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# Artificial Intelligence with a Decentralized Approach

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***Abstract:*** Blockchain has always had a part in debates regarding cryptocurrencies and payments. However, blockchain's nonfinancial applications like digital identity management and supply chain management have revealed more of the technology's promise. As multiple blockchain use cases gained attraction, the potential for merging blockchain with AI began to emerge. Blockchain is a distributed digital ledger that is shared across network peers. Transactions that you must add to the blockchain network must be agreed upon by peers or nodes. The network's transactions are stored on blocks with unique hash values and timestamps to ensure their integrity. The word "blockchain" comes from the linking of blocks in the form of a chain. The chain of connected peer-to-peer networks is almost unchangeable and provides the needed data security. Artificial intelligence refers to the ability to simulate human intelligence using computers. The ability of AI to enable technology solutions with cognitive qualities is critical to the blockchain artificial intelligence equation. Artificial intelligence's main purpose is to reduce human errors while also ensuring speedier operations. As a result, it's easy to see how AI and blockchain both strive to speed up operations. Combining the two opens up some intriguing possibilities for increasing blockchain's uses across many industries.

***IndexTerms*** – Blockchain, Cryptocurrencies, Artificial Intelligence, Machine learning, Interoperability, Sybil.

## I. INTRODUCTION

Blockchain and machine learning (ML) have become the two most popular technologies in recent years. The blockchain was specially designed to speed up and simplify the transaction entry process. Since blockchain is a distributed ledger, it can manage almost any type of existing transaction. This means that with this completely decentralized system, any type of asset can be managed transparently [20]. This is the main reason for its growing popularity and power. But there are still many hurdles to overcome, such as security, interoperability (as there will likely be multiple blockchains), and regulation.

The data in the blockchain is not completely safe as the blockchain is vulnerable to a 51% attack [16] or Sybil attack in which the attacker creates a large number of fake identities to gain a disproportionately large influence on the blockchain network [18].

However, by using machine learning to control the chain the security can be significantly increased. One of the potential applications could be a fraud detection tool for the finance and insurance industries.

Today various companies implemented both technologies together some examples are -

1.1. Unilever and Nestlé have used blockchain and ML to help them to maintain their supply chain efficiency to reduce wastage of food.

1.2. IBM with Twiga Foods has integrated this technology to create a microfinancing system for food vendors by determining their credit scores and predicting their creditworthiness.

Blockchain and machine learning are two potential technologies when integrated together could yield ground-breaking results by potentially increasing security and efficiency.

These can be used in fields like -

1. Automation in Manufacturing
2. Food and Logistics
3. Energy and Utilities
4. Finance and Insurance
5. Government Services

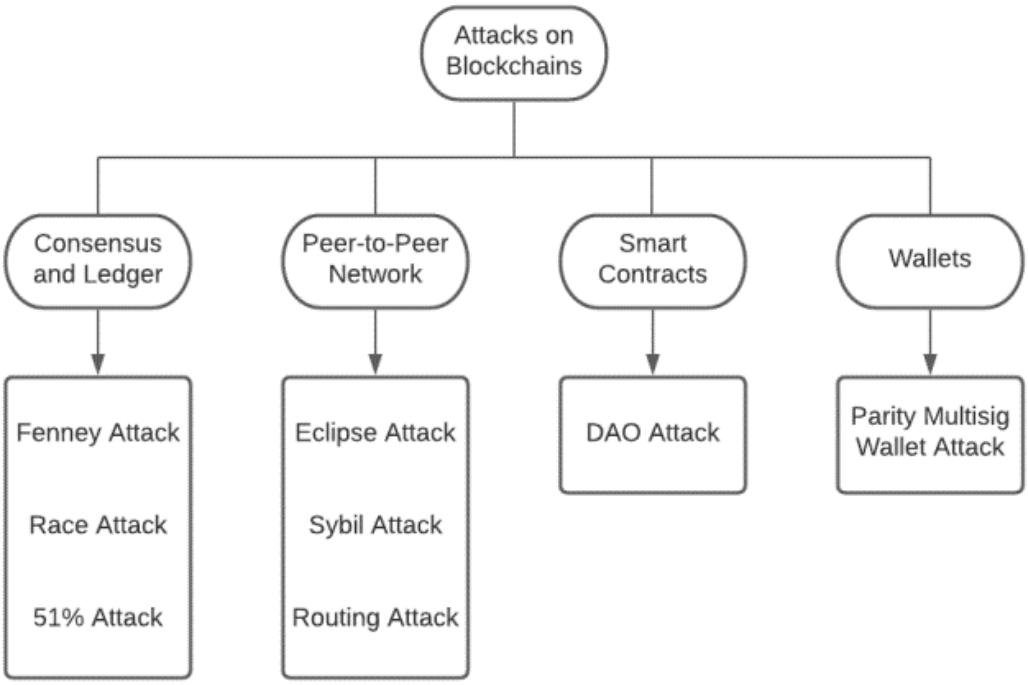
DAI (Distributed Artificial Intelligence), is a decentralized and collaborative approach where a complex problem would be decomposed into sub-problems which would be solved individually similar to a divide-and-conquer algorithm. Each problem could be passed down to each node of the blockchain network to find a solution and smart contracts could be used to reward each node [12].

## II. LITERATURE REVIEW

### 2.1. Blockchain

A blockchain is a distributed database of records, or public ledger, of all transactions, digital events, or smart contracts that have been completed and shared among participants. Blockchain is distributed and immutable providing an unprecedented level of security and integrity of data compared to centralized databases. In recent days many applications have leveraged its advantages, the most prominent being a cryptocurrency. Even with its high level of security and integrity, it is still vulnerable to 51% attack [16] or Sybil attacks [18]; other attacks are shown in Figure 2.1. Furthermore, blockchains can be slow and inefficient leading to slow transactions and high energy consumption.

Table 2.1. Attacks on Blockchain

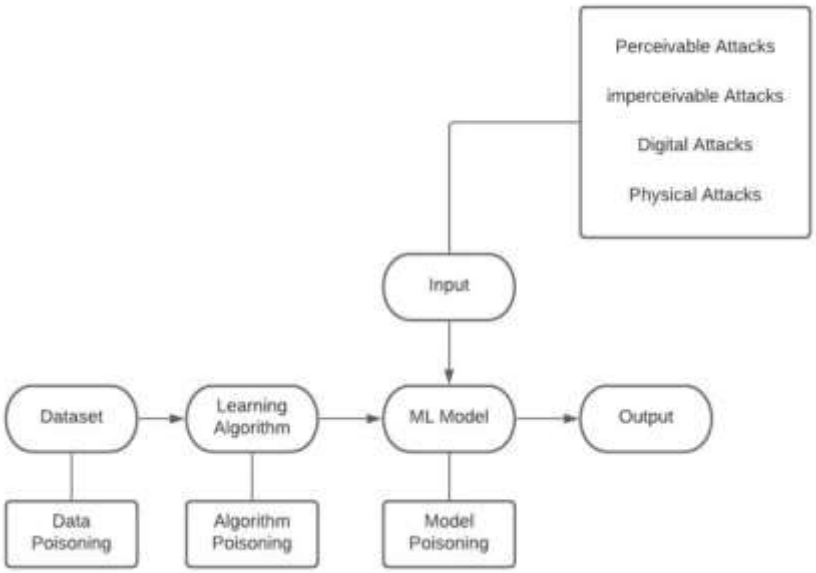



### 2.2. Machine Learning

Machine Learning (ML) is a subspecialty of Artificial Intelligence (AI) where computer algorithms improve themself with experience and by the use of data. Machine learning algorithms use training data to make predictions or decisions. This method has many advantages over traditional programming in which the programmer has to manually program the logic.

Over the years Machine Learning has been used in a wide range of real-world applications such as speech recognition, natural language processing, classification etc.

Table 2.2. Attacks on AI



### 2.3. Combining Machine Learning and Blockchain

Both ML and blockchain are robust technologies that have a vast range of applications but the combination of both technologies could be a game-changer. Blockchain still has disadvantages in terms of security, efficiency, and high energy consumption [21]. This can be overcome by integrating ML and blockchain together. Furthermore, it can be used to build smart blockchains.
Data from various sources can be collected and stored on a blockchain which can then be used for analysis or prediction using ML algorithms. By storing the data on a blockchain network reduces data errors such as duplication, missing data value, errors, and noise. ML models can also be trained with certain parts of the chain rather than the entire dataset helping to develop fraud detection and identity theft detection systems [14].
ML enables real-time analysis for all types of data. It uses in-memory computing but keeps continuously updated data safe. Improves the precision of analysis and accelerates the predictive behavior of ML models. Real-time analytics of information on a huge scale can be accomplished using ML and blockchain frameworks [19].
Figure 2 shows the possible attacks that can affect an AI system using blockchain will help mitigate attacks involving data [15]. Also, DIA (Distributed Artificial Intelligence) can mitigate attacks on the learning algorithm and the ML model [12].

ML and Blockchain can also be used in smart applications such as UAVs, UCAVs, manufacturing, Medical, and Healthcare, Smart Cities, automated Customer Service [13].

DAI (Distributed Artificial Intelligence) could enable sharing of resources to train an ML model. This decentralized and collaborative approach to training ML models could resolve Data privacy issues. Data privacy can be an issue when dealing with sensitive or personal data like genetic and biometric, health records, etc. DAI can help prevent unauthorized and unethical use of data [12].

Microsoft has introduced a Decentralized & Collaborative AI on Blockchain with this new framework contributors can collaboratively and continuously train and maintain models and create data sets on public blockchains to evaluate predictions. According to Microsoft, this framework is ideal for applications in personal assistants, playing games, or using recommendation systems [17].

## III. METHODOLOGY AND EXPERIMENTATION

### 3.1. Blockchain for AI

#### 3.1.1. Data sharing that is secure and a marketplace

The mining nodes keep a copy of the whole ledger, which is made up of chained blocks of all transactions, and they require private keys to access the data.
As a result, it provides a more secure location for keeping sensitive and personal data in a non-disk environment. It fosters data sharing of many components of AI, such as data, algorithms, and computing power, because it provides openness and accountability in data access. As a result, blockchain can create a decentralized and coordinated marketplace platform [11].

#### 3.1.2. Decentralized AI

In a supervised learning program, multiple agents are involved in making high-level decisions, and they all have access to the same training data. When it comes to cybersecurity, separate AI agents work together to provide security across networks and address problems.

#### 3.1.3. AI's explanation

Because all of the data and programming is hidden from view, AI programmes are now known as Blackbox systems. All of AI is predicated on large amounts of data, algorithms, and processing power. As a result, AI's decisions are difficult to comprehend. Every step of data processing, as well as the decision-making process, may be tracked using blockchain. As a result, it could give AI's decisions more certainty and clarity.

#### 3.1.4. Untrustworthy devices should be combined.

Untrusted devices include swarm robotics, the Internet of Things, and cell phones. In this scenario, Blockchain can serve as a coordinating platform where compromise is only possible if maximum profit is realized. This plot might be used for a variety of things, from updating refrigerator software to creating swarm robotics [11].

### 3.2. AI for Blockchain

#### 3.2.1. Boost Security

The term "security" in the context of a blockchain system refers to applications such as smart contracts and data encryption mechanisms.
IDS (intrusion detection system) and IPS (intrusion protection system) are two crucial pieces for monitoring threats in an application. The swarm intelligence technique is used to improve the efficiency of IDS. Artificial intelligence (AI) plays a significant role in cryptographic systems, with applications ranging from cryptography to cryptanalysis to hash functions. AI helps to improve the robustness of blockchain systems by producing more robust cyphers and strengthening the system attack defense mechanism.

#### 3.2.2. Ensure Scalability

Scalability refers to the ability to scale capabilities as the number of users grows. Scalability concerns such as response time, start time, and cost brought forth every confirmed transaction limit the efficiency of the blockchain system. As a result, mining processes are hampered by these difficulties. AI, on the other hand, can determine scalability from decentralized data sources and propose the best solutions for the blockchain system [11].

#### 3.2.3. By optimizing the hash function, you can protect your personal information.

As the volume of private data in the blockchain system grows, data encryption becomes a concern for ensuring user privacy. To solve this challenge, several AI algorithms can be employed to find the secret keys. The bitcoin blockchain system, for example, employs elliptical curves to generate both private and public keys.

#### 3.2.4. Energy consumption has been optimized.

Artificial intelligence (AI) approaches are being used to improve large-scale systems like power system planning and operation.
The nature of blockchain and microeconomics is similar, with different interrelated subsystems and decentralized computation. The intelligent optimization algorithm is the most basic instrument for studying microeconomics. Microeconomics is the study of resource allocation among many uses with the goal of optimizing consumer utility and producer profit. As a result of the large-scale complex system perception, AI can deliver optimum energy use [11].

### 3.3. APPS FOR COLLABORATION

It has grown at an exponential rate in the information era, and the value of data is in its circulation. However, the current data trust system is not ideal, which hinders secure data circulation and has a negative impact on the industry's development. Because of its intrinsic qualities, such as immutability, decentralization, and traceability, blockchain technology can provide new technical mechanisms for data sharing. In general, however, blockchain is only employed as a safe and dependable distributed database in data-sharing applications. The usefulness of blockchain is severely limited due to a lack of data analysis capabilities. As a result, artificial intelligence technology may be utilized to compensate for blockchain's shortcomings while also increasing the value of its applications.

#### 3.3.1. Smart Grid

A smart grid is a component of the energy Internet, in which everyone contributes to the provision of energy. Traditional centralized grid systems cannot be organically coupled with distributed energy trading, which is the current mainstream development trend of smart grids. As a result, smart blockchains' decentralized properties can successfully assist smart grids in making the transition from centralization to distribution. Smart blockchain's decentralization eliminates information barriers and allows for secure data sharing among different participants. Furthermore, smart blockchain technology can help smart grids save money on operations and maintenance.

#### 3.3.2. Vehicles on the Internet

The Internet of Vehicles is becoming increasingly significant in smart mobility as communication technologies advance. Through vehicular connection, the Internet of Vehicles can assist in solving existing traffic and road safety concerns, however, there may be a trust crisis and safety risks in the information transmission process. Smart blockchain can provide trust guarantees, trustworthy data security, and effective reward mechanisms, as well as guide the development of IoV technology. Cars, people, and service providers are all introduced into the network by blockchain.

#### 3.3.3. Supply Chain

Because of its decentralization, high dependability, and immutability, blockchain technology has become a key technical tool for breaking through the development limits of traditional supply chains. Using the blockchain network to publish information data held in a database can enable accurate and speedy sharing and collaboration of logistics data while also successfully resolving the problem of information asymmetry between upstream and downstream firms in the supply chain system. Artificial intelligence technology integrated into a blockchain system has the potential to reshape the supply chain by automating the entire procedure. When the artificial intelligence platform is integrated with the blockchain, it can extract useful information from point-of-sale sales data, historical purchase data, and other sources so that data characteristics can be identified and predictive analysis, such as future demand forecasts, sales model forecasts, path planning, and network management, can be carried out.

#### 3.3.4. Health Care

Health care has entered a period of rapid development as a result of the development of the social economy. However, there are several issues that must be addressed. On the one hand, consumers have high expectations for the protection of personal information and health data; on the other hand, data sharing among medical institutions can lead to more accurate and effective diagnosis and treatment. The difficulties artificial intelligence technologies can then be used to harvest the data's hidden value, allowing for more extensive data analysis. Above can be solved with blockchain technology. The blockchain's immutability makes it ideal for data tracking and anti-counterfeiting while also providing a secure trust mechanism. Secure data sharing is possible with blockchain.

## IV. RESULTS AND DISCUSSIONS

All of the research done on integrating AI with Blockchain takes advantage of many of Blockchain's intrinsic qualities, such as security, traceability, decentralized storage processing, and so on. Certain properties, like consensus and redundancy, have the potential to contribute to futuristic AI systems.

An AI expert system might be created, with consensus among different AI models acting as distinct experts' perspectives in real life. The consensus method can be designed in such a manner that each AI model's viewpoint is taken into account in a unique way when making a final decision.

Consensus can also be used to foster competition between AI models. PoW is one such competition that presents competitors with a cryptographic challenge.

The nature of this puzzle can be altered so that participants must use AI to answer it. Only the smartest, not the fastest, will be able to commit the work using such a consensus procedure.

Redundancy is another significant feature of Blockchain. Each node in the network stores all of the data. If training data is kept in a blockchain, it will be able to train numerous models in parallel on the same data, compare them, and choose the best one. This can help to speed up the AI model creation process.

## V. CONCLUSIONS

Decentralized AI is a hot topic in research and development right now, although practically all efforts in this field are still in the early stages. DApps (Decentralized Applications) and Distributed Ledger Technologies (DLT) have recently emerged and grown in popularity, demonstrating the development towards distributed computing. Inside this present AI paradigm, giant technological corporations are mostly driving AI growth; in light of recent data scandals, data breaches, and data security difficulties, Decentralized AI appears to offer a solid solution for preventing such privacy issues while not impeding AI progress. Contrary to popular assumption, major technological organizations such as Google and Microsoft, in addition to new enterprises and rising startups, are actively studying viable approaches to decentralize AI processes.

Artificial Intelligence's capabilities have the potential to benefit a variety of industries. The intriguing aspect is that both innovative technologies have a lot to offer in terms of mutual improvement. Blockchain, for example, aids in the traceability of Artificial Intelligence algorithms, and AI could increase the transaction speed and resource efficiency of blockchain applications.

## REFERENCES


[1]. T. Marwala and E. Hurwitz, "Introduction to man and machines," in Artificial intelligence and economic theory: skynet in the market, T. Marwala and E. Hurwitz, Eds., ed Gewerbestrasse 11, 6330 Cham, Switzerland: Springer International Publishing AG, ISBN 978-3-319-66103-2, Chapter 1, pp. 1-14, 2017.

[2]. M. Swan, Blockchain: blueprint for a new economy. 1005 Gravenstein Highway North, Sebastopol, CA 95472: O'Reilly Media, Inc., ISBN 978-1-491-92049-7, 2015.

[3]. The Economist, "The DAO: theft is property," The Economist, vol. 419, No. 8995, p. 66, 2016.

[4]. D. Yaga, P. Mell, N. Roby, and K. Scarfone, "Blockchain technology overview, retrieved fromhttps://csrc.nist.gov/CSRC/media/Publications/nistir/8202/draft/documents/nistir8202 -draft.pdf, accessed on 08 February 2018," National Institute of Standards and Technology (NIST), U.S. Department of Commerce, Draft NISTIR 820 2018.

[5]. S. Powers, JavaScript cookbook, 2nd ed. 1005 Gravenstein Highway North, Sebastopol, CA 95472: O'Reilly Media, Inc., ISBN 978-1-491-90188-5, 2015.

[6]. N. Prusty, Building blockchain projects: develop real-time practial DApps using Ethereum and JavaScript. Livery Place, 35 Livery Street, Birmingham, B3 2PB, UK: Packt Publishing Ltd., ISBN 978-1-78712-214-7, 2017.

[7]. S. Ray, Scalable techniques for formal verification. New York Dordrecht Heidelberg London: Springer Science+Business Media, LLC, ISBN 978-1-4419-5997-3, 2010.

[8]. A. Spillner, T. Linz, and H. Schaefer, Software testing foundations: a study guide for the certified tester exam, 4th ed. 802 East Cota St., 3rd Floor, Santa Barbara, CA 93103: Rocky Nook Inc., ISBN 978-1-937538-42-2, 2014.

[9]. W. Afzal, R. Torkar, and R. Feldt, "A systematic review of search-based testing for non-functional system properties," Information and Software Technology, vol. 51, pp. 957-976, 2009.

[10]. S. Ali, L. C. Briand, H. Hemmati, and R. K. Panesar-Walawege, "

[11]. Konstantinos Sgantzos ,Ian Grigg "Artifificial Intelligence Implementations on the Blockchain. Use Cases and Future Applications"

[12]. Gupta, Ishan. (2020). Decentralization of Artificial Intelligence: Analyzing Developments in Decentralized Learning and Distributed AI Networks. 10.13140/RG.2.2.17018.93124.

[13]. S. Tanwar, Q. Bhatia, P. Patel, A. Kumari, P. K. Singh and W. Hong, "Machine Learning Adoption in Blockchain-Based Smart Applications: The Challenges, and a Way Forward," in IEEE Access, vol. 8, pp. 474-488, 2020, doi: 10.1109/ACCESS.2019.2961372.

[14]. Samanta Singhar, Sunil & Jena, Debasish & Sharma, Suraj. (2020). Integrating Machine Learning with Blockchain to Ensure Data Privacy. 10.1109/ICCCNT49239.2020.9225342.

[15]. Shinde, Rucha, Shruti Patil, Ketan Kotecha, and Kirti Ruikar. 2021. "Blockchain for Securing AI Applications and Open Innovations" Journal of Open Innovation: Technology, Market, and Complexity 7, no. 3: 189. https://doi.org/10.3390/joitmc7030189

[16]. Nils Amiet. 2021. Blockchain Vulnerabilities in Practice. Digital Threats: Research and Practice 2, 2, Article 8 (April 2021), 7 pages. DOI:https://doi.org/10.1145/3407230

[17]. Justin D. Harris 2019, Microsoft accessed 18 October 2021,<https://www.microsoft.com/en-us/research/blog/leveraging-blockchain-to-make-machine-learning-models-more-accessible>

[18]. R. John, J. P. Cherian and J. J. Kizhakkethottam, "A survey of techniques to prevent sybil attacks," 2015 International Conference on Soft-Computing and Networks Security (ICSNS), 2015, pp. 1-6, doi: 10.1109/ICSNS.2015.7292385.

[19]. S. Tanwar, Q. Bhatia, P. Patel, A. Kumari, P. K. Singh and W. Hong, "Machine Learning Adoption in Blockchain-Based Smart Applications: The Challenges, and a Way Forward," in IEEE Access, vol. 8, pp. 474-488, 2020, doi: 10.1109/ACCESS.2019.2961372.

[20]. S. Nakamoto, Bitcoin: A Peer-to-Peer Electronic Cash System, 2009.[Online]. Available: https://bitcoin.org/en/bitcoin-paper

[21]. W. Fauvel, "Blockchain Advantages and Disadvantages" [online]. August 2017. Available from: https://medium.com/nudjed/blockchain-advantage-and-disadvantages-e76dfde3bbc0