Four trillion dollars change hands each day in the foreign exchange market (Forex). The desire to be part of that motivates my research. Unfortunately there are a few things in my way. The market is extremely volatile, consequently to trading optimally is nearly impossible without a computer. Also, I would like to pass English (so I have to write a research paper) and I would like to publish something in the field of evolutionary computing. Finally, I don’t have the money to invest. To solve all of the aforementioned problems I decided that I would research and develop what is called an algorithmic trader, use the research for both my English paper and my publication, then when my algorithm becomes effective I will have it funded by outside sources.

To begin I developed a question “How do I program a computer to forecast and effectively trade instruments?” After my initial research I discovered that the primary problem with predicting the market is that it is a dynamical chaotic system (a system who’s underlying function is changing and when any of its parameters are modified the result of the function is nearly unpredictable) (Iokibe et al.) consequently forecasting the market is nearly impossible. In light of this I modified my question to include a clause about the forecasting a dynamical chaotic system.

By the time I had completed my research I had come up with a hypothesis (annotated) which is as follows: To forecast and effectively trade instruments in a dynamical chaotic system, incorporate the current state of the chaos that is present by having multiple agents (instances of the trading algorithm) with different 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 the agent has to deal with by splitting the situations that an agent has to evaluate into roughly statistically similar situations (if you were looking at a graph of the stock market filled with statistics you would see similar numbers). Then optimize what “roughly statistically similar” means and what to do in each situation.

To come to this conclusion I examined research on a variety of topics including Neural Networks (ANNs), Genetic Algorithms (GP), and Statistical Analysis as they related to algorithmic trading specifically. All of my references are academic journal articles that were published in peer reviewed journals (this means that other scientists have agreed that what is said is not only feasible but is in the context of the article correct). Furthermore every one of these journals all of which 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 communities. Additionally all of the articles cited have experimental evidence or have cited other articles which do to support any claims made. Put simply each of the articles cited are accurate and should be taken as fact to the best of sciences knowledge.

First came ANNs. To study this I reviewed (Hayward) on GP and ANN hybrids, (Wang, Phua, and Lin) A particular variable be used for short term prediction, and (Saad et al.) comparing different types of ANNs. I found all of these articles to be extremely useful. The basics of Time Delayed Neural Networks (TDNNs) which recognize patterns over periods of time, Recursive Neural Networks (RNN) that feedback into themselves to help find patterns that are deeply hidden, and Statistical Neural Networks (SNN) which use special purpose statistics at each “neuron” to better recognize patters (Wang, Phua, and Lin). Another critical concept that I learned about was GP and ANN hybrid methods (evolutionary algorithms that use GP for the construction and training of the ANN) (Hayward). Hybrid algorithms ended up being a building block in my hypothesis. I also uncovered some critical facts about algorithmic traders. Primarily In (Hayward) I read that the general form of an agent is a trigger (the component that determines when a profit opportunity arises) and a broker (the component that determines how large a trade to make). Secondly in the article by (Wang, Phua, and Lin) the phenomenon of a fundamental variable (in this case trade volume) having a measurable effect on the market when observed in retrospect, but too sporadic of an effect to be used as a predictor with any benefit beyond general analysis; In short the article pointed to that fact that many variables need to be observed and none can be depended on alone at all times. In addition, there were also a few citations to further articles on the specifics of implementing each of the studied ANNs.

After I finished with ANNs I decided to move to GP, partially because it was reference in the ANN articles. 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). Statistics to use as indicators for my algorithm were also discovered (Moving Average (MA), Trader Breakout Rate (TBR), Filter (FLR), Volatility (Vol), Momentum (Mom), and Momentum Moving Average (MomMA)), I decided to adopt them (at least preliminarily) because they have had success in practice (Kampouridis, Chen, and Tsang) though I need to do more research on what exactly each statistic means.

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 paper described a system, that allowed agents to trade triggers with each other, this created a more diverse environment and allowed agents that were “stuck” to start evolving their triggers in a new direction. This article also showed a significant increase in profitability of their agent when using social learning in conjunction with evolving the triggers individually with empirical evidence.

After competing this research and some on statistical algorithms (details on blog), I feel very confident in the direction that I am going. To complete the research phase of this and enter the experimentation and implementation stage I have to accomplish a few small tasks: More research on the merits of the different types of ANNs and chose one that fits my situation; Estimate O() statistics for algorithm I am proposing; Find a Forex that is developer friendly and review other solutions that are similar to mine; And finally, I need to verify that my research is unique. From here I will be able to implement and test my algorithm and come up with an argument as to its efficacy.