

# Cryptocurrency algorithmic trading with price forecasting analysis using PowerBI

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## Abstract

As an alternate form of trade money, cryptocurrencies are now widely accepted and have been integrated into all financial activities. Trading cryptocurrencies is one of the most well-liked and promising forms of lucrative investing. Financial markets are notorious for their tremendous volatility, regardless. An automation-enabled trading model, accurate and trustworthy predictions, and portfolio management and optimization are necessary because of the considerable volatility and price discrepancies over short periods. A kind of trading called algorithmic trading uses computers to carry out trades in accordance with a trend and a set of rules. Profits may be produced through trade at inhumanly high speeds and frequencies. The software is given a set of trading instructions, which might be based on time, value, quantity, or any other mathematical model. In addition to providing profitable trading opportunities, algorithmic trading increases market fluidity and increases trading accuracy by reducing human elements like human emotions on trade. This work aims to contribute to the impending market revolution by developing an algorithmic trading bot that will exchange client strategies closely accompanied by its own calculations for daily exchanging based on economic conditions and client approaches. It will also contribute and exchange with ongoing adjustments throughout the day to ensure the best tradability.

**Keywords:** Cryptocurrency, bitcoin, ETHUSDT, technical, breakout, watchlist, interface, forecasting, PowerBI, python, binance futures

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## 1. Introduction

Crypto bots are a group of computer programs that automate the entire cryptocurrency trading process. The bots were programmed to perform routine chores more quickly than humans. They acquire trading and market data using established criteria, then trade on your behalf using algorithmic trading algorithms. The ability of crypto bots to make decisions is influenced by price, order volume, and temporal variations. The algorithm can be fine-tuned by users to get the most out of a well-coordinated trading strategy. They're a subset of the large trading ocean, complete with user statistical models and high-performance algorithms.

Algorithmic exchanging is an approach to executing orders utilizing programmed exchanging parameters that will require some investment of time, money, and volume into account. This style of trade exchange, in contrast to human brokers, aims to take advantage of computers' speed and computational skills. Only one in every five investors makes money. Algorithmic trading improves these possibilities by improving method configuration, testing, and execution. A trading bot's USP is that it makes traders' jobs easier and allows them to generate quick money with little effort. Algorithmic trading has become a "must-have" skill in future financial markets. The worldwide algorithmic trade exchange market is supposed to develop from \$11.1 billion in 2019 to \$18.8 billion in 2024, according to industry projections. (Singh *et al.*, 2002).

Between 2018 and 2026, the worldwide algorithmic trading market is predicted to increase dramatically. Our approach intends to accelerate this transition in future markets by giving a realistic and effective solution to the limitations of manual trading. Other advantages of using an automated trading bot include the following:

*One-Click-Trading with Bots:* Traders spend a lot of time studying the latest market movements to avoid getting caught off guard. This isn't great unless bitcoin trading is your full-time job. While your talks are ongoing, you want to be able to handle other critical demands. As a result, trading bots' automation is extremely important. All our trade settings will be in place with just one click. The bot may also keep an eye on the market, spotting favorable entry opportunities and profiting as trades progress. All of this might happen while we're sleeping!

*Bots with Multiple Functions:* We have always wanted to work as a trader on a variety of exchanges, but it's been a challenge. On the one hand, you don't have time to trade across various platforms. On the other side, trading many crypto pairings at the same time is tough. On the other hand, a bitcoin trading bot can easily handle all of this. Trading on many exchanges at the same time is simple for the bot.

*Bots lower the entry barrier:* Because cryptocurrency trading is a difficult industry to grasp, millions of people throughout the world have yet to begin trading it. Cryptocurrencies are a new financial asset market that is challenging to comprehend. Only Buy and Sell orders may be available to the typical bitcoin fan. Technical components such as trend analysis, price action research, and keeping up with the news can all be difficult. Cryptocurrency trading bots solve a lot of these problems by lowering the entrance barriers. Novice crypto traders merely need to duplicate or imitate the techniques utilized by expert traders to make money. Trading has become much easier because of the bot's adaptability and automatic function.

*At its most straightforward:* The software's transparency demonstrates the trustworthiness of cryptocurrency trading bots. Most cryptocurrency trading bots are open source, allowing users to inspect and learn how they work. By setting automatic rules, bots can also assist humans to reduce their chance of being revealed. Keep in mind that because their source code is openly available on the internet, independent trading bots are more transparent.

## 2. Literature Review

We here discuss the few works of writing we read for our paper, as well as our conclusions and understandings. This is significant since we really want to be aware of existing research on the topic we have picked. The prominence of cryptocurrency exchange has soared. There are many research papers, web journals, blogs, and articles to look over, all of which we've broadly reviewed beneath. Early bitcoin studies questioned whether the cryptocurrency was a currency or merely speculative asset, with most writer's side with the latter due to its extreme volatility, excessive short-term gains, and bubble-like price behavior (see e.g., Yermack 2015; Dwyer 2015; Cheung et al. 2015; Cheah and Fry 2015).

Kyriazis (2019) looked at the cryptocurrency market's efficiency and trading possibilities. Ahamad et al. (2013) and Sharma et al. (2017) give a quick summary of cryptocurrencies, their benefits over fiat currency, and a comparison of many cryptocurrencies presented in the literature. Mukhopadhyay et al. (2016) did a comprehensive study of cryptocurrency systems. Merediz-Sola and Bariviera bibliometric analysis and studied the bitcoin literature (2019). While Urquhart (2016) and Bariviera (2017) feel Bitcoin is inefficient, Nadarajah and Chu (2017), as well as Tiwari et al. (2018), do not. However, as Urquhart (2016) and Bariviera (2017) make out, Bitcoin has progressed toward efficiency as the market matured after a brief period of inefficiency. The demand-supply theory is the most utilized premise in the literature to determine Bitcoin's price. According to Blundell-Wignall, bitcoin's value has surged because to "inelastic demand and finite supply" (2014). In analogous research, Kristoufek (2015) employs the wavelength coherent analysis technique to construct a demand variable as a trade exchange ratio. According to the research, pricing influences the trade exchange ratio in the short term but not in the long term. There appears to be no link between the estimated future supply of Bitcoin and its price (Polasik et al. 2015). Viglione (2015) noticed the importance of governance and other related factors in determining the price of Bitcoin, as assessed by consumers' willingness to pay a premium using the Economic Freedom Index.

According to this study, actual interest rates, tax burdens, and investment freedom vary by authority and have a major influence on Bitcoin valuations. Inflation rates and monetary independence across borders, on the other hand, have no impact on Bitcoin values. As Brandvold and colleagues point out, pricing information is typically available from Bitcoin exchanges (2015). As Bitcoin is a digital currency, it requires a different strategy than normal currencies. Ciaian and Rajcaniova examine currency pricing determinants in both traditional and digital currencies (2016). They investigated whether Bitcoin may be used as a means of exchange, a unit of account, or a store of value. They also discussed Bitcoin's pricing strategies which frequently change due

to its desirability, and about the Bitcoin cannot compete with current currencies owing to its hypothetical character. Later, Athey et al. (2016) fostered a model to explore harmony estimating in two situations. At the point when there is not a financial backer, and when one with explicit characteristics is acquainted with the model.

### 3. Profit Maximization & Optimization

Investor preferences are described in terms of risk and profit in the contemporary theory of portfolio selection. It is common knowledge that certain markets see significant changes, such as those in technology, telecommunications, and cryptocurrencies. Therefore, diversification abides with the proverb in portfolio management that you “must not put all of your eggs in one basket.” (Tenkam et al., 2022).

The primary elements of crypto assets are cryptocurrencies or virtual currencies (VC), a sort of unregulated or decentralized digital money developed and often controlled by its developers and utilized and accepted by members of a virtual community. Therefore, if one has some fundamental understanding of their operation, it is simple to enter the cryptocurrency market. VCs differ from other financial instruments in many ways, including their lack of centralized control, (pseudo-) anonymity, difficulty in estimating their value, hybrid nature, which combines elements of traditional financial instruments with intangible assets, and the speed with which their underlying technology is developing.

Swing trading in cryptocurrency is standard among traders of all levels of expertise. The longer time horizons compared to day trading and the volatility of virtual currencies like Bitcoin make strategies appealing. Swing trading techniques are effective in trending markets, such as cryptocurrency, equities, and foreign exchange. The most significant cryptocurrencies for swing trading are Bitcoin, Ethereum, and Tether, especially if you're a beginner since they have the highest market capitalization and are some of the most volatile and actively traded coins.

Successful cryptocurrency swing traders frequently watch short- to medium-term charts using technical analysis to spot daily and weekly patterns. Since economic events can take days or weeks to play out, fundamental analysis is also beneficial. Swing trading is a great learning strategy and is ultimately less complicated than other crypto investment methods. Additionally, there are more advantages:

- **Longer-term strategy:** Unlike other kinds of investing, trades can last days or weeks, so there is no need to spend hours checking positions.
- **Less Intensity:** Because swing trading involves larger time frames and fewer investments per transaction, many traders find it less stressful than day trading. Due to this, it is conceivable to trade part-time while continuing to work full-time employment. Due to the nature of swing trading cryptocurrencies like Bitcoin, volatility is essential. The highly volatile nature of the cryptocurrency market might result in huge rewards. While swing trading cryptocurrency, various strategies can be used; nevertheless, it may take some time for traders to decide which approach they favor the most.
- **Stuck in a Box:** This trading approach uses support and resistance levels to track a market range. The market is considered trapped in a box between the two lines above and below as a result. When the price breaches the support level, the trader waits for a substantial price rejection (a candle that closes above the support level) and then continues to buy on the opening of the next candle.
  - The idea is to effectively close off the position before selling pressure builds up at resistance. We require a thorough comprehension of our daily candlestick chart and support and resistance levels to ensure success with this swing trading cryptocurrency approach. To not endanger limits, we must use our stop-loss and take-profit levels.
- **Catch The Wave:** As the name implies, the goal of this approach is to enter after the retreat has been completed to capture one move in a trending market. Investors spot a trend, such as one with a 50-period moving average and attempt to ride it. Let us say the bitcoin price is getting close to the moving average. In that instance, traders will hold off on going long on the next candle until there has been a bullish price rejection. We should place our take-profit before the market swings high and our stop-loss before the candle low. The markets for stocks and cryptocurrencies are unpredictable, dynamic, and nonlinear. Accurately predicting stock prices is difficult due to several (macro and micro) elements, such as politics, global economic conditions, unforeseen events, a company's financial performance, and others. All of this implies that datasets exist in which to search for trends.
  - Financial experts, researchers, and data scientists are all still looking into analytics technologies to find stock market patterns. It led to the development of algorithmic trading, which employs automated, pre-programmed trading strategies to conduct orders.
- **Time-series data using stock prices & crypto prices:** Although volatile, stock, and crypto values are not made up of random numbers. It can be examined as a succession of discrete-time data or time-series observations made at later moments (usually daily). Stock forecasting can receive help from time series forecasting, which projects future values

using data from the past. We require a method to aggregate this data sequence because of sequential view of time-series data. MA is the most logical strategy out of all those that could be used to smooth out short-term oscillations.

- Algorithmic Trade in cryptocurrencies involves scripting the execution instructions for trading orders. Direct contact with cryptocurrency exchanges is a crucial part of crypto algorithmic trading. Automated trading is far faster and more efficient than manual trading, and algorithms are not affected by emotions.
- **LSTMs for time-series data introduction:** Long Short-Term Memory, or LSTM, is a robust time series algorithm. It can record historical trend patterns and supply precise predictions about future values. Understanding an LSTM model requires understanding the Cell State (Ct), which denotes a cell's innate short- and long-term memories. The core concept of LSTMs is the cell state and its numerous gates. Throughout the sequence chain, the cell state serves as a highway for moving relative information. It is the “memory” of the network.
  - In theory, processing the sequence may provide significant information from the cell state. Because information from earlier time steps may be transferred to later time steps, the effects of short-term memory get reduced. Data is added to or removed from the cell state as it moves through gates. The gates might be instructed to retain or discard some pertinent information during training.

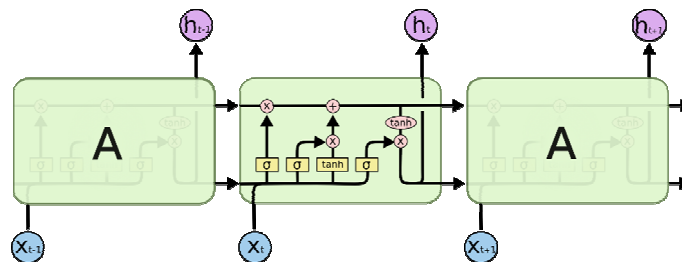


Figure 1. The repeating module in an LSTM contains four interacting layers.

The GRU is a more modern class of recurrent neural networks member and shares many characteristics with an LSTM. GRUs transferred information using the concealed state as opposed to the cell state. It has only two gates: a reset gate and an update gate.

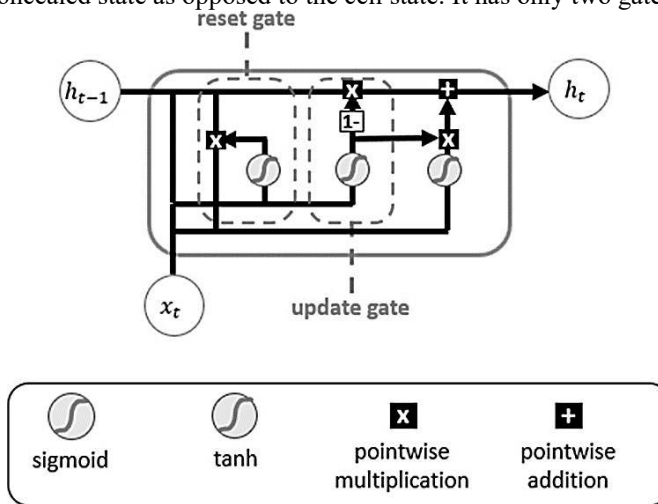


Figure 2. GRU cell and its gates mechanism.

#### 4. Hardware and Software Specifications

It is imperative to know about the system requirements before using our proposed solution of an automated time series trading bot. The specifications are as follows:

- Software :-
  - OS: Windows 10 or higher
  - LANGUAGE: Python and its modules
  - DATABASE: SQLite
  - IDE: PyCharm
  - Data Analytics: PowerBI

- Hardware :-
  - Processor: Dual Core of 2.2 GHz
  - Hard Disc: 201 GB
  - RAM: 4GB
  - Monitor, Keyboard, Mouse, UPS, DVD Writer
  - Active Internet/ Fiber Connection

**Rise of Microsoft Power BI as a Data Analytics powerhouse:** The tech industry is familiar with the brand Microsoft. Microsoft already has a sizable customer base consisting of businesses and individual customers. Everyone is familiar with Word and PowerPoint, which makes it simple to introduce Power BI to the market and locate consumers.

**Artificial intelligence:** Users of Power BI can get text analytics, image recognition, and integration with Azure Machine Learning. Such assistance frequently changes the game.

**Adaptation to a variety of other tools:** Power BI interfaces very effectively with Microsoft and non-Microsoft products, including Spark, Hadoop, Google Analytics, SAP, Salesforce, Office 365, Dynamics 365, and SharePoint. It can therefore be used widely throughout the sector. Therefore, we can conclude that Power BI is a straightforward, user-friendly, cloud-based BI tool that can be utilized to enhance corporate performance. It is particularly well-liked in marketing, sales, analytics, strategy, human resources, operations, and other sectors because it can work with practically all sorts of data ideas in detail.

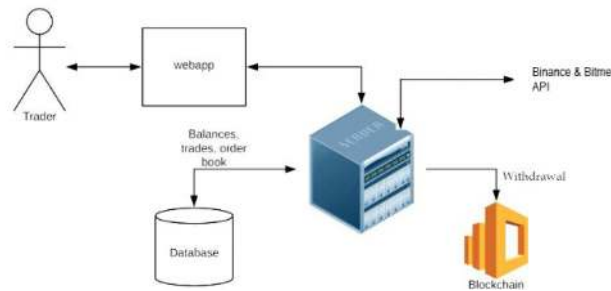


Figure 3. Use Case Diagram - Cryptocurrency Trading

## 5. Implementation

We created a parent Strategy Class using the Hierarchical Inheritance approach, from which two child classes, Technical and Breakout, were created. The child classes will inherit all the common characteristics of the base class as well as some unique ones. Contracts, time periods, take-profit percentages, stop-loss percentages, and balance percentages are all frequent features. Now, because we want to trade as soon as the strategy is enabled, we can try to obtain historical data as soon as the strategy object is created. The data, however, will not be updated in this manner, and we will be unable to request it on a frequent basis. As a result, we've been using the WEBSOCKET stream to keep the candlesticks updated with real-time data from the exchanges (BINANCE and BITMEX).

The data for the trading bot application was extracted through REST & WebSocket APIs by the means of BINANCE Futures & BITMEX Networks.

For our endeavor, we mostly traded using two basic strategies: technical and breakout. These two procedures are among the most extensively utilized and extremely effective on the market. These are tried-and-true tactics that have provided traders with steady profits. Their concise description is as follows:

- **Technical Strategy:** Technique strategy is an exchanging discipline that investigates measurable patterns emerging from exchanging action, like value development and volume, to assess speculations and track down exchanging potential open doors. Technical analysis, in contrast to fundamental analysis, centers around cost and volume. The underlying assumption of technical analysis is that those price movements in the future will follow a particular pattern. To determine how much certain financial assets will cost in the future, it is essential to analyze historical market data.
  - Buy and sell signals may be generated using one or more indicators, such as Moving Average Convergence Divergence (MACD), Relative Strength Index (RSI), and others. Essential investigation plans to assess a security's worth considering business execution like deals and profit.
- **Breakout Strategy:** Breakout trading is a sort of momentum trading in which the trader must quickly join and exit the intraday market. Traders seek to enter the market when the script's price swings outside of a specified price range in this sort of trading (which could be support or resistance). Traders should try to initiate a trade at the peak point, as this is when the breakout is most likely to happen. To make this technique work, traders must be quick and aggressive, as well

as willing to trade in larger volumes. Traders also do not have to wait to see if a deal is viable because it is obvious right away. There are four prices related to a candlestick, and they are as follows:

- **Open Price:-** The initial rate of a given commodity at the start of a trade.
- **Close Price:-** The final price of a given commodity at the end of a trade.
- **High Price:-** The highest value of the commodity during the trading duration.
- **Low Price:-** The lowest value of the commodity during the trading duration.
- **Making Markets:** For securities traded on exchanges, market-making is a market-neutral trading strategy performed to add liquidity. The two essential elements of market makers are the bid-ask spread and transaction volumes.
  - A market maker is a person, professional trading firm, or brokerage firm that is ready to continuously buy or sell shares at a publicly announced price to provide market liquidity.
    - Market makers use a crypto trading algorithm to quote simultaneously on the buy and sell side. Once they take a position, they continue to provide liquidity, but they are usually more active on the opposing side of their holding position.

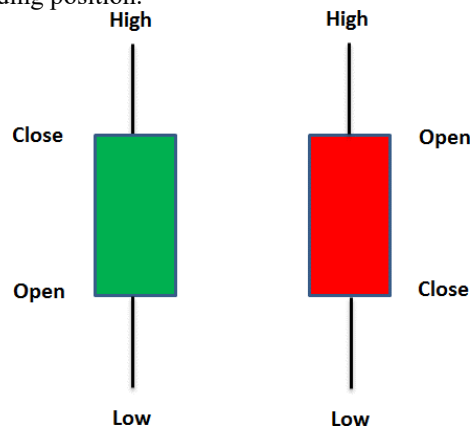


Figure 4. Trading Candlesticks

## 6. Results & Discussion

The suggested approach is based on a Windows PC with Python installed and PyCharm installed as an IDE. To establish the authenticity of the proposed technique, it is put through a set of tests, which are described below. The approach is put to the test with data from Binance and Bitmex that is currently available. Various types of images are used by our system to identify the asset, as shown here:

| Symbol  | Binance  |          | Bitmex   | Status |
|---------|----------|----------|----------|--------|
|         | Exchange | Bid      | Ask      |        |
| BTCUSDT | Binance  | 24605.30 | 24612.70 | X      |
| ETHUSDT | Binance  | 1999.79  | 1999.83  | X      |
| ETHUSDT | Bitmex   | 1997.50  | 1998.65  | X      |
| XBTUSDT | Bitmex   | 24268.5  | 24300.0  | X      |

Figure 5. Watchlist Component – Trading Bot

```
Sat 08:29:35 :: Buy order placed on Binance | Status: new
Sat 08:29:35 :: Long signal on ETHUSDT 1m
Sat 08:29:23 :: Technical strategy on ETHUSDT / 1m started
Sat 08:29:23 :: Breakout strategy on ETHUSDT / 1m started
```

Figure 5. Logging Component – Trading Bot

| Strategy  | Contract        | Timeframe | Balance % | TP % | SL % | Add strategy |    |   |
|-----------|-----------------|-----------|-----------|------|------|--------------|----|---|
| Breakout  | ETHUSDT_Binance | 1m        | 1.0       | 0.1  | 0.1  | Parameters   | ON | X |
| Technical | ETHUSDT_Binance | 1m        | 1.0       | 0.1  | 0.1  | Parameters   | ON | X |

Figure 6. Strategy Component – Trading Bot

| Time         | Symbol  | Exchange        | Strategy  | Side | Quantity | Status | Pnl   |
|--------------|---------|-----------------|-----------|------|----------|--------|-------|
| Aug 13 13:59 | ETHUSDT | Binance_futures | Breakout  | Long | 0.015    | Open   | -0.01 |
| Aug 13 14:01 | ETHUSDT | Binance_futures | Technical | Long | 0.015    | Open   | -0.01 |

Figure 7. Order History Component – Trading Bot



Figure 8. Forecasting Analysis – BTC (PowerBI)

## 7. Conclusion

An algorithmic trading Bot, a new tool for the future financial markets and economy, delivers security, cost, and speed. The Algorithmic Trading Bot can help both new and expert traders achieve good results with minimum effort, time, and risk. Integration of finance and machine learning Futures trading demands education, which improves both performance and profits. The demand for Bitcoin has raised a discussion about Bitcoin’s and other cryptocurrencies’ futures. Since its inception in 2009, Bitcoin’s success has inspired the development of alternative cryptocurrencies such as Ethereum, Litecoin, and Ripple, despite its current problems.

Swing trading in the cryptocurrency market is partly appealing because it requires less time and stress than other types of investing. Novice investors should practice swing trading virtual currency assets on a practice account before investing real money. Once we have mastered the fundamentals, we can start choosing the swing trading crypto methods that will work the best for us.

To be conceded into the standard monetary framework, a digital currency should satisfy different prerequisites. While such a situation is far-fetched, there is little inquiry that Bitcoin’s prosperity or disappointment in adapting to the issues it will stand up to before long will affect the fortunes of other digital forms of money.

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