Motivation

The high frequency trading (HFT) industry has exploded in recent years. HFT firms now account for over half of all equity trading volume in the United States and make over $1 billion in profit per year.\(^1,2\) As these firms become more advanced, the strategies they employ move farther and farther away from those available to retail investors. While some, such as low-latency arbitrage, will never be viable for a retail investor, other strategies, such as machine learning techniques, can be adapted and developed to work in a low frequency retail environment. Researching these methods might open up new trading strategies to individuals that were previously only available to institutional firms.

Project

I am proposing to develop algorithmic trading “robots” intended for use by retail investors in foreign exchange markets. I will first make robots that trade on traditional technical indicators using “naïve” algorithms. I will then attempt to improve the performance of my “naïve” robots by developing more complex algorithms through various machine learning techniques. Finally, I will compare the performance (in terms of net profit on historical data) of my robots to determine if the advanced strategies provide any edge over the “naïve” strategies.

Machine Learning Techniques

While there are a lot of machine learning techniques available, I decided to focus on those that have already shown promise in market applications and have
a suitable scope for this project. I have chosen to use support vector machines (SVM) and artificial neural networks (ANN). I will use SVM and ANN to carry out time series prediction in order to forecast moves in the foreign exchange markets. If there is enough time, I will then explore applying evolutionary learning for feature selection of traditional technical indicators.

**Software**

I will use the MetaTrader5 platform and the MQL5 programming language to program these trading robots. I have chosen to use this platform and its accompanying language for several reasons. First, it is already a popular platform for trading currencies. Second, it does not cost money to sign up, and all features are provided at no cost through a demo account. Finally, it has a wealth of technical indicators and backtesting capability built in, which will vastly simplify the final stages of my project.

For the machine learning methods, I will use the open source Encog Machine Learning Framework provided by Heaton Research. The MetaTrader platform allows for the use of external C++ libraries and easy exportation of data to allow the use of feedback learning loops with training data. Additionally, I will be drawing on a few papers that research the use of machine learning in HFT applications, for both stock and FX trading (see supplemental reading).

**Why Foreign Exchange?**

I chose to focus on the foreign exchange markets due to the simplicity of the data, the numerous markets to which my robots can be applied, and the vast troves of data on which to backtest these robots. I will focus on the major currency crosses, each of which have tens of thousands of data points per day. Furthermore, it will be easy to test my algorithms across multiple currency markets with no re-coding at all, raising the probability of finding an effective market for a particular algorithm.
Deliverables

- A set of naïve trading robots
- A set of trading robots whose algorithms were developed through the use of machine learning techniques
- A report detailing the performance of all robots with analysis on if these are viable trading strategies for retail clients.

Supplemental Reading

Ullrich, Christian, Detlef Seese, and Stephan Chalup. *Foreign exchange trading with support vector machines.*


Evans, Cain, Konstantinos Pappas, and Fatos Xhafa. *Utilizing artificial neural networks and genetic algorithms to build an algo-trading model for intra-day foreign exchange speculation.*


References


3 http://www.mql5.com/

4 http://www.heatonresearch.com/encog