Fuzzy Stock Predictor

A Stock prediction tool based on Fuzzy Indicators

Nondescript
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Introduction

One of the hardest challenges that traders face when entering a new position (handling a new stock) is choosing the right strategy to maximize their potential profits.

Stock trading is a very flexible form of investment, and it's possible to profit from several different outlooks over above simply expecting a financial instrument to rise or fall in price. However, in order to do so a trader must choose an appropriate trading strategy and this isn't always an obvious choice. Also, understanding various methods of analysing stock data can be a tedious process.

There isn't necessarily always a right decision in any given circumstance; there are strategies, though, that are particularly suitable for certain outlooks.

This system provides a tool to help you decide a trading strategy by self-assessing stock's future outlook on an underlying asset. To use the tool, you simply need to pick the underlying asset (here: company's stock you want to trade on) *and it suggests you the step to be taken with the best profit result.*

Background Theory

To study trends of the market, there are various technical indicators used by traders to make buy and sell decisions. This system uses four indicators for decision making process: **Moving Average Convergence/Divergence (MACD), Relative Strength Index (RSI), Stochastic Oscillator (SO) and On-Balance Volume (OBV)**. The fuzzy rules combine the trading rules for each of the indicators. The result is a **recommendation to buy, sell or hold**. Real historical data of three months was collected for testing and evaluation of the system. The technical indicators were then computed for each data and from these computed values, system generates a recommendation whether the user should buy, sell or hold.

The four indicators are:

1. Moving Average Convergence/Divergence : [https://en.wikipedia.org/wiki/MACD]
    - Used to identify moving averages that are indicating a new trend, whether it's bullish or bearish.
    - Depends on exponential moving average of the finalised stock price (i.e. close price).

2. Relative Strength Index (RSI) : [https://en.wikipedia.org/wiki/Relative_strength_index]
    - Used to indicate temporary overbought (bought more than you should implying a need to sell) or oversold (sold more than you should implying a need to buy) conditions in a market.
3. Stochastic Oscillator (SO) : [https://en.wikipedia.org/wiki/Stochastic_oscillator]
    - Used as a technical indicator of stock price momentum used to compare closing price to range of price over a given period of time.
4. On-Balance Volume (OBV) : [https://en.wikipedia.org/wiki/On-balance_volume]
    - Used to measure buying and selling pressure as a cumulative indicator that adds volume on stock-up days and subtracts volume on stock-down days.

Knowledge Base

For MACD, we calculate a value called Signal Trigger which helps in deciding whether MACD is high or low:

[Rule 1] IF MACD is above the Trigger signal line THEN BUY
[Rule 2] IF MACD is below the Trigger signal THEN SELL

For RSI, different industries have different threshold levels.
Stocks of some companies go as high as *75* to *80*. These are the guidelines used by the system for fuzzification:

[Rule 3] IF RSI increases to above 70 (implies overbought) THEN SELL.
[Rule 4] IF RSI is between 30 and 70 (implies normal) THEN HOLD
[Rule 5] IF RSI decreases to below 30 (implies oversold) THEN BUY

For SO, plotting is done within a range of 0 to 100 and signals over-bought conditions above 80 and oversold conditions below 20:

[Rule 6] IF SO increases above 80 (implies overbought) THEN SELL
[Rule 7] IF SO is between 20 – 80 (implies normal) THEN HOLD
[Rule 8] IF SO is below 20 (implies oversold) THEN BUY
[Rule 9] IF MACD is HIGH and RSI is LOW and SO is LOW and OBV is HIGH THEN BUY
[Rule 10] IF MACD is LOW and RSI is HIGH and SO is HIGH and OBV is LOW THEN BUY
[Rule 11] IF MACD is HIGH and RSI is MED and SO is MED and OBV is HIGH THEN BUY.
[Rule 12] IF MACD is LOW and RSI is MED and SO is HIGH and OBV is LOW THEN SELL.
[Rule 13] IF RSI is HIGH and SO is HIGH and OBV is LOW THEN SELL.
[Rule 14] IF MACD is HIGH and RSI is MED and SO is MED and OBV is LOW THEN HOLD.
[Rule 15] IF RSI is LOW and SO is LOW and OBV is HIGH THEN BUY.
[Rule 16] IF MACD is HIGH and RSI is MEDIUM and SO is HIGH and OBV is HIGH THEN SELL.

On Balance Volume is calculated by adding the day's volume to a cumulative total when the stock's price closes up, and subtracting the day's volume when the stock's price go down. The values are then plotted; its upward motion or downward motion tells us whether OBV is indicating high or low.

The trading rules for this indicator can be of the following form:

[Rule 17] IF line is Upward then BUY (HIGH)
[Rule 18] Else IF line is Downward then SELL (LOW)

User Manual

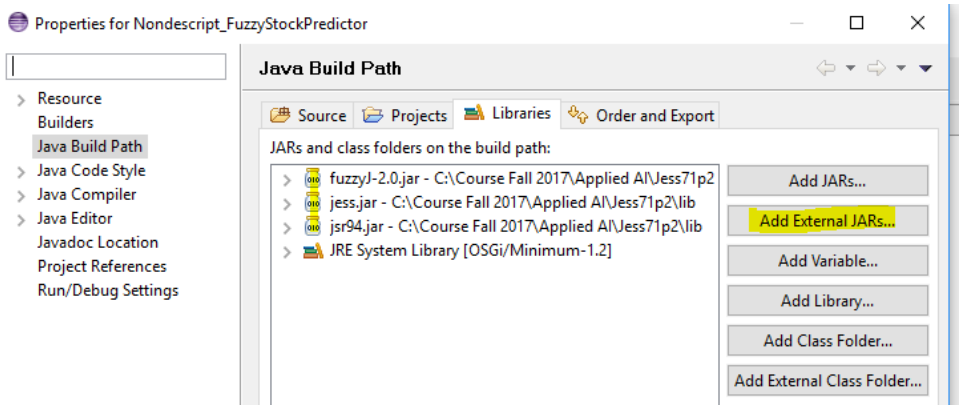
Instructions:

Copy the file **optionAndroker.clp** to the **BIN** folder under the **JESS** directory.

Open JESS and execute the below commands:

(batch optionAndroker.clp)

1. Launch Eclipse IDE
2. Create new Java Project called "FuzzyStockPredictor"
3. Import "FuzzyStockPredictor.zip" zip folder into the newly created "FuzzyStockPredictor" Project
4. Right click on project -> build path -> configure Build Path… -> Add Jess and Fuzzy external JARs



5. Right click on "FuzzyStockPredictor.clp". Click on "Run As", and then select "Run Configurations"
6. Once the "Run Configurations" dialog box opens, navigate to the "FuzzyStockPredictor.clp" file from the left panel
7. Replace the Jess main class (under the Jess Application tab) from "jess.Main" to "nrc.fuzzy.jess.FuzzyMain"
8. In "indicatorsCalculations/**Main**.java", ensure "csvFile" in the function ReadData(..) **points to the correct location** of folder "Stock Data"

```
*/
public static ArrayList<StockEntry> readStockData(String fileName)
        throws NumberFormatException, ParseException {
    // Read Stock Data
    System.out.println("Fetching Historical Stock Data...");
    String csvFile = new File("").getAbsolutePath() + "/Stock Data/" + fileName + ".csv";
    BufferedReader br = null;
    String line = "";
```

9. If you get the following error, click on the suggested error bubble and allow **jre 1.5** or above:

   Syntax error, parameterized types are only available if source level is 1.5 or greater

   This is needed for ArrayList to function.
10. Run the "Main.java" file
11. In case the grader wants to change inputs and test new inputs, there is a separate file called 'VaryInput.clp' (do step 4. to 6.); make changes to the following lines only:

```
(reset)
(defrule init
    (declare (salience 50))
=>
(assert (Data
            (id "name")
            (macd 6)
            (macd_trigger 12)
            (obv "Low")
            (rsi 95)
            (so 95)
```

Results

Here is the sample output for one of the scenarios:

For running Main(…):

```
_____________________________________________________

                Fuzzy Stock Predictor

_____________________________________________________


Enter the option number of the Company you want to trade in:
        [1]             Apple Inc. [Stock Symbol : AAPL]
        [2]             Alphabet Inc. [Stock Symbol : GOOGL]
        [3]             Facebook Inc. [Stock Symbol : FB]
1

        You chose Apple Inc. (AAPL)


Fetching Historical Stock Data...
Processing historical data...


following are the values:
MACD is greater than MACD Trigger. Hence, MACD is High. ( MACD is -5.90054429566743. MACD trigger is -9.155544943414945 )
RSI stock is normal(neither overbought nor oversold) implying RSI of Medium level. ( RSI is 51.76609077054863 )
SO stock is normal implying Medium SO level. ( SO is 49.79579194139785 )
OBV is Low

_____________________________________________________________________________________

                                Prediction & Recommendation


System recommends to 'hold' i.e. to neither buy nor sell the stock.
This company is expected to perform with the market or at the same pace as comparable companies.
This rating is better than sell but worse than buy,
meaning that investors with existing long positions(already own the stocks) shouldn't sell,
but investors without a position(do not own the stocks) shouldn't purchase either.


_____________________________________________________________________________________
```

User enters the number on the company he wants prediction on. System analyses the historical stock data of the company and gives its recommendation of action to take according to the prediction.

For VaryInput():

```
On-Balance Volume:Low
MACD : 6 is < MACD Trigger : 12. Hence, MACD is Low
SO : Data_so<Java-Object:nrc.fuzzy.FuzzyVariable> is Overbought implies SO is High
RSI : Data_rsi<Java-Object:nrc.fuzzy.FuzzyVariable> is Overbought implies RSI is High
```