Cryptocurrency Trading Bot vs Buy and Hold Trading Strategy

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I. ABSTRACT

In recent years, the tendency of various financial experts has accelerated towards cryptocurrencies. Cryptocurrencies are also included as pure digital assets by asset managers. Even though they have their separate nature, their behavior as an asset and trading strategies are still in process of being understood. The most common strategy is to buy and hold, but due to the high volatility of the market the Sharpe Ratio (which represents the risk-adjusted return of the investment) is often low. Therefore the process of implementing more favorable trading strategies and algorithms can be automated using programming. This paper proposes automating the trading process with trading strategies and then Backtesting the trading strategy with historical data and implementing it in python, by using Binance API to get real-time market data and TwelveData API to get the historical market data of the cryptocurrency. This trading bot uses algorithms that follow a trend and refer to a predefined set of instructions to perform favorable trades. A well-timed trade can generate revenue at an inhuman speed. Our objective through this project is to take this revolution in the market by providing an efficient and effective solution that can overcome the limitations that are being faced due to manual trading by applying various available algorithms for day trading based on market conditions and user approach.

Keywords: Trading, Cryptocurrency, Automation, Backtesting, Binance, TwelveData, Python, Programming, Algorithms, Day-trading

II. INTRODUCTION

Cryptocurrencies are hyper-volatile assets. Unlike traditional markets, trading in cryptocurrency happens round-the-clock and crypto traders may find it difficult to react to price moves in a fraction of seconds. This is where crypto trading bots can respond quickly and take charge. Traders can leverage the pre-defined set of rules into a robot to execute the trade in the most efficient way possible.

Cryptocurrency trading bots are automated trading systems that work on behalf of the investor. They allow you to execute trades automatically when specific conditions for that trade are met. These trading bots take into account information, like current prices and volatility levels. In short, they simplify the process of investing and make crypto-trading easier. Bots offer relatively better efficiency than humans and make fewer errors with little room for emotion or sentiment. This is especially helpful since the cryptocurrency market is notorious for dramatic price movements.

- ### A. Services provided by a trading bot:

  Data Analysis on live market data: The Bot uses Binance API (Application Program Interface) and WebSocket to get raw market data from a variety of sources, interpret it, apply trading strategies and algorithms and then conclude whether to buy or sell.

- Applying trading strategies: Cryptocurrency trading bots strategically buy or sell cryptocurrency assets, according to the given strategies.

B. Pros of Cryptocurrency Trading Bots

- Saves time by automating trading orders at any time as many times deemed to be necessary by the trading strategy.
- Provides effective stop-loss function through predetermined high and low price levels.
- Traders don't need to observe and analyze huge market data.
- Bots are used by traders to take advantage of the cryptocurrency markets that trade 24/7 all over the world.
- Quick, Fast, and Reduced Cost Trading

The global cryptocurrency market is expected to grow significantly between 2018 and 2026.

Our project aims to further this revolution in the markets of tomorrow by providing an effective and efficient solution to overcome the drawbacks faced due to manual trading, as because the bot trades are executed at the best possible price according to the market

- The trade request situation is instant and precise (there is a possibility of execution at the ideal levels).
- Trades are coordinated effectively and immediately to keep away from huge value changes.
- Although the bot will make many transactions and transaction costs will eventually add up. We will use the Binance exchange platform since it has a low transaction cost, thus ideal for our bot.

III. METHODOLOGY

The working of a cryptocurrency trading bot contains some stages as shown in the figure.

In the first stage, the bot requests the live data from Binance using Binance API. Binance is a cryptocurrency exchange that is the largest in the world in terms of the daily trading volume. Binance API is used to connect the bot to the Binance server via python socket programming.

We install WebSocket-client, declare a socket variable, and bind the Binance API including the cryptocurrency type and interval for live market data. After collecting data through Binance, the live data of every passing minute can be obtained in real-time.

After that, various trading strategies based on different concepts are implemented and executed via Binance API. The bot works on various strategies and is aimed to get low-risk adjusted returns.

After applying the strategies the bot places orders for buying and selling of assets according to the technical analysis value.

Following are some of the important and major concepts and strategies that we have implemented in our project according to the working of a paper trading live trading simulator and bot.

A. Paper Trading Simulator

Paper trading is a concept of simulated trading that allows a trader to practice buying and selling assets without risking real money. The term dates back to a time when (before the proliferation of online trading platforms) aspiring traders would practice with fake money before risking real money in live markets. While learning, a paper trader records all trades by hand to keep track of hypothetical trading positions, portfolios, and profits or losses. Today, most practice trading involves the use of paper trading simulators, which looks and feels like an actual trading platform.

We have implemented this concept of the paper trading simulator in our project. In the simulation, users have a paper trading wallet that contains virtual money to buy or sell any choice of an asset with real-time market prices of the cryptocurrency. This is done through Binance API and WebSocket in python. All the transaction and price changes will be reflected in his portfolio. This simulator also shows all the trade history of buying or selling of assets in the user portfolio.

B. Core-Satellite Approach

Core-satellite investing is a method of portfolio construction designed to minimize costs, tax liability, and volatility while providing an opportunity to outperform the broad stock market as a whole. The core of the portfolio consists of passive that tracks major market indices. Additional positions, known as satellites, are added to the portfolio in the form of actively managed investments.

This is a very simple, safe, and cost-effective strategy. In this approximately 70-80% of the total portfolio is invested in passively managed assets while the remaining 20-30% of the portfolio is kept for actively managed investments. The core portion of the portfolio helps to minimize costs because passive investments are almost always less expensive than their active counterparts. Since passive investments track indices, the portfolio changes only when the index changes. Because indices change infrequently, transaction costs and capital gains tax are minimized. Active portfolio management, on the other hand, is based on trading. Each trade generates execution costs and potential tax liabilities in the form of capital gains.

C. Aroon Oscillator Indicator Strategy

The Aroon indicator indicates if a price is trending or is in a trading range. It can also reveal the beginning of a new trend, and its strength and can help anticipate changes from trading ranges to trends. Aroon down and the Aroon up indicators are used together and combined are called the Aroon indicator.

Aroon up measures how long it has been since prices have recorded a new high within the specified period. If the current bar's high is the highest within the user-defined number of periods before it, then the Aroon up value is 100. In other words, it is a new high for the period. Otherwise, it returns a percent value indicating the time since a new high occurred for the specified period.

Aroon down measures how long it has been since prices have recorded a new low within the specified period. If the current bar's low is the lowest within the user-defined number of periods before it, then the Aroon down value is 100. In other words, it is a new low for that period. Otherwise, it returns a percent value indicating the time since the new low occurred for the specified period.

The Aroon Oscillator is calculated by subtracting the Aroon Down from the Aroon Up. The resultant number will oscillate between 100 and -100. The Aroon Oscillator will be high when the Aroon Up is high and the Aroon Down is low, indicating a strong upward trend. The Aroon Oscillator will be low when the Aroon Down is high and the Aroon Up is low, indicating a strong downward trend. When the Up and Down are approximately equal, the Aroon Oscillator will hover around zero, indicating a weak trend or consolidation.

D. Engulfing Pattern Indicator Strategy

Engulfing candles tend to signal a reversal of the current trend in the market. This specific pattern involves two candles with the latter candle 'engulfing' the entire body of the candle before it. The engulfing candle can be bullish or bearish depending on where it forms with the existing trend.

Engulfing candles assists us to visualize the trend reversals, prompt us trend continuation and exit strategy. The Engulfing candle is either bullish or bearish on the basis of where it forms with the ongoing trend.

- Bullish engulfing pattern: A bullish engulfing pattern is a candlestick pattern that forms when a bullish green candlestick engulfs the entire body of the prior bearish red candle.
- Bearish engulfing pattern: A bearish engulfing pattern is a candlestick pattern that forms when a bearish red candlestick engulfs the entire body of the prior bullish green candle.

Engulfing candles assist traders to spot reversals, indicating a strengthening trend, and assist traders with an exit signal:

- Reversals: Spotting reversals are self-explanatory – it allows the trader to enter a trade at the best possible level and ride the trend to completion.
- Trend continuation: Traders can look to the engulfing pattern to support the continuation of the existing trend, for example, spotting a bullish engulfing pattern during an uptrend provides more conviction that the trend will continue.
- Exit strategy: The pattern can also be used as a signal to exit an existing trade if the trader holds a position in the existing trend which is coming to an end.

E. Backtesting Trading Bot

Backtesting is a process that allows you to simulate a trading strategy's performance using historical data. As a predictive financial model, backtesting uses data from a previous time frame so you can test it out before the strategy goes live and your funds are committed.

Backtesting lets traders estimate a strategy's performance. If it worked in the past in similar market conditions, it has a good chance of working again. When traders backtest, they get to analyze data via charts, historical market movements, patterns, and technical indicators to get an edge in crypto markets.

Having a backtesting feature at your trading terminal means you can continually test and refine your strategies. Backtesting lets traders estimate a strategy's performance. If it worked in the past in similar market conditions, it has a good chance of working again.

IV. RESULT

After implementing all the above, we have successfully achieved the following results:

- Paper Trading Simulator: We start by defining Bitcoin as a cryptocurrency type and 1 min as an interval in the Binance API and get live data through WebSocket-Client. We then make a list of high, low, opening, and closing of the candle of cryptocurrency, a list of investments made by the bot, and the real-time portfolio value of the bot every interval.

  a) Core-satellite approach: Initially we include virtual $1000 in our wallet. By using the core-satellite approach, we initially invest 80% of our wallet directly into Bitcoin and keep 20% of our wallet reserved for the bot.

  b) Aroon Oscillator Indicator strategy bot: We define the Aroon time period as 14. So the bot will run for 14 intervals and gather the highs and lows of each candle in a list. Using the technical analysis library of python, we get the Aroon oscillator indicator, by passing the highs and lows of the candle since the bot is running into the AROONOSC function of TA-lib. After getting the Aroon value, if it is negative then the bot sold some recommended amount of Bitcoin and if the last Aroon is positive the bot bought some recommended amount of Bitcoin.

  c) Engulfing Pattern Indicator strategy bot: Using the technical analysis library of python, we use the engulfing pattern recognition function to get engulfing pattern indicator value, by passing the highs, lows, opening, and closing value of the candle into the CDLENGULFING function of TA-lib. If the last engulfing value is zero the bot does not make any trades, and if it is -100 then the bot sold the recommended amount of Bitcoin, and if it is 100 the bot bought some recommended amount of Bitcoin.

- Backtesting Analysis: We made a dataset of the previous 2 months (as of 2022-04-07) of the Bitcoin market using twelve data. We then applied the above strategies and calculated the real-time portfolio value of each strategy with respect to the traditional buy and hold strategy. And then we did a return analysis of given strategies by calculating the Sharpe ratio, risk analysis, volatility, value at risk, and excess returns of the strategies.

a) <u>Backtesting Aroon Oscillator Indicator strategy:</u>

	datetime	open	high	low	close	aroon	rt_port_value	bh_port_value
0	2022-02-07 00:00:00	42426.89844	42480.32031	42292.85156	42292.85156	NaN	1000.000000	1000.000000
1	2022-02-07 00:05:00	42360.87109	42360.87109	42293.23047	42305.00000	NaN	1000.230371	1000.287246
2	2022-02-07 00:10:00	42282.23047	42282.23047	42173.37109	42189.76953	NaN	998.045255	997.562661
3	2022-02-07 00:15:00	42082.71094	42155.75000	42032.76172	42032.76172	NaN	995.067896	993.850265
4	2022-02-07 00:20:00	42039.94141	42080.05859	42022.53125	42080.05859	NaN	995.964801	994.968583
...	...	...	...	...	...	...	...	...
17013	2022-04-07 23:35:00	43637.89062	43637.89062	43589.44922	43608.67188	57.142857	1091.823223	1031.112121
17014	2022-04-07 23:40:00	43611.89062	43613.92969	43557.35938	43557.35938	57.142857	1090.718141	1029.898855
17015	2022-04-07 23:45:00	43564.41016	43589.32031	43550.57812	43555.83984	57.142857	1090.685411	1029.862926
17016	2022-04-07 23:50:00	43555.51172	43571.94141	43465.62891	43497.71094	-42.857143	1089.433345	1028.488488
17017	2022-04-07 23:55:00	43461.69141	43493.60156	43440.48047	43469.46094	-50.000000	1088.954647	1027.820526

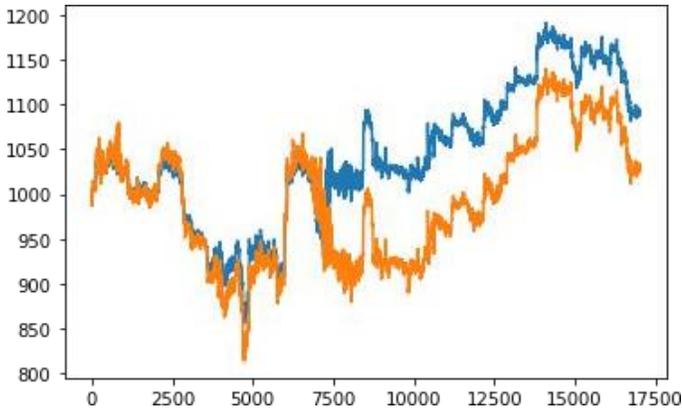Dataset for backtesting of Aroon Oscillator Indicator strategy

Chart of Real-time portfolio value of Aroon bot and Real-time portfolio value of Buy and Hold Strategy.

i) Sharpe ratio: We observe that the Sharpe ratio of the Aroon strategy is more than the buy and hold strategy, and a higher Sharpe ratio is preferred in trading.

> Sharpe ratio for risk-adjusted return of Aroon bot:
> 0.0009739776528093787
> Sharpe ratio for risk-adjusted return of buy and hold:
> 0.0002511307714219586

ii) Daily average return: The daily average return of the bot is also three times more than the buy and hold strategy.

> Daily bot average return:0.1451638096126695%
> Daily bnh average return:0.0466988941601576%

iii) Excess daily return:

> excess daily average return:0.0984649154525119%

iv) Risk analysis:

> Value at Risk :
> In one interval the Aroon Bot will not make a loss of more than: 0.8501057642801957%
> In one day the Aroon Bot will not make a loss of more than: 14.426773215559177%

b) <u>Backtesting Engulfing Pattern Indicator strategy:</u>

	datetime	open	high	low	close	Engulfing	rt_port_value	bh_port_value
0	2022-02-07 00:00:00	42426.89844	42480.32031	42292.85156	42292.85156	0	1000.000000	1000.000000
1	2022-02-07 00:05:00	42360.87109	42360.87109	42293.23047	42305.00000	0	1000.229797	1000.287246
2	2022-02-07 00:10:00	42282.23047	42282.23047	42173.37109	42189.76953	0	998.050129	997.562661
3	2022-02-07 00:15:00	42082.71094	42155.75000	42032.76172	42032.76172	0	995.080212	993.850265
4	2022-02-07 00:20:00	42039.94141	42080.05859	42022.53125	42080.05859	0	995.974866	994.968583
...	...	...	...	...	...	...	...	...
17013	2022-04-07 23:35:00	43637.89062	43637.89062	43589.44922	43608.67188	0	1041.058192	1031.112121
17014	2022-04-07 23:40:00	43611.89062	43613.92969	43557.35938	43557.35938	0	1039.852343	1029.898855
17015	2022-04-07 23:45:00	43564.41016	43589.32031	43550.57812	43555.83984	0	1039.816634	1029.862926
17016	2022-04-07 23:50:00	43555.51172	43571.94141	43465.62891	43497.71094	0	1038.450598	1028.488488
17017	2022-04-07 23:55:00	43461.69141	43493.60156	43440.48047	43469.46094	0	1037.786720	1027.820526

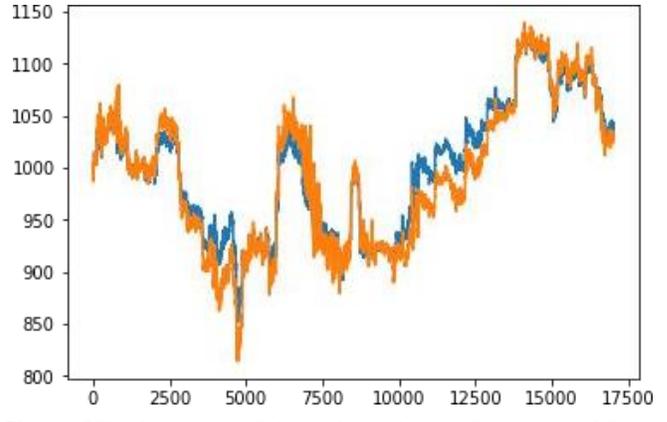Dataset for backtesting of Engulfing Pattern Indicator strategy.

Chart of Real-time portfolio value of engulfing bot and Real-time portfolio value of Buy and Hold Strategy.

i) Sharpe ratio: We observe that the Sharpe ratio of engulfing strategy is more than the buy and hold strategy but is less than the Aroon strategy, and a higher Sharpe ratio is preferred in trading.

> Sharpe ratio for risk-adjusted return of bot:
> 0.0004887776084456008
> Sharpe ratio for risk-adjusted return of buy and hold:
> 0.0002511307714219586

ii) Daily average return:

> Daily bot average return:0.05935502493323863%
> Daily bnh average return:0.0466988941601576%

iii) Excess daily return:

> excess daily average return:0.012656130773081031%

iv) Risk analysis:

> Value at Risk :
> In one interval the Engulfing Bot will not make a loss of more than: 0.6931440154026292%
> In one day the Engulfing Bot will not make a loss of more than: 11.763044007121723%

V. CONCLUSION

Cryptocurrency Trading Bot makes it easier for both new traders as well as established ones in getting profitable outcomes with minimized effort, time, and loss. The integration of Financial Knowledge with the trading bot is a demand for future Trading and enhances both Performance and Revenue.

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