Examining Artificial Intelligence and Its Role in Digital Currency

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Abstract*— Around the Globe, Digital Currency is a fascinating phenomenon. Whether for short-term gains on cryptocurrency exchanges or long-term gains through asset investments, rapidly rising digital currencies remain a very profitable financial tool. Artificial intelligence, or AI, is another topic that is now getting a lot of interest. This is as a result of the extensive and positive effects; AI has had on numerous industries. The Digital Currency (DC) industry has benefited from artificial intelligence in a number of ways. This study examines the several artificial technologies that are utilized in cryptocurrency to improve performance and benefit investors. An analysis is conducted on a range of academic articles, blogs, websites, and secondary sources. The result demonstrates the importance of market analysis, sentiment analysis, cryptocurrency trading bots (CTB), and other tools for assisting investors in making price predictions and increasing returns. Artificial intelligence branches are a marvel in the cryptocurrency business.

Index Terms- AI, ML, CTB, DC, Cryptocurrency

I. INTRODUCTION

Cryptocurrencies that are only available digitally are known as digital currencies. They may facilitate seamless cross-border transfer and reduce the cost of transaction processing. Despite its recent boom, the sector of Digital Currency is still regarded as innovative. Crypto assets, sometimes referred to as cryptocurrencies, are a class of digital asset designed to operate similarly to currency as a trading instrument (Tredin nick, 2019) [2] [5]. Central banks are no longer needed to regulate the money flow because cryptocurrencies are decentralized. In contrast to other, more reliable financial assets, the price of cryptocurrencies fluctuates drastically. The globe was first exposed to Bitcoin towards the end of 2008. Bitcoin was introduced to the globe [6]. Cryptography is used in decentralized and highly field-dependent money for transactional hashing and signature. All connected computers can view and update the public blockchain ledger where these transactions are kept (Sabry et al., 2020). Cryptocurrency is just one small part of the amazing technological breakthroughs and revolutions of the last ten years [8] [13]. Due of its wide-ranging, beneficial influence on numerous industries, artificial intelligence (AI) is becoming a hot issue as well. Professor John McCarthy described artificial intelligence (AI) as "the science and engineering of constructing intelligent machines, especially intelligent computer programs" in 1956. The blockchain system's characteristics make cryptocurrency data extremely relevant for Big Data analysis. For example, all transaction records for each participant are stored in the decentralized blockchain architecture, and the data are accurate and well-structured, creating a data-intensive environment that is ideal for conducting Big Data analytics (Hassani et al., 2018). The numerous AI techniques utilized in cryptocurrency will be the main topic of this study [15]. On the other hand, the widespread use of virtual currencies presents both new difficulties and chances for AI. These currencies' decentralized and frequently anonymous structure can make financial oversight and regulatory initiatives more difficult. For the sake of both financial stability and technological growth, it is imperative to comprehend how AI can be used to address these issues while maintaining transparency and compliance. [4] The objective of this manuscript is to investigate the intricate correlation between digital currency and artificial intelligence. The use of AI technology to improve the operations of digital currencies will be examined, along with the advantages and disadvantages of this integration and the field's potential for growth in the future [3] [15]. We can better comprehend how artificial intelligence (AI) and digital currencies are influencing the financial industry and the ramifications this will have for different players in the market by examining these components.

II. LITERATURE REVIEW

Artificial Intelligence (AI) and digital money constitute a fast developing topic with important ramifications for technology, economic policy, and financial systems. Artificial Intelligence (AI) is playing a more and more significant role in defining the development, security, and usefulness of digital currencies, including cryptocurrencies and central bank digital currencies (CBDCs). By examining important topics such AI-driven market analysis, fraud detection, algorithmic trading, and the influence on monetary policy, this literature review seeks to summarize recent research on the integration of AI with digital currency.

Hassani et al. (2018) outlined the interactions between two key concepts in a world gone digital: cryptocurrencies and big data. These two subjects represent the state of the art in technical research. This study examines the overlaps between them and all the new advances and applications that have occurred since 2016. Therefore, they sought to offer a thorough analysis of the interaction between Big Data and cryptocurrencies in order to assist academics in identifying research gaps and outlining future studies.

Valencia et al. (2019) advocated forecasting changes in the markets for Bitcoin, Ethereum, Ripple, and Litecoin using common machine learning tools and openly accessible social media data. Using input features from Twitter and market data, we investigate the use of neural networks (NN), support vector machines (SVM), and random forests (RF). The findings showed that machine learning and sentiment analysis may be used to forecast cryptocurrency markets, with NN beating the other models and Twitter data alone being able to predict specific coins.

Sabry et al. (2020) explored how artificial intelligence (AI) techniques can be used to address the issues caused by the daily flood of data generated by the cryptocurrency business, which is too much for one individual to absorb, evaluate, and gain knowledge from. The most recent research in this area was reviewed, and differences in approach and data sets were compared. It also highlighted other areas in need of further research and improvement.

Shahbazi and Byun (2022) added the Hierarchical Risk Parity model and unsupervised machine learning to the bitcoin infrastructure. Formal accounting procedures are related to the inherent risk of bitcoin, encompassing the probability of events and the statement of their economic impact. Two of the most significant risks that need to be considered while working with bitcoin are the unauthorized disclosure of private key information and how frequently they occur. Experts who have transacted with cryptocurrencies for a longer period of time are less likely to lose money and have a shorter learning curve. The Hierarchical Risk Parity's adjusted risk tail yields superior results when it comes to risk management. This finding illustrates the robustness of the proposed model to imbalanced intervals and the covariance window estimate.

Sebastiao and Godinho (2021) The best trading strategies (e.g., support vector machines, random forests, and linear models) were determined when machine learning forecasts for Bitcoin, Ethereum, and Litecoin were assessed for accuracy. First tested in a period of bear markets, the models are then validated during an unusual period of market turbulence to see if the forecasts stay true even when the direction of the market shifts between the validation and test periods. The aforementioned findings bolster the theory that machine learning can effectively investigate the predictability of cryptocurrencies and devise profitable trading tactics inside these markets, even in the face of adverse market conditions.

Choithani et al. (2022) spoke about Current AI studies for Bitcoin and other cryptocurrencies. SVM, ANN, LSTM, GRU, and further AI and ML techniques related to Bitcoin and cryptocurrency have been investigated. Also covered are several areas for future research and strategies for enhancing the outcomes. The main goal of this study is to examine how artificial intelligence has altered our current world. The attraction of artificial intelligence is examined, as well as how it affects employment and what prospects it offers.

OBJECTIVES AND METHODOLOGY

- To give a general introduction to cryptocurrency and artificial intelligence.
- To look at how AI functions in cryptocurrencies and the technologies that make it.

In order to accomplish these goals, secondary data was acquired from other sources. (Books, periodicals, websites, and other electronic information).

III. ARTIFICIAL INTELLIGENCE

Artificial intelligence (AI) has evolved from fictional works to real-world applications due to the increasing

accessibility of computing power. Initially defined in 1956 by John McCarthy, AI focuses on making intelligent machines. Advancements in AI have made it possible to build computers for cognitive tasks, such as task automation, data analysis, pattern recognition, trend forecasting, and autonomous robotic systems. AI research focuses on programming robots to act intelligently, with machine learning being a widely used sub-discipline [2]. AI has become a major focus in various industries, including business, transportation, engineering, education, medical, security monitoring, finance, marketing, economics, the stock market, agriculture, and sports. AI can be used for real-world tasks such as route finding, trip rate estimation, email spam filtering, online shopping, and cancer screening recommendations [8]. Advancements in AI have improved human-robot interactions, changed work routines, and significantly improved people's quality of life. AI systems can become more intelligent through machine learning, allowing machines to self-train and improve at their assigned tasks without human assistance.

Categorization of artificial intelligence

Another criterion for categorizing AI systems could be how sophisticatedly they replicate human intelligence. This section discusses pertinent technologies and real-world applications. We can therefore divide artificial intelligence into theoretical and operational programs. Here are a few instances of diverse AI forms:

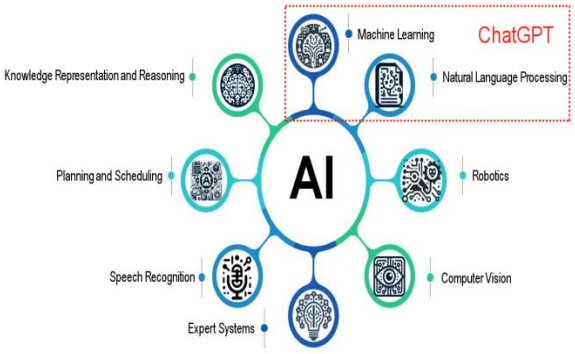
Artificial Narrow Intelligence (ANI) ANI, also known as Weak AI or Narrow AI, is the only type of artificial intelligence that humans can currently feasibly achieve. This kind of artificial intelligence is limited in what it can do and goal-oriented (Das 2021) [5]. Weak artificial intelligence can be found in Siri, Alexa, self-driving cars, Alpha-Go, Sophia the Humanoid, and other systems. Weak AI is present in nearly every AI-based system that has been created to yet.

Artificial General Intelligence (AGI) Artificial general intelligence, or AGI, is also referred to as strong or deep AI. At this moment, the idea that AI may successfully mimic human intellect is simply theoretical. Over time, artificial general intelligence (AGI) has the potential to recognize patterns in its work and so gain greater utility. Deep AI has human-like comprehension and thought processes. Although robust artificial intelligence has advanced significantly, it has not yet fully materialized. To build Strong AI, machines must be capable of awareness and a wide range of cognitive functions (Das 2021) [5]. Though there are currently no examples of Strong AI, there is a general belief that human-level intelligence will soon be attainable in machines.

Artificial Superintelligence (ASI) when computers reach a level of artificial intelligence known as artificial superintelligence, their capabilities will surpass those of humans. Currently, artificial superintelligence (ASI) is a fictionalized world where computers have taken over the human race and the entire planet; it is a concept found only in science fiction literature and movies. The underlying idea behind artificial superintelligence is that computers will eventually be able to understand human intelligence in the context of the present. They would then form their own opinions and values as a result.

Subdisciplines of Artificial Intelligence

The techniques and approaches listed below can help artificial intelligence be used to solve problems that arise in the real world.



World problems. Computers may use machine learning to teach themselves and make judgments on their own because it produces a lot of data. Computers can now make predictions based on past data thanks to this technology. Machine learning techniques and algorithms can be used to train a model, allowing it to be adjusted and refined based on the available data to create predictions. Teaching computers to acquire new information and apply it automatically is the field of research known as machine learning. A few of the advancements made possible by machine learning are voice recognition, internet search, and driverless cars. These three general categories could be used to categorize machine learning.

- Supervised Learning
- Unsupervised Learning

- Reinforcement Learning

Deep Learning uses Neural Networks on high-dimensional data to extract insights and provide solutions. A branch of machine learning called "Deep Learning" holds promise for use in solving trickier problems. In a nutshell, a neural network is a collection of algorithms created to discover fundamental relationships between data sets in a way that is similar to how the human brain works. Therefore, a neural network is just a group of neurons, whether they are artificial or genuine. As a type of artificial neuron, the perceptron can be used to deduce the neural network's entire perceptron model. A mathematical function, like an activation function, functions as a "neuron" in a neural network, gathering and classifying data according to a predefined pattern. The network makes heavy use of regression analysis and other statistical techniques to achieve its objectives. Forecasting and market research are just two of the many uses for these models. Other uses include fraud detection, risk analysis, stock exchange prediction, sales prediction, and many more.

Natural Language Processing It could be comparable to conversing with someone who doesn't speak your language when people try to interact with a computer system. Since computers can only understand binary numbers, words provide a big hurdle. Natural language processing is a branch of computer science that was created to address this problem. This simply means that normal social signs and behaviors are being taught to computers and other automated systems. By converting a human speech from an encounter into text format, a computer can make the voice more readable and understandable for people.

Robotics The research, creation, and manufacturing of robotic machinery is the focus of this fascinating area of artificial intelligence. Robotics is the study of robot design, manufacture, and application that combines technological and scientific ideas. Often, robots are employed to reduce the strain of laborious tasks. These include things like data translation, computer system administration, and car manufacture. NASA utilizes it to send large pieces of equipment into orbit. Robots can also be thought of as intelligent agents that carry out tasks in the real world. In this area of artificial intelligence, incredible progress has been made. A well-known example of artificial intelligence in the field of robotics is Sophia, the humanoid robot.

Expert Systems Often referred to as "expert systems," artificially intelligent (AI) systems examine and model human decision-making processes. Expert systems, in contrast to traditional programming, use logical notations to solve complex issues. In order to monitor hospitals and identify viral infections, the healthcare industry uses it extensively. It is also utilized for loan and investment analysis in the financial industry.

IV. CRYPTOCURRENCY

The key distinctions between cryptocurrency and traditional money are that the former is digital, encrypted, and cannot be printed, while the latter is a useful store of value and a medium of exchange. When most people hear the phrase "cryptocurrency," they immediately think of Bitcoin, the virtual money that was invented by Satoshi Nakamoto in 2008 (Nakamoto 2008). Since 2009, when the first cryptocurrency, known as Bitcoin, went into circulation, it has become widely accepted worldwide. Bitcoin has reached its maximum potential, as evidenced by the fact that the number of coins in circulation is quickly reaching the maximum of 21 million as specified in the Bitcoin Protocol (Hassani et al., 2019) [7] [12]. The cryptocurrency industry is becoming a prominent subject of research due to its astounding growth. Studying trading rule performance, among other things, could provide traders and diversifiers in this emerging financial sector with a wealth of new information. The technology behind digital currencies is called blockchain, an electronic distributed ledger that served as the foundation for the original cryptocurrency and currently supports a wide range of cryptocurrencies. Peer-to-peer networking, distributed data storage and encryption are combined in a study published by the Federal Reserve Board (FED). Among its potential applications, it may change how digital assets are stored, transferred, and recorded. It looks like a stock ledger that several people on a computer network maintain. Blockchain uses cryptography to process and validate entries in a register, or ledger, assuring users that their data is secure and impervious to theft. "Data transformation is at the heart of the mathematical discipline of cryptography, which can be applied to provide a range of security services, such as

non-repudiation, authentication, data integrity, and secrecy. The two essential elements of cryptography are a key and an algorithm, often known as a cryptographic approach. Whereas the key is a transformation parameter, the method is a mathematical function. (2019 Girasa) [6] [11]. The swift growth of the cryptocurrency market makes it more challenging to monitor every purchase, sale, and other transaction that takes place on the several exchanges and blockchains. Artificial intelligence (AI) presents a possible alternative for handling problems with this huge volume of data because human analysts are unable to handle it.

V. AI ROLE IN CRYPTOCURRENCY

A small portion of the technology advancements and upheavals during the past ten years are represented by Bitcoin and other cryptocurrencies. The widespread, positive impacts artificial intelligence (AI) has had on numerous fields have made it a hot issue these days. Artificial intelligence (AI) is the study and use of complex data interpretation and analysis to teach robots how to reason and solve problems like humans. Conversations about cryptocurrencies and artificial intelligence dominated one of the biggest technology conferences in Japan. Cryptocurrency platforms and investors are utilizing artificial intelligence (AI) technologies to enhance decision-making and maximize earnings. Artificial intelligence (AI) has the potential to improve blockchain technology by strengthening its security, optimizing its energy efficiency, and expediting the adoption process, among other aspects. Furthermore, Hassani et al. (2018) [7] [12] note that blockchain might offer publicly accessible data, which is a useful resource for AI processing. This could lead to an increase in AI's need on trust. Conventional financial markets are already full of artificial intelligence applications. An increasing number of hedge funds are utilizing AI technologies to optimize investment returns. Considering the wealth of empirical data available in the stock market, it should come as no surprise that the financial industry uses AI to expedite procedures. Because cryptocurrencies fluctuate so much, trading them is riskier than any other kind of investing, but it also has higher potential benefits. If they do their arithmetic well, traders could be able to support themselves from the daily price fluctuations. It is possible to compute the trends of the quickly changing cryptocurrency market by using artificial intelligence and machine learning algorithms to examine enormous volumes of data [18].

Advantages of integrating virtual currency and Blockchain computing with AI

Billion-dollar stocks and bonds, along with other traditional assets, are already managed by artificial intelligence. Artificial intelligence (AI) and machine learning (ML) technologies are being aggressively implemented in the cryptocurrency market, despite not yet being extensively utilized in the sector.

Implementing Neural Networks- Neural networks are used to better predict the direction of the cryptocurrency market. The system itself calculates, compares, and tracks currency fluctuations. This should be advantageous for the system's integration of both technical and fundamental analysis. This can save a ton of time for novice cryptocurrency traders who haven't had a chance to learn everything. Prognostic systems can manage the majority of market technical analysis with amazing accuracy, despite their inability to forecast the future exactly.

Market Sentiment Analysis- To determine the sentiment of the cryptocurrency market, massive amounts of data must be processed. Anything from an article to a blog post to a forum conversation to the comments section below might be considered one of these. Senno is a blockchain and artificial intelligence platform that does the analysis automatically and provides a quick response. The system's operations also use elements of machine learning.

Finding the Right Broker- One source of conflict in the cryptocurrency sector is the lack of easily accessible capital. Because of their extreme exchange rate volatility, digital currencies are not recommended for use in business transactions. The discrepancy between supply and demand is usually compensated for by high fees from banks and exchanges. The problem is being addressed by machine learning-based systems like Trade Connect. Through its side-matching process, it helps customers identify the bank and broker that best suit their needs, enabling them to do business with them directly for a reduced price.

Utilization of a Virtual Assistant- A few companies are currently developing AI systems to provide services to the cryptocurrency sector. For example, the Money Token team created Amanda, an AI assistant, as a resource for the cryptocurrency sector. As seen from the by loan application to loan repayment, the virtual assistant will be able to offer loans secured by cryptocurrency collateral and manage all associated paperwork.

Using Crypto Bot Securely- Take care who you provide access to your exchange API keys. Such recognition is reserved for trustworthy providers with a proven track record. Keep in mind that your API key grants you access to your account so you may perform operations like trades and withdrawals. The mere fact that a bot requires the API in order to operate does not suggest fraud. Make sure you've done your homework before deciding on a platform. Examine the security mechanisms in place. Access to accounts should always be restricted via two-factor authentication.

Introducing Robotic Trading- Usually, automated trading on stock exchanges is carried out by robots. The speculative behaviors of crypto bots offer several advantages, which have contributed to their widespread usage. The trader does not have to monitor the virtual currency market or carefully consider when to enter and leave trades. Crypto robots eliminate human emotion from the trade of digital assets by automating the process. The majority of novice cryptocurrency traders lose money as a result of their inability to regulate their emotions and thoughts as well as their violations of their own trading plan's guidelines. Trading cryptocurrencies is challenging due to the numerous unknowns. Even the most seasoned traders find it challenging to consistently turn a profit because of human fallibility. As a result, trading bots were created to make automated cryptocurrency trading easier. This was helpful since trading has a higher chance of success when emotional and other human flaws are eliminated.

VI. CRYPTO TRADING BOTS

An automated program created to carry out trades in the cryptocurrency market is known as a crypto trading bot. To put it simply, they are trading algorithms that are meant to produce certain results. The majority of cryptocurrency bot trading platforms offer pre-established trading rules, but you may also alter the behavior of the bots to suit your own demands. For example, you can use a bot to help you with your cryptocurrency trading strategy by telling it to buy a particular coin at a given price and time. Platforms for cryptocurrency bot trading also offer back-testing services, allowing you to test your trading plan on historical data before implementing it. It is much less risky to enter into a business like this. Another important function of cryptocurrency trading bots is that they take human emotion out of the trading process. Any time a trader's emotions get the better of them, if they're not careful, they can make costly mistakes for them. Once more, this is about the psychological effects of traders on the cryptocurrency market.

How Can a Bot Be Utilized?

When it comes to automating bitcoin trading, investors look for the best trading bots and then buy the source code from a developer. The price of the bot you're thinking about might be a bit steep. A bot's hardware and software requirements change based on what it is used for. A trader can fully realize the potential of a bot through efficient utilization. As an example, investors in cryptocurrencies must open trading accounts and deposit their bitcoin holdings on cryptocurrency exchanges. Investing decisions such as when to buy and sell must be made regardless of what transpires. A crypto bot is not an efficient way to make money if you're not prepared to put in the required time and effort.

Most cryptocurrency trading robots have these fundamental characteristics:

Data mining in the Markets this module may save and evaluate market data from several sources to help you decide whether to buy or sell a certain Bitcoin asset. To gather additional data, a lot of robots let users select what information is fed into the signal-generating area.

Economic Forecasting This is an essential part of a bitcoin trading robot. This module, like the previous one, uses market data analysis to assess the degree of risk. This data will be used by the robot to inform its trading and investment decisions.

Asset Purchasing and Disposal this section of the trading bot uses application programming interfaces to buy and sell bitcoins in a calculated manner. Sometimes purchasing tokens in bulk isn't necessary; in other cases, a single purchase will suffice. These are

all problems that the Execution subsystem can solve.

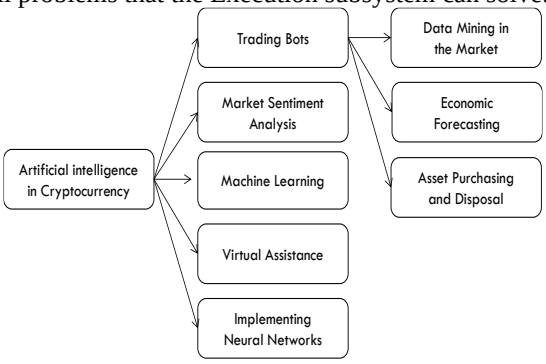


Figure 1: AI in Cryptocurrency

Figure 1 above illustrates the function of AI in cryptocurrencies and the significance of trading bots. Trading bots can be useful for automating deals, but they can also be problematic if a trade doesn't go through as expected. This is because orders are definitive and cannot be changed once they have been given. Because artificial intelligence can resemble human intelligence, analysts and investors have begun using it extensively in high-frequency trading methods. Financially, faster traders typically outperform slower ones. Many investment and hedge funds use high-frequency trading, a type of algorithmic trading in which a computer executes many orders in a split second.

Limits and Opportunities for Further Research in This Study

Although it is still relatively new, the discipline of cryptocurrency analysis has grown over the past ten years. Although this topic is the most studied when it comes to using AI to handle cryptocurrency difficulties, more research could be done on the use of AI approaches for cryptocurrency price forecasts in novel situations. This study examined the role of artificial intelligence in cryptocurrency from the investors' point of view.

CONCLUSION

These days, cryptocurrencies are a fascinating phenomenon. From USD 1.6 billion in 2021 to USD 2.2 billion in 2026, the cryptocurrency market is predicted to grow by 7.1%[16]. Funding from venture capital and distributed or access ledger technologies power the expansion of the cryptocurrency business. Because of Bitcoin's broad acceptance, issues unique to emerging markets have been addressed head-on. With profound effects on people and society as a whole, the field of artificial intelligence (AI) is likewise growing quickly. Though there's no denying that blockchain and artificial intelligence will continue to gain traction and evolve, some have voiced doubts regarding the practical applications of these technologies. Large data sets can be quickly evaluated by artificial intelligence, and it can also predict future trends in the market. This can prove particularly beneficial in the erratic and constantly changing domain of bitcoin trading. Price fluctuations that happen frequently during the day might provide traders with steady earnings. To find trends that AI and learning robots can then exploit, the rapidly growing crypto industry needs to analyze enormous amounts of data. Automating the process of analyzing market data is a straightforward task when using cryptocurrency trading bots. In addition to gathering and analyzing market data and evaluating possible market risk, they are able to buy and sell cryptocurrencies. The crypto business is using AI more and more. In the cryptocurrency space, artificial intelligence (AI) is being used to improve the efficiency of mining hardware, lessen the environmental impact of mining, and analyze market data to determine which coins are most profitable to mine. Another area that AI is being utilized to assist dealers in keeping up with the high speed of technological and societal development is automated dealing in the market for digital currencies such as Bitcoin. The employment of AI algorithms to assess, interpret, classify, and forecast data is more significant for blockchain applications. Digital assets based on artificial intelligence are likewise becoming more and more popular.

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