

Algorithmic Trading System

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Abstract: Financial markets are regarded as one of the most popular investment options since they offer high returns in a short period of time. However, because of its highly volatile and unpredictable character, it is considered a dangerous investment option. As per popular estimates, up to 90% of those who engage in the stock market lose money, including both rookie and experienced traders. And the reasons behind this can include a lack of information, a lack of trading discipline, and decision-making based on emotion. As a result, the Algorithmic Trading System is an attempt to make the lives of investors easier through study and the development of profitable trading techniques by examining and evaluating market conditions. And trading with algorithms may be able to generate fair trades and more profitable chances with financial instruments. In this paper we have discussed various applications of algorithmic trading system.

Keywords: Algo trading , Trading discipline, Natural language processing

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I. INTRODUCTION

Algorithmic trading (frequently known as algo-trading or automated trading) makes use of computer program that follows a predefined set of instructions (an algorithm) pertaining to variables like time, prices and technical analysis to place a trade. Theoretically, the trade, in theory, can generate profits at a frequency and speed which is impossible for a human trader. [1].

Algorithmic trading allows traders to define particular rules for all trade entries and exits that, once programmed, can be automatically executed using a computer.

It is a trading system which can extract data periodically, perform the analysis, can execute the trading strategies and also place / close orders in an automated fashion.

The aim of this project is to experiment the possibility of studying historical price data or live data of the real-world financial assets and building the trading algorithms with that data and to make the most profitable trades in the market.

A. Importance

As previously stated, 90% of people lose money in financial markets due to a lack of knowledge and discipline.



Fig. 1. Algorithmic Trading System

As a result, an algorithmic trading system can be the differentiator for this number, as it performs complex calculations and does not miss out on trade opportunities.

It also includes a time module, so users do not have to sit in front of a computer and constantly check prices; the algorithm will evaluate specified instruments for a given time interval. And whenever the appropriate parameters are met, the trade will begin.

B. Scalability

Algorithmic trading systems are scalable in terms of both order size and the quantity of instruments that can be traded. There is no continuous market monitoring: Algorithms can monitor market changes, make choices, and execute transactions.

Algorithmic trading system exclusively rely upon the Data and precise programming, every trader in any financial market requires a broker to conduct a transaction with an exchange, so one of the most important factors in algorithmic trading is the broker's API terminal from which we will connect our algorithm and automate our trading. as long as the API functionality is stable and capable of obtaining market data in the script, the algorithm will run without errors.

II. PROPOSED METHODOLOGY

System Architecture of an Algorithmic Trading Platform

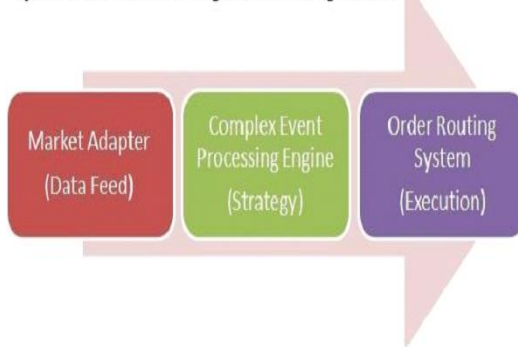


Fig. 2. Architecture of the System

A. Data Extraction

In this project we have used two data extraction terminologies:-

yfinance - yfinance is a Python library that allows us to use Python to retrieve historical market data from the Yahoo Finance API. With the aid of yfinance, all Python developers can acquire data very quickly.

oanda api - Oanda is the largest forex broker, and in this project, we are connecting our script with the oanda api functionality. For live trading, we need live data, and we are extracting that data in our algorithm using the oanda api.

B. Backtesting

Back testing is simply taking a trading strategy and testing how well it would have done in the past using historical pricing.

We have back tested two strategies:-

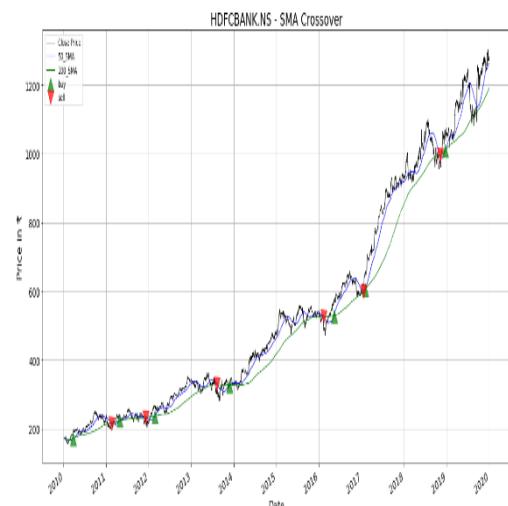
Moving Average Crossover:

The Moving Average Crossover technique is a simple momentum strategy.

A specific time series is subjected to two independent simple moving average filters with varying look back durations.

When the fast-moving average exceeds the slowmoving average, it is a signal to buy the asset. If the slow-moving average eventually outperforms the fast-moving average, the asset is sold back. And the technique works effectively.

For daily close prices, simple moving average is used as crossover method for HDFCBANK from 2010 to 2020.



Date	Close Price	50_SMA	200_SMA	Signal	Position
2010-03-25 00:00:00	192.615	171.054	171.048	1	Buy
2011-02-17 00:00:00	218.56	215.917	216.177	0	Sell
2011-04-28 00:00:00	233.775	224.128	223.809	1	Buy
2011-12-05 00:00:00	231.175	232.44	232.679	0	Sell
2012-02-22 00:00:00	265.725	236.201	235.748	1	Buy
2013-08-07 00:00:00	300.6	329.957	331	0	Sell
2013-11-25 00:00:00	329.875	325.676	325.662	1	Buy
2016-02-12 00:00:00	485.7	525.778	526.529	0	Sell
2016-05-11 00:00:00	569.4	530.29	529.891	1	Buy
2017-01-19 00:00:00	618.15	601.408	601.751	0	Sell
2017-02-03 00:00:00	655.525	607.168	607.16	1	Buy
2018-11-06 00:00:00	973.275	997.632	998.607	0	Sell
2018-12-21 00:00:00	1055.57	1010.24	1009.72	1	Buy

Fig.3. Algorithmic Trading Strategy

This strategy has given only one false signal in the last ten years, and everything else has been profitable.

Portfolio Rebalancing:

Portfolio Rebalancing - this approach has been adopted for monthly investment plans thus if someone has to invest every month rather than trade, this is the strategy.

Initially, we will add the top 6 dow jones index performers in our portfolio and at the end of each month, we will eliminate three of the worst performers from our portfolio, and then add the top three from the dow jones index again. We will do this for 5 years, and when compared to traditional investing, this strategy has produced significant results.



Fig. 4. Index Return vs. Strategy Return

C. Building Algorithmic Trading System

In this phase of the project we are going to do live trading in the forex market. We used the oanda api functionality to link our algorithm with the forex broker, and after establishing a reliable connection, we have defined the strategy parameters.

Strategy Parameters:-

Input parameters - We begin with the currency pairs that will be included in the strategy, followed by the position size (capital allotted per position of any given currency pair).

Hardcoded functions -

- SMA (to calculate simple moving averages)
- ATR (to calculate true range and average true range we are using this ATR value as a stoploss)
- CANDLES (to obtain and contribute continuous data to our algorithm)
- MARKET ORDER (to place a trade with units and stoploss functionality in the real market)
- TRADE SIGNAL (to identify the SMA crossover of moving averages and visualization of the crossover)
- MAIN (to bring everything together in order to begin live trading)

Continuous execution - In the final section of this algorithm, we used the Time module to run this algorithm continuously, because we are obtaining 5 minute data in our algorithm, which means the script will analyze the prices every 5 minutes and going to apply the functions we have coded, and after analyzing the pairs, the algorithm will sleep for 5 minutes until new candles or prices are formed in the real market, at that point it will resume analyzing the pairs.

This algorithm can run n number of hours And When the golden crossover or sma crossover conditions are met, it will initiate the trade, and a stoploss is placed on the transaction to limit the downside risk.

D. Natural Language Processing

The purpose of this NLP technique is to identify the most popular stocks (stocks that may be seen in big action). We are using sentiment analysis to identify stocks and currencies for a given day; we are scraping daily financial articles and apply a lexicon-based sentiment analyzer, then calculate the compound value for given instruments, and we are getting the hot stocks based on their article sentiments.

III. EXPERIMENTAL RESULTS

When we run our algorithm, it immediately begins evaluating the given currencies, and when the USD/JPY crossover happened, it has initiated a trading signal and automatically placed a short (sell) order.



Fig.5. Experimental Results

On the web trading platform of oanda fx, Our system has automatically placed the transaction in the real market.

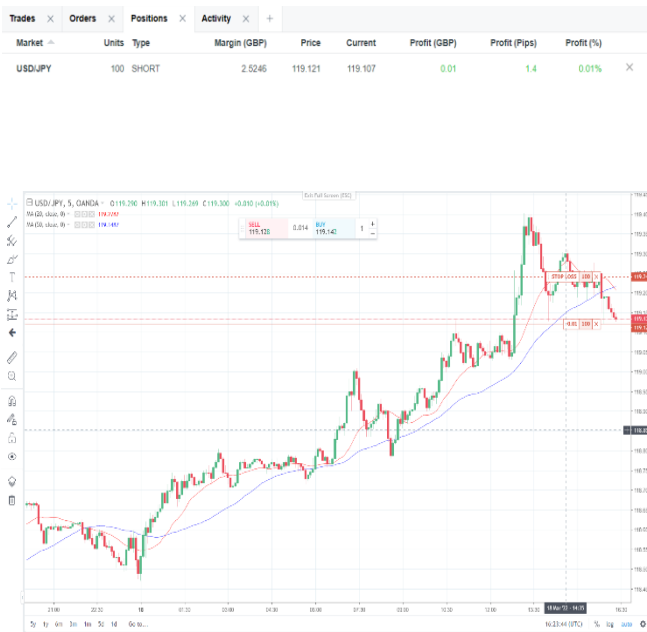


Fig. 6. Analysis of Trading System

IV. TERMINOLOGIES USED

A. Key Performance Indicators

The word "Key Performance Indicator" is used to describe a quantifiable measurement of performance over a period of time for a predefined goal.

Here we have used 3 KPI's with historical data: -

- **Compound Annual Growth Rate** - The compound annual growth rate is known as the rate of return (RoR) that would be needed for an investment to grow from its initial balance to its final balance, for this it is assumed that the profits were reinvested at the end of every period of the investment's life span
- **Sharpe ratio** - Sharpe ratio is known as the excess return of a portfolio above the risk-free rate relative to its standard deviation.
- **MDD** - A maximum drawdown is the maximum seen loss from a peak to a trough of a portfolio, just before a new peak is found. Maximum drawdown represents downside risk over a specified time period.

B. Cloud Deployment

Running algorithms in the cloud is faster and more reliable because it avoids issues like power cuts, slow internet connections, and a slow operating system. Running algorithms in the cloud can also be very scalable because it increases your computational power and makes it easier to manage algorithms with high computational demands. In this project we have used AWS EC2 cloud.

V. CONCLUSION

Previously, this process is pretty much done by only institutional investors or investments firms like mutual funds or pension funds, but with algorithmic trading both professional traders and new traders would be able to perform better trades and minimize their losses.

Algorithmic Trading has the benefit of executing and scanning on many indicators at a speed that no human could do. As trades can be executed and analyzed faster, many opportunities are available at better prices The future of trading and dealing is in automation and data driven decisions.

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