

# Analysis of Cryptocurrency Using a Genetic Algorithm (GA) †

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**Abstract:** Finance, in particular, is tightly correlated with information-technology development. Digital currency or cryptocurrency is the outcome of the advancement of financial technology. As a means of payment over the internet, digital currencies are beginning to be widely used. This currency was developed in order to facilitate and secure transactions. Transaction fees have decreased as a result of the adoption of blockchain technology. Because it has a negative effect on the financial system, monetary stability, and payment system, government policy forbids transactions involving cryptocurrencies. Understanding of the stochastic and genetic algorithm models used in cryptocurrency is provided by this research. Cryptocurrency is a financial technological advancement that is part of the technological package and it enables banknotes to be replaced in financial transactions. A genetic algorithm (GA) achieved an MSE value of 0.0863 and an MPE of 0.0084 with data on cryptocurrencies. The aim of this research was that, in the future, the government would support cryptocurrency technology so that the laws that are passed preserve the Indonesian market while not forbidding anything outright.

**Keywords:** foreign exchange; trading; genetic algorithm; cryptocurrency



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## 1. Introduction

The first decentralized digital money is generally regarded as being Bitcoin. More than 4000 altcoins—alternative forms of Bitcoin or other cryptocurrencies—have been developed since the creation of Bitcoin. Before cryptocurrency can be delivered to recipients, user software has to retrieve them from banks and specify specific encrypted keys. This makes the digital currency impossible for the issuing bank, the government, or any other third party to track [1].

Cryptocurrency can be more challenging for law enforcement to regulate when owned by financial institutions or as cash.

Numerous people in Indonesia are becoming more familiar with cryptocurrencies. The community is now directly benefiting from one of the blockchain representations and additional potential is still being investigated. Actually, interest in cryptocurrencies as investments did not really pick up until the price of Bitcoin skyrocketed [2].

After that, Bitcoin's value soared. The goal of alt-coins, or non-Bitcoin cryptocurrencies, is typically to close the Bitcoin loophole or provides other methods of mining and transaction processing. The CoinMarketCap website now lists 1568 different varieties of cryptocurrencies. Along with the continuous existence of ICOs (initial coin offerings) held in numerous nations, including Indonesia, this number is still increasing.

Not all cryptocurrencies are well-known; the ten with the biggest market capitalization in March 2021 were not all well-known. Table 1 demonstrates that Bitcoin continues to dominate the cryptocurrency market. Genetic algorithms are able to predict Cryptocurrencies trends and patterns [3].

**Table 1.** The factors that influence the FOREX.

Variable	Mean Square Error (MSE)	Mean Prediction Error (MPE)	Adjusted R Square	Durbin–Watson
Bitcoin (BTC)	0.0850	0.0840	0.8000	1.8600
Ethereum (ETH)	0.0800	0.0790	0.7900	1.8300
Tether (USDT)	0.0840	0.0800	0.8600	1.8400
USD Coin (USDC)	0.0860	0.0790	0.8200	1.7900
Ripple (XRP)	0.0830	0.0800	0.8200	1.8300
Binance USD (BUSD)	0.0810	0.0840	0.8000	1.8500
Doge Coin (DOGE)	0.0800	0.0840	0.8200	1.8600
Cardano (ADA)	0.0810	0.0820	0.8500	1.8500
Polygon (MATIC)	0.0830	0.0820	0.8700	1.8000

Users are now attempting to find other alternatives to buy in or use existing cryptocurrencies since the price of Bitcoin has risen steadily. Several cryptocurrency investors from Indonesia have quite rational justifications for picking altcoins. The circumstances for crypto items are rather close to the ranks above in terms of choice and reliability. Each form of coin, however, aims to provide a particular value. DailySocial attempts to condense each one by using a variety of written and verbal Indonesian sources.

## 2. Research Methods

### 2.1. Cryptocurrency Prediction

The previous research of Cryptocurrencies the Indonesian market understand and become more knowledgeable about cryptocurrency. Ref. [4] This study uses mixed methods in processing and analyzing cryptocurrency data. The difficulty of research using cryptocurrencies is technical and fundamental interpretation. The use of genetic algorithms allows combining fundamental and technical analysis in cryptocurrency. The author uses secondary data for this research. These data are of a public nature and came, among other places, from the publication of scientific papers, research findings, textbooks, and writings from websites. By offering a specific description based on the information systematically gathered by classifying the data that had been gathered for analysis, data analysis used descriptive qualitative methods.

### 2.2. Genetic Algorithm (GA)

The genetic algorithm was first developed by John Holland of New York, United States, and was published in 1975 in his book entitled *Adaption in Natural and Artificial Systems*. The genetic algorithm is a technique for finding optimal solutions to problems that have many solutions. This technique will search from several solutions obtained to get the best solution according to predetermined criteria or what is known as the fitness function. These algorithms are included in the group of evolutionary algorithms using the Darwinian evolutionary approach in fields of biology such as inheritance, natural selection, gene mutation, and recombination (crossover). Because it is an optimal search technique in the field of computer science, these algorithms are also included in the group of metaheuristic algorithms.

Applications of genetic algorithms can be found in various fields, especially fields that require combinatoric solutions such as scheduling, forecasting, shortest distance, and combinations of rations or ingredients. Genetic algorithms are often used to perform simulations with computers to get the best solution based on the visible candidate solutions. The process of finding the best solution begins by representing possible solutions based on the domain, which is usually in the form of binary strings (0 and 1). From this representation the population is formed randomly and this forms a generation. Then, each population that is formed is evaluated using the fitness function to be able to choose the best population. The population is then modified by mutation and recombination to get a new population.

This process is repeated until you get individuals from the population that reach the fitness value [5].

The steps of the genetic algorithm can be described as follows:

1. Maintenance of individual representation of the population;
2. Random selection of individual populations;
3. Evaluate the fitness of each individual in the population based on the fitness function;
4. Choose the individual with the highest match score;
5. The recombination of selected individuals in the population and mutation of individuals with a certain level to form a new population;
6. Process 3 is repeated until the best solution is found (Figure 1).

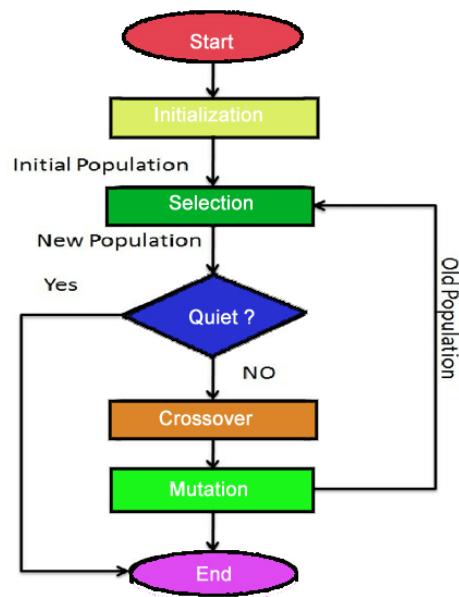


Figure 1. Genetic algorithm flowchart.

Figure 2 shows that the processes in genetic algorithms are evaluation, mutation, crossover, and selection. Evaluation is random selection of parental genes. Selection is done to get good results with the approach that if a good parent is chosen, it will produce good offspring. Crossover is the random exchange of genes from parents to get offspring with better traits. Mutation is the exchange of genes with opposing genes; usually this is used to correct gene weaknesses.

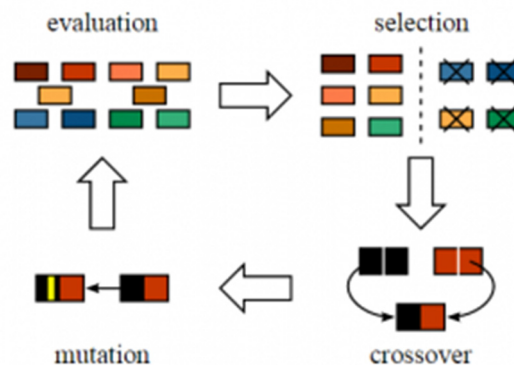


Figure 2. Genetic algorithm (GA) function.

Apart from using the Markov approach, you can use random method such as using the Poisson series [6].

The process carried out in the genetic algorithm is always looking for the best value from the data obtained based on fitness [7].

A genetic algorithm functions in the same way as natural selection in evolution. Only the best, strongest, and fastest individuals will survive. These algorithms have been successfully used to predict a trend whose movements often experience deviations [8].

### 2.3. Cryptocurrency Data

This study uses as the dependent variable, the rupiah exchange rate and the independent variables of cryptocurrency from Coinmarketplace 1990–2022. Use of models based on artificial intelligence, fuzzy logic, or genetic algorithms requires a large amount of data, so the data obtained from 1990–2022 were used as data per day so that as many as 12,000 datasets were obtained. Cryptocurrency data consisted of: Bitcoin (BTC), Ethereum (ETH), Bitcoin Cash (BCH), USDT, USDC, BNB, BUSD, XRP, LINK, and MATIC and were compared with a statistical model and volume (Tables 1 and 2 [9]).

**Table 2.** Crypto volume.

Variable	Crypto Capitalization (\$)
Bitcoin (BTC)	319,183,133,470
Ethereum (ETH)	146,461,358,788
Tether (USDT)	66,243,081,064
USD Coin (USDC)	44,517,474,628
Ripple (XRP)	17,191,461,593
Binance USD (BUSD)	16,722,294,410
Doge Coin (DOGE)	9,094,359,021
Cardano (ADA)	8,467,678,471
Polygon (MATIC)	6,621,808,956

### 3. Results and Discussion

The benefits and drawbacks of Bitcoin can serve as a broad representation of cryptocurrencies. In the development of the global community, where gold and cryptocurrencies can slow the rate of inflation, the fact that Bitcoin is a cryptocurrency with the advantages of a more sophisticated hash rate, rising public confidence, and a sense of security that lowers risk actually helps to reinforce its position as a currency that cannot be readily influenced [10]. However, as a group of people or business entities that accept Bitcoin determine its worth, Bitcoin is speculative (in terms of value). The value will continue to rise the more it is received and then used. On the other hand, the selling price will not drop as much. This procedure is open to the public, and no organization is permitted to guarantee against negligence that results in loss or error throughout the delivery process. Coins are lost because hardware wallets, which are specialized devices for holding private keys, are frequently targeted by viruses and suffer damage from improper maintenance.

Ethereum is identical to Bitcoin but was created particularly as an open smart contract. A smart contract can be executed through blockchain transactions in a variety of ways, such as by delivering data or digital money to the contract’s address. If the smart contract is successfully carried out, it may carry out other transactions or other smart contracts. Developers may utilize the Ethereum Virtual Machine (EVM) software to make a variety of applications just as readily as they can make applications that require cryptographic transactions. Developers do not have to build and manage their own blockchain in accordance with the proposed concept. There are still certain flaws, despite the convenience that the creation process offers. Due to its strong reliance on server dispersion, access speed is unreliable. The construction of Ethereum applications is comparable to renting web hosting; if the server goes down, the functioning system breaks down. Additionally, the developer has not been able to independently enhance the functionality of the blockchain. A hard-fork, in which miners use vastly different protocols, will directly affect the application being created. The amount of Ether (a type of coin) needed for each calculation will vary based on the application’s complexity and user base.

By enhancing some of the processes it uses, Bitcoin Cash (BCH), an improved form of Bitcoin, is able to make the increase in value more steady. Users gain because Bitcoin Cash is regarded as having speedier transactions. In order to make it more attractive, the level of security and protection has also been raised while keeping in mind the design and features. One of the difficulties is the potential for hardware damage. However, because adoption is still not widespread, the underlying problem is what is produced. This indicates that the network stability of Bitcoin Cash has not yet hit “crucial mass,” the minimum critical period necessary for blocks larger than 1 Mb to always be created correctly. Little by little, people have started to arrive. The speculative nature of Bitcoin Cash is further impacted by adoption that is not yet widespread.

One of the cryptocurrencies that the tether corporation claims to have created is called Tether, or USDT, and it has a value of one US dollar per token. Typically, these digital tokens are linked to specific ratios, such as 1:1 in US dollars, Yen, and Euros. The biggest stable token in the world is the USDT tether token. In order to maintain its value relative to other assets and prevent severe price volatility, this tether is categorized as a stable coin, or stablecoin so that it can be utilized as an investment tool that is unaffected by price speculation as well as as a means of trade. One may argue that the development of auditable and cryptographically controlled global blockchain technology is what led to USDT. In transactions involving foreign currencies and assets with somewhat stable prices, participants can benefit from this technology with a concession system. Since they can be used as an asset without requiring a USD bank account, Tether tokens have been officially traded since 2015. USDT has a number of benefits including: (1) value stability (Tether may convert fiat currency into digital currency, with 1 USDT being equal to 1 USD), (2) transparency (ownership of publishing reserves and adherence to expert audits); (3) blockchain technology, which uses emerging technology to guarantee data security and transparency; (4) broad integration, which digitizes fiat currency, which is frequently used as a trading instrument; (5) artificial intelligence; and security (world-class security and international regulatory compliance standards are met when employing decentralized blockchain technology). Additionally, Tether offers traders the ability to purchase and sell in situations where the claim value is equal to the USD value, while also facilitating secure money transfers.

The newest cryptocurrency that benefits from blockchain technology is called Cardano. This decentralized digital currency system aims to create a secure economy and financial system. Additionally, Cardano has a goal of fostering democracy in financial markets, especially in underdeveloped nations. Cardano comes with benefits and helpful features. This blockchain-based digital asset and currency is known as ADA. Thanks to the availability of ADA, investors or shareholders can now send coins to other members, pay bills and for necessities such as goods, store money on the exchange, and submit applications. Like other cryptocurrencies, ADA requires a wallet. A wallet can be used to protect your belongings and the wallet that Cardano offers is called Daedalus. Cardano incorporates networked systems, good design techniques, and cryptography in order to address current demands, so that Cardano becomes the first cryptocurrency built using the Haskell language that ensures investment security.

By establishing stronger custody between them, the Polkadot project seeks to close the gap between the various blockchains. The multi-chain project Polkadot is regarded as one of the most innovative and potentially competitive ventures. It seeks to offer the most cutting-edge and best peer-to-peer network for different blockchains. The Web3 Foundation, based in Switzerland, created Polkadot with the intention of offering a fully functional and user-friendly decentralized platform. The following are the primary characteristics of the Polkadot platform: strong interoperability; joint safety of relay and parachains; a productive, shared network; sophisticated governance procedures; and simple blockchain setup. These all examples of strong interoperability. Following the completion of an ICO in 2017, Polkadot debuted an experimental, unaudited version named “Kusama” in 2019. The Polkadot mainnet was then deployed in May 2020. The original token for

Polkadot was a DOT with the goals of governance through networking, locking, and binding. The token entered the top 10 list of cryptocurrencies in September 2020 as a result of an unexpected increase in market value, and it will hold that ranking until May 2021. Dot, on the other hand, uses the Polkadot blockchain and is not an ERC-20 coin. The Polkadot Foundation's Polkadot (DOT) technical analysis successfully completed an initial coin offering (ICO) in October 2017, raising more than USD 140 million and selling nearly half of its 10,000,000 DOT supplies. In short, "DOT" wants to give users access to several blockchains while ensuring robust cooperation between different blockchains. Projects have a good chance of succeeding, but as was already noted, no project or asset experiences market swings. We hope that after reading the content, you have a clear grasp of the Polkadot project and the potential cost to the DOT.

Ripple (XRP) is used by large companies and institutional investors who buy or invest in this cryptocurrency. This year, XRP increased by nearly 150% and even jumped over 160%. Bitcoin's increase was only 66%, and the performance of XRP was more than double that of Bitcoin. On the other hand, XRP is very cheap. Managed by Ripple Labs, it has decentralized ownership, i.e., Ripple Labs has the power to control the value of XRP so that central banks can exert influence. The exchange rate can be controlled by controlling its supply.

Uniswap is a decentralized exchange that does not rely on a centralized order book or matching engine. It offers fast turnaround times, high trading volumes, and ever-increasing liquidity. However, there is another type of exchange that is growing in popularity—a trustless protocol that does not use intermediaries or custodians. Despite the advantages of blockchain technology, it is difficult to build a DEX that competes with centralized exchanges. Uniswap is one of the pioneers in this field, and its innovation has made it one of the most successful projects in the cryptocurrency market.

Litecoin is a cryptocurrency created in 2011 using open-source software. Mining can be executed using the GPU graphics card. Meanwhile, according to the official Litecoin.org website, Litecoin is a P2P (peer-to-peer) internet currency that allows you to directly pay fees to anyone in the world. Litecoin is an open-source (open for public development) and completely decentralized global payment network without a central authority. Complex mathematical algorithms protect networks and allow people to control their finances.

Chainlink has its own cryptocurrency called LINK. LINK is available on the Ethereum network and can be used to pay fees on Chainlink's own platforms. LINK is also used to buy and sell Chainlink on various exchanges. The average price of LINK relative to the Indonesian rupiah over a short period of time is calculated using an algorithm. The current exchange rate of the rupiah against the Central Bank dollar is used to calculate the Chainlink price in rupiah. The average price of LINK against the dollar today is multiplied by the current exchange rate of the rupiah against the Central Bank dollar. The Chainlink price in dollars (USD) is the average price of LINK calculated for today. The most popular way to convert Chainlink into another currency is through an online Chainlink to a rupiah calculator.

By understanding these types of coins, you can check which ones are available on the exchange you are interested in. For example, Tokocrypto provides information on 34 types of coins, Indodax has information on 110 types of coins, while Zipmex provides information on 15 types of coins. However, you need to be careful in choosing which coins to invest in, because many of the types of coins are not yet popular and their prices can be very volatile. When you are investing in cryptoassets, it is important to choose an exchange where you can make transactions safely. There are thirteen companies in Indonesia that have been approved by the government to trade cryptoassets, and these companies include PT Tokocrypto, PT Upbit, PT Tiga Inti Utama, PT Indodax National Indonesia, PT Pintu Anywhere, PT Zipmex Exchange Indonesia, PT Bursa Cripto Prima, PT Luno Indonesia Ltd, PT Rekeningku Dotcom Indonesia, PT Indonesia Digital Exchange, PT Cipta Koin Digital, PT Trinity Investama Berkat, and PT Plutonext Digital Aset. Before investing in cryptoassets, you need to understand the different types of cryptocurrencies available on

the market. Bitcoin (BTC) is a popular choice, but there are also other cryptocurrencies that are popular, such as Ethereum (ETH), Ripple (XRP), and Tether (USDT).

Cryptocurrencies are different from other investments because they are very risky and can be very volatile. Before trading, it is important to have a plan and be prepared for the risks. You should also focus on technical analysis to understand the market. Figure 3 shows the use of automatic trading and investing based on a genetic algorithm to reduce loss risk. Table 3 shows that the use of a statistical model is important for validating that a genetic algorithm can analyze cryptocurrency data.



Figure 3. Genetic algorithm (GA) function for cryptocurrency.

Table 3. The factors that influence the rupiah-dollar FOREX.

Dependent Variable	Independent Variable	Mean Square Error (MSE)	Mean Prediction Error (MPE)	Adjusted R Square
BTC	ETH, BCH, USDT, USDC, XRP, BUSD, BNB, DOGE, ADA, MATIC	0.0863	0.0084	0.895616

#### 4. Conclusions

Cryptocurrencies are decentralized, meaning they are not controlled by the government or central bank. This means they are resistant to inflation and other economic problems caused by activities carried out by banks or the government. Blockchain technology is still considered the future of cryptocurrencies. There are some risks associated with using cryptocurrencies as most people make decisions based on speculation. However, it is important to educate the Indonesian market about cryptocurrencies so that they have a better understanding of them.

Genetic algorithms (GAs) can be used for the analysis of the movement of cryptocurrencies (BTC, ETH, BCH, USDT, USDC, BUSD, BNB, ADA, LINK, and MATIC). This influence can be seen from the small MSE and MPE values which shows that this model can be analyzed in both the short and long term. The MSE value is used to analyze the movement and to predict long-term Forex information perceptions. This research can give information to the government to protect cryptocurrencies.

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