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A Fuzzy Approach to Stock Market Timing

525.770: Intelligent Algorithms Final Project

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Overview

- Motivation & Problem Setup
- Author’s Approach
- Author’s Results
- My Approach
- Results Comparison
- Conclusions

Motivation

- In A Fuzzy Approach to Stock Market Timing, Dong and Wan demonstrate a Fuzzy System to trade securities
- China's A-Share market companies

Author's Approach

- Short Term Price:
  - Oscillation Interval is the prices in the range: ***(i-18)th to (i-3)th*** days
  - % above/below the high and low points in this range define the trend.
- Exchange Volume:
  - Difference between Exchange Volume at current day and 15 Day Moving Average of Exchange Volume
- Long Term Price:
  - $$\boldsymbol{bob(i) = 0.98^{D\_Max(i)} \times \frac{MA10(i) - GlobalMax}{GlobalMax} + 0.98^{D\_Min(i)} \times \frac{MA10(i) - GlobalMin}{GlobalMin}}$$
  - A bob threshold value is set such that if *bob(i) > 0.15* the market is Bullish, if *bob(i) < -0.15* the market is *bearish*, otherwise, the market is *neutral*.

Author's Approach (Cont.)

- The Fuzzy Inference System uses the below Input Membership Functions
  - All MFs are triangular (including the Long Term Price MF and Output MF)
- Output MF Linguistic Variables
  - Strong Sell (-2), Sell (-1), Hold (0), Buy (1), Strong Buy (2)
- Sum Min Inference and CoG Defuzzification are used

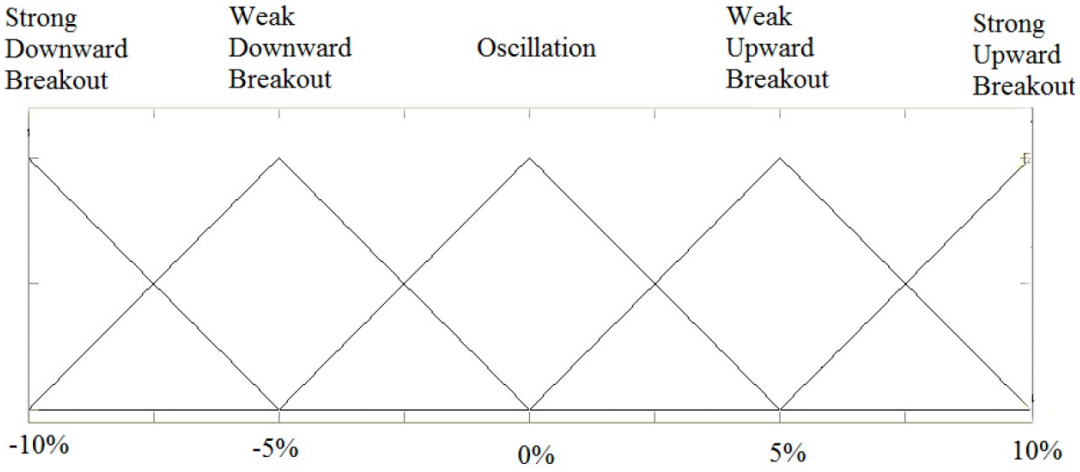


Figure 1. Membership functions of short term price change

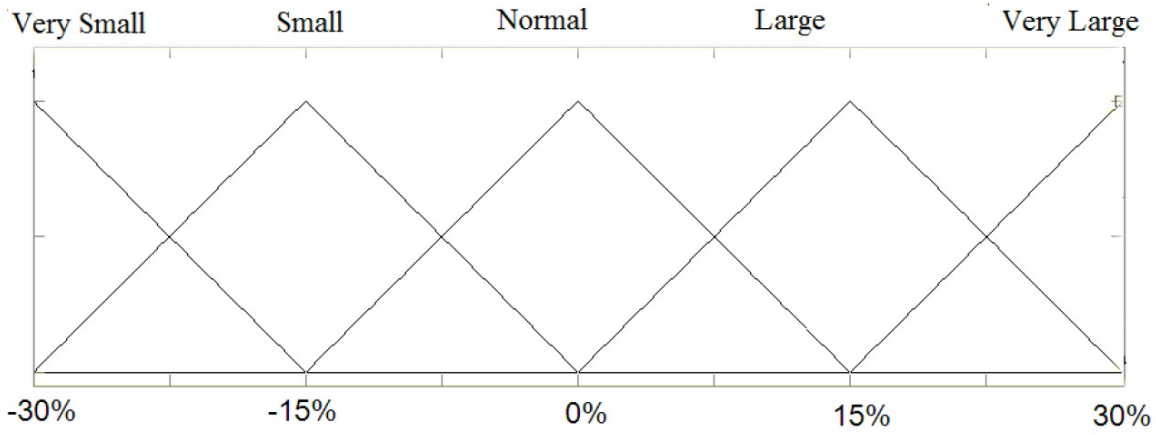


Figure 2. Membership functions of exchange volume change

Author's Approach (Cont.)

- The Rule Base used is below.
  - Strong Sell (-2), Sell (-1), Hold (0), Buy (1), Strong Buy (2)
  - IF the market is bullish THEN strong buy (2)
  - IF the market is bearish THEN strong sell (-2)
- Sum Min Inference and CoG Defuzzification

TABLE I. RULE TABLE FOR COMMON MARKET

Suggestion		Short Term Price Change				
		-10%	*-5%*	*0%*	*5%*	*10%*
Short Term Exchange Volume Change	*-30%*	-2	-1	0	0	0
	-15%	-2	-1	0	0	0
	0%	-2	-1	0	1	1
	15%	-2	-1	0	1	2
	30%	-3	-2	0	2	2

Author's Results

- The Fuzzy System Outperforms the Buy and Hold Investor in 4/5 scenarios.

TABLE III. PERFORMANCE OF THE FUZZY SYSTEM

Stock Code	Proposed System	Buy and Hold	ROC	MACD	RSI
000002	1650.46%	714.52%	148.0%	139.6%	1.1%
000651	523.78%	1016.40%	200.3%	112.3%	28.6%
002202	62.12%	-28.64%	3.5%	-20%	-25.4%
600000	740.40%	333.58%	76.2%	-24%	57.8%
601918	132.29%	11.32%	121.5%	80.6%	-9.2%
Average	621.81%	409.44%	109.89%	77.13%	10.56%

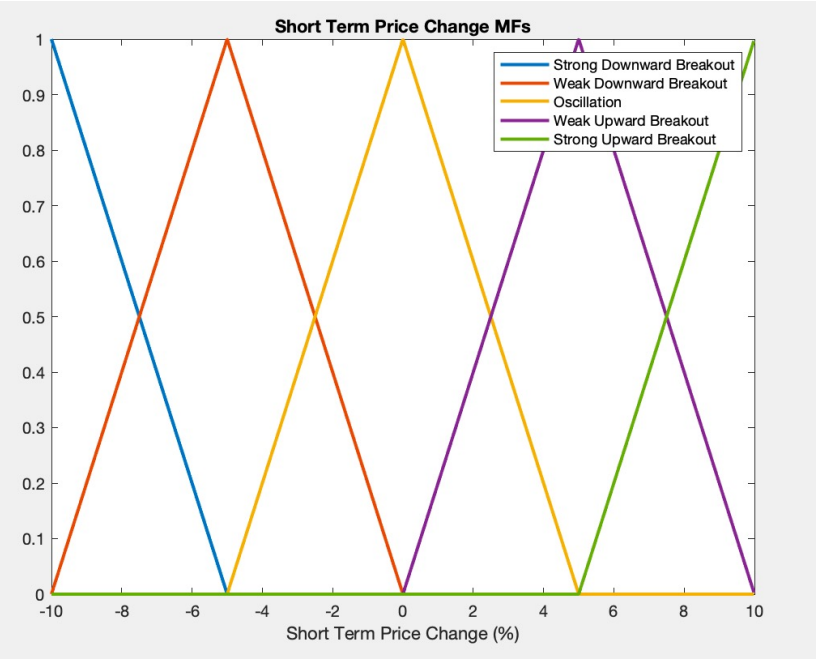
TABLE II. BASIC INFORMATION OF STOCK DATA

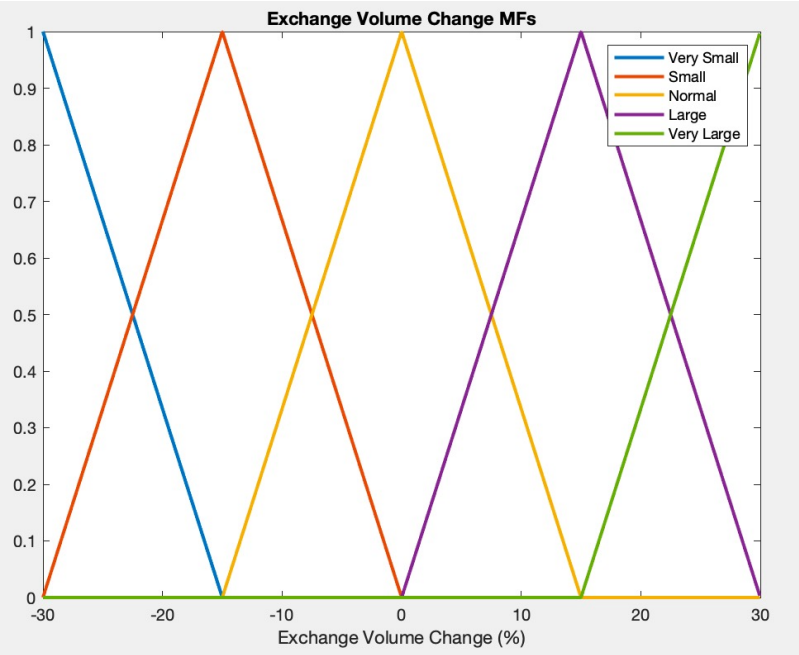
Code	Stock Name	Samples	Beginning
000002	VANKE-A	1224	2004-03-02
000651	GREE	1232	2004-03-02
002202	GOLDWIND	331	2007-12-26
600000	S/PUDONG DEV BANK	1212	2004-03-02
601918	SDIC XINJI	290	2007-12-19

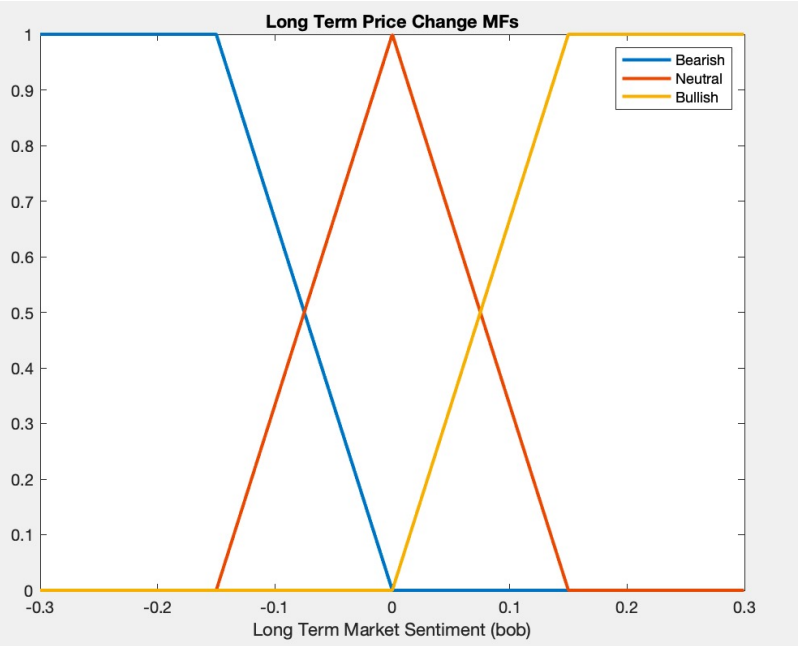
*End Date: 2009-05-15

My Approach

- Three MATLAB functions written and available on GitHub
  - *create_stock_trends.m*
  - *fuzzy_stock_engine.m*
  - *fuzzy_stock_trader_main.m*
- If the fuzzy system gives a strong buy/sell then buy/sell all shares. Otherwise buy/sell 500
- Starting capital: $10,000



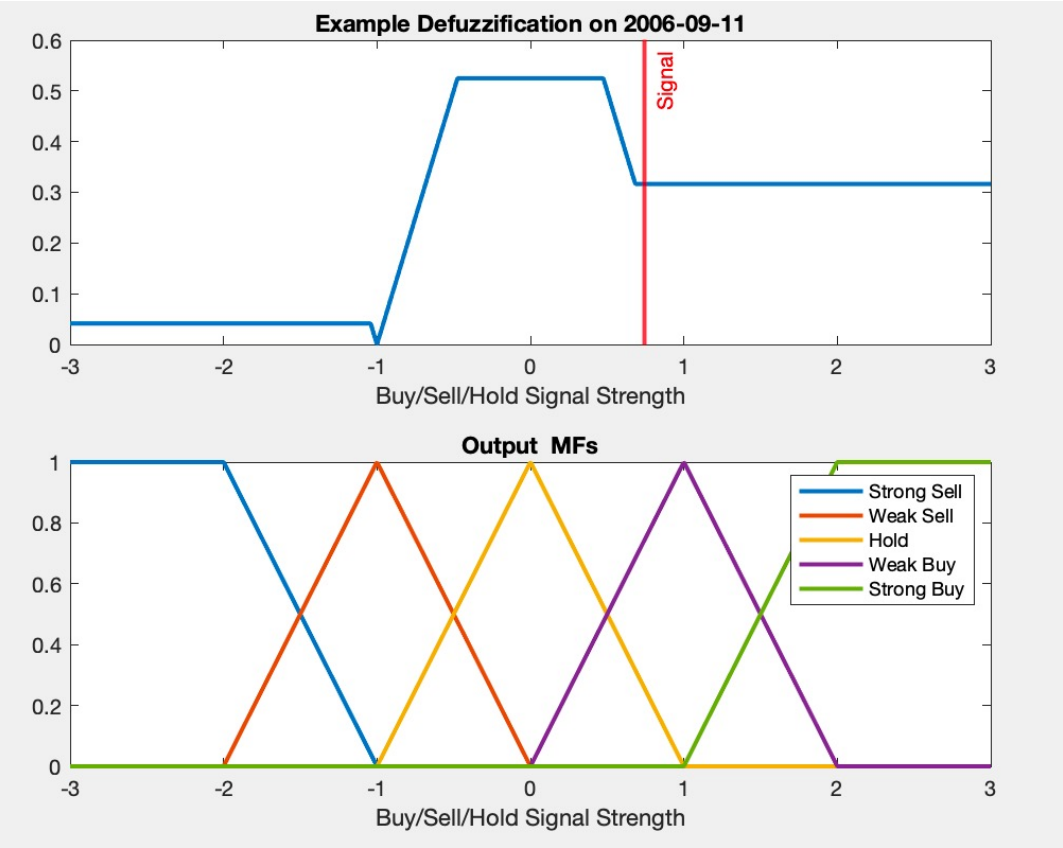




My Results

- Depending on Fuzzy System Output either buy/sell all shares or a chunk of shares
- My Fuzzy System was able to outperform a buy/hold investor in 4/5 scenarios
- However, they are not the same 4/5 scenarios as the author.
- Fuzzy Operation on example day below:

```
Short Term Price Trend 1.5827%
Exchange Volume Trend 22.12%
Long Term Price Trend bob -0.01
Defuzzified Recomendation: 7.458199e-01
```



Results Comparison

- The author provides little details on how to act on the Fuzzy System's output Buy/Sell/Hold signal.
- It is unlikely this is due to improper operation of the Fuzzy Engine
- Likely Causes
  - Yen vs Dollar
  - Limited detail on how the financial simulation was implemented in the paper. That is, how to act on the fuzzy system's recommendations

Stock	Author	Buy/Hold	Fuzzy System
VANKE (000002)	1650.46%	681.38%	751.52%
GREE (000651)	523.78%	850.86%	449.81%
PUDONG (600000)	62.12%	389.07%	429.81%
XINJI (601918)	740.40%	104.84%	144.66%
GOLDWIND (002202)	132.29%	65.27%	91.30%

Conclusions

- A Fuzzy Inference System was developed that can outperform the Buy & Hold investor for certain stocks
  - Sum Min Inference with Triangular Membership Functions
- Author's Results were difficult to replicate
  - Overall returns and fuzzy system returns do not match

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