# Intro

## Quick introduction of the methods available (ANN, GP, Statistical)

grab reader with an something about this research not only being interesting but unlike most academia possibly lucrative, tell story of how I became how I got to this topic.

# Neural Network (ANN) research

## Article: "Setting Up Performance Surface of an Artificial Neural Network with Genetic Algorithm Optimization: In Search of an Accurate and Profitable Prediction of Stock Trading" (S. Hayward ) ( RefWorks:23 )

### Info: Intro to hybrid GP/ANN methods

### Info: There is no best predictor… it may be better just to pick indicator statistics that work most of the time and save the computation

### Critical Info, Direction: The basic form of an agent being broker, and trigger

### Direction: Use a hybrid method

## Article: “Stock Market Prediction using Neural Networks: Does Trading Volume Help in Short-Term Prediction?”(Wang, Phua, & Lin, 2003)

### Direction: Use MSE, MAPE statistics to compare and state efficacy of my trader

### Info: Analysis of an implementation of TDNN

### Info: An instance where while there is a relationship between a variable and the outcome of the value of an instrument, the relationship is one that is to weak to be observed in a way that can predict the futer values with any consistency past what could be done without analyzing said variable

### Direction: Don’t depend on any single variable for all predictions

### Info: More evidence is presented on the dangers of over specialization

### Possible design info: references 3 and 10 talk about the implantation and merits of a well know TDNN in the context of trading

### Critical Info: Most “fundamental factors” (eg. Trade volume) have to weak an effect on the market to be use in circumspect.

## Paper "Comparative Study of Stock Trend Prediction using Time Delay, Recurrent and Probabilistic Neural Networks."(Saad, Prokhorov, Wunsch, & II, 1998)

### Direction: Helped identify what type of neural network to use

### Design Direction: Specified all of the applicable neural network types and difficulty of implementation (RNN, TDNN, SNN)

## In all papers ANNs are successful at predicting short term patterns

# GP research

## “Investigating the Effect of Different GP Algorithms on the Non-Stationary Behavior of Financial Markets” (Kampouridis, Chen, & Tsang, 2011)

### Info: Introduces concept of SFI (Santa-Fe Institute) (GPs that learn to construct rules for new situations then reuse them when the same situation comes up again) vs. N-Type model (GPs learn what preset strategies to apply new situations).

### Direction: My TDNN will be driven by a SFI GP

### Info and possible direction: Use MA, TBR, FLR, Vol, Mom, MomMA as indicator with reasonable success…

### Design: Have GP output evolutionary stat in human readable text.

## “Learning with Imperfections - a Multi-Agent Neural-Genetic Trading System with Differing Levels of Social Learning” (Kendall, Su, & Kendali, 2004)

### This paper was the most interesting of the lot.

### Perspective: The market is so complex it has to be treated as imperfect system to gain useful information.

### Method Used (and possible design): Have multiple agents each trained with similar data or with different evolutionary parameters examine the same training set and then let them communicate with each other to decide on triggers and trade volume. Personal: this is like having a team of people with different experience work together to solve the same problem.

### Method Used (and possible design): While agents are communicating allow them to convey their surety of a situation and their experience.

### Method Used (and possible design): Let agents acquire some of their peers knowledge to help combat over specialization. Personal: This is important because if all of the agent have very narrow experience and a lot of it they will never really collaborate they will just let one agent decide… this may not be terrible but I have a bad feeling about it.

# Statistical

## Exploration of algorithms that don’t change over time and statistical methods that may be used in conjunction with ANN and GP alogs

## Paper: "Experiments on Stock Trading Via Feedback Control"

### Method and evidance: Barmish-Iwarere (BI) trading algorithm is used with moderate success

### Personal: Use BI as a method the GA can use

### Personal: Use BI as a benchmark

### Evidence: Even extremely simple non-evolutionary algos can work because humans take risks thereby presenting an for the algo to take advantage of

### Method: Ito (a formula for simulating a system similar to the market) process for simulation

### Open Question: How to optimize risky investments for BI to take.

## Paper: "Prediction of Foreign Exchange Rate by Local Fuzzy Reconstruction Method"

### Perspective: the market is a chaotic system and as such concepts that apply to chaos should be applicable to analyzing the market.

### Info: Deterministic Chaos, this is a extension (though not intentionally by the author) and restriction of the idea of an imperfect system discussed in the multi-agent paper.

### Info: Takens’ Embedding theorem is a method for finding the location an attractor in a chaotic system

### Info and method: Local Fuzzy Reconstruction Methods (LFRM) are methods for finding the approximant probable location of an attractor in a chaotic system.

### Evidence: LFRM is used with moderate success to predict short term positions in the market

### Personal: Combining LFRM with a TDNN may be a good idea.

## Paper: "Software Agents and Market (in) Efficiency: A Human Trader Experiment."

### Info: Human traders are more effective when they have the knowledge that a computer is exploiting a failing they have

### Perspective: Trading algos work by exploiting the mistakes and shortcomings of humans

### Parallel: Sniping sites for ebay, this principle is what some algos work on

### Critical Design: “passive arbitrage-seeking” or arbitrageur and was developed by Grossklags, it is effective in situations where traders are much more prevalent then agents and acts on the imperfections of human traders. The arbitrageur can be consider a passive, and rather parasitic agent. Personal: I will use this as one of the methods that the driving GP can employ if I either have time to implement it or can find a implementation of it, low priority though

# What Now Thesis

## State that \*this\* is my working thesis and my extrapolations from my research.

# What Next

## Overview of what am i going to do to continue the progress of this paper?

### Do analysis on multi-agent paper

### Do further research into what ANN to use

### Do research to determine wether my hypothesis that GA are decent at course prediction is correct.

### Justify using a GA to drive ANN

## What is my plan to complete the research phase of this paper?

### Find a programming language and framework that gets the most work done and finish up verification research detailed above

# To be searched

## Terms

Self Organizing Maps

Clustering mechines