Penn Lehman Automated Trading Project: MakeOrBreak

MakeOrBreak

Client

Five rules: measurement, estimation, calculation, balancing of changes, and victory.

-Sun Tzu

Sam Abraham, Corey Kanon

Faculty Advisor: Professor Michael Kearns

Abstract

- Developed automated stock trading client algorithm to implement investment strategy that optimizes profitability, robustness, and consistency in security trading environment.

PLAT Background

- The Penn Lehman Automated Trading Project (PLAT) has been running for three years and has evolved over that time to closely simulate a real financial market environment. PLAT is based on the market microstructure, or “the underlying mechanics of financial markets and exchanges,” (Kearns, Ortiz 2003) of NASDAQ.

- PLAT takes advantage of Island, an Electronic Crossing Network (ECN) that maintains stock limit order books electronically and allows for computerized automated trade execution. The PXS simulates the market for stocks by using Island’s limit order books to represent real world positions.

- The goal of PLAT is to develop automated trading clients to test various investment strategies in the PXS simulated market environment. Twice a year PLAT holds competitions between client traders in a real-time setting to test the success of developed clients.

December 2004 Competition

- Each submitted strategy was run in a total of 13 different simulated scenarios. Each of the simulations contained one of the following background agents:
  - A symmetric background agent (denoted SBG) in which the buy and sell distributions were symmetric.
  - An asymmetric background agent, where the asymmetry of the distributions would (in isolation) cause either an uptrend or downtrend in price (denoted ABGup and ABGdown).
  - A real-data background agent trading based on historical data from DELL, MSFT or YHOO (denoted REALBGdell, REALBGmsft, and REALBGyhoo).

- In terms of raw performance, the single criterion for the competition was the Sharpe ratio (average of profits)/(standard deviation of profits).

- There were no limits on how many shares a client can buy or sell in a day, but each client had to liquidate its position by the 4 PM close of the market or face a monetary penalty.

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- The client polls the market, recording price data for a period of ten minutes. It then uses this data to measure the market’s volatility, represented by the standard deviation of price differences between each recorded price and the moving average. If there is enough volatility, the client market makes (Scenarios I, II, and III), otherwise it channel breaks (Scenario IV).

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The MakeOrBreak Client


- We focused on two specific market behaviors: volatility, characterized by rapid price fluctuations, and trending, marked by the upward or downward overall movement of the stock price over time. When combined, the two types of behaviors produce four market scenarios:
  - Trending Upward or Downward
  - Level and Flat
  - Level with Lots of Rapid Up/Down Swings
  - Smooth upward or downward trend

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Analysis

- Overall, neglecting penalties, the MakeOrBreak client placed in 3rd place. In terms of profitability, the client was outright superior to all other clients, earning an average of $4160.233, 25% more than the nearest competitor. It was the leading proﬁt in four scenarios, and placed in the top three in three other scenarios.

- Unfortunately, relatively poor performance in three scenarios increased the client’s overall standard deviation and dropped it to third. The behavior of the client in these scenarios can be improved with a few simple changes to the code, discussed in the later section.

Future Improvements

- Better system of liquidation
- Dynamic adjustment of variables (mmdelta, sdtheta, channel)
- Volume adjustment/boosting

Results

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Senior Project Poster Day 2005, CIS Dept. University of Pennsylvania