit local optima to start evolving other agent’s triggers. Significant increase in profitability of their agents when using social learning in conjunction with evolving the triggers individually was demonstrated with empirical evidence.

After completing this research, I feel very confident in the potential of my hypothesis and therefor my argument being meaningful. There are still a few key pieces missing though, More research on the merits of the different types of ANNs and chose one that fits my situation is needed, an Estimate of the cost of the algorithm I am proposing to verify that it is practical. After these tidbits are collected I will be able to implement and test my algorithm and come up with an argument as to its efficacy.

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