HIGH SCHOOL EDITION
Journal of Student Research
Volume 12 Issue 4 (2023)

Enhancing Blockchain Technology Platforms: Leveraging Artificial Intelligence for Optimal Support and Efficiency

Anushka Patil[1] and John Hester[2#]

[1]Cupertino High School
[2]Northeastern University
[#]Advisor

ABSTRACT

Recently, the landscape of e-commerce has undergone a remarkable transformation, propelled by a sudden surge in blockchain technology. The traditional era of bank transactions was plagued by technical difficulties, transfer limitations, security breaches, and high transfer fees. However, blockchain technology, which utilizes a decentralized public database for storing and transferring funds via cryptocurrencies, has emerged as a promising solution. This literature review delves into the multifaceted challenges associated with blockchain technology and explores various works addressing these concerns. Additionally, this study investigates the potential of integrating artificial intelligence to tackle the obstacles faced by blockchain technology, paving the way for an even more efficient and secure e-commerce ecosystem.

INTRODUCTION

Blockchain technology has garnered significant attention in recent years due to its various benefits, including resistance to counterfeiting, decentralization, and fortified security through consensus algorithms (GeeksforGeeks 2022). However, this study recognizes the possibility of potential challenges that may arise in the context of blockchain systems. To address these concerns, a comprehensive dataset was created to analyze and categorize the specific issues highlighted across various research papers focused on different aspects of blockchain technology. As with any advancement, challenges are inevitable, ranging from potentially harmful to detrimental. Some of these challenges include invasive measures taken by large organizations targeting DeFi transactions, inefficiencies in expediting transfers, and vulnerabilities to security breaches. Recognizing the prominence of artificial intelligence in diverse fields and its potential to revolutionize numerous industries, this study embarks on a unique perspective by conducting qualitative analysis to explore how AI could complement blockchain technology. Rather than viewing AI merely as a computerized tool, this research delves into the possibility of leveraging AI as an ally to support the strengths of blockchain technology.

METHODS

To ensure a comprehensive and up-to-date dataset, a diverse range of sources were utilized, including PubMed, Brown University Library, and Google Scholar. The search process involved inputting five key terms: AI, Blockchain, Challenges, E-Commerce, and Bitcoin, using both AND and OR operators to find relevant articles. Care was taken to select papers with recent information to ensure the relevance of the study. The collected data included various types of blockchain systems, such as private and public variants. Although there are other types like consortium and hybrid

blockchains, this study focused on two main categories: private and public. To establish an overview in the best way, a “blockchain frontier” was created, borrowing the term from one of the selected papers. This frontier identified the top three most popular blockchain systems and determined whether they were public or private, especially those related to DeFi transactions like Ethereum. From the information gathered on blockchain technology, three primary challenges emerged as the focal points for this research: security breaches, efficiency concerns, and DeFi transaction access. These overarching problems were thoroughly analyzed and addressed in the selected papers. To explore potential solutions, the study delved into the realm of artificial intelligence. Papers on AI were analyzed to identify its capacity to complement and address the identified blockchain challenges.

RESULTS

The research involved a review of three selected papers, with two focusing on issues related to public and private blockchains, and the remaining pertaining to public blockchains. Despite some commonalities in the challenges faced by both types of blockchains, the classification into public and private proved beneficial in facilitating the organization and analysis of the data. Additionally, the data set provides an area for the advantages and disadvantages. These will prove important moving onward due to the solutions being drawn from the disadvantages specifically.

Title	Blockchain Type	Advantages	Disadvantages
The public blockchain ecosystem: An empirical analysis	Public/Private	Bitcoin handles simple payments. Ethereum handles and leads with DeFi transactions and gaming like EOS. TRON leads with data storage and gambling applications while Stellar is the most secure blockchain.	Bitcoin possesses a lack of functionality for users and lacks DeFi transactions, gaming, gambling or data storage. The other blockchain programs in the "blockchain frontier" comprising Bitcoin, TRON, and Ethereum have issues with security and DeFi transactions in general.
Public blockchain evaluation using entropy and TOPSIS	Public/Private	Mentions how major blockchain platforms like Ethereum and Bitcoin have a consensus algorithm called proof of work (POW).	The group of nodes managing the network of shared digital ledgers do not fully trust each other according to this paper. The consensus algorithm needed to approve purchases need hash operations that are performed by the computers in the network to obtain accounting rights which decreases transactions per second and can cause less efficiency.

Title	Blockchain Type	Advantages	Disadvantages
A survey of consensus algorithms in public blockchain systems for cryptocurrencies	Public	Mentions how blockchain in general has great potential and can improve many fields of technology.	How consensus algorithms are time consuming and could use better efficiency. There are also unresponsive bugs in the nodes like crash failure which means nodes will fail to respond due to hardware or software failure, and byzantine failure in which nodes have software bugs and behave maliciously.
Performance Analysis of Private Blockchain Platforms in Varying Workloads	Private	Evaluates hands-on performance levels of newer blockchain platforms. Mentions how lack of third-party aids in the overall efficiency of blockchain.	The implications of certain blockchains are mentioned and there is a rising concern for execution time for certain transactions.
BLOCKBENCH: A Framework for Analyzing Private Blockchains	Private	This paper uses an evaluation framework to analyze the potential benefits of certain blockchains. Finds certain gaps in performance in blockchains.	Talks about the different distribution systems that can seem disadvantageous as certain blockchains harbor hard to split currencies such as sheep.

Based on the data presented in the table, it is evident that the prominent blockchain systems (referred to as the "blockchain frontier") include Bitcoin, TRON, and Ethereum. It should be noted that Ethereum is a private blockchain system since it handles DeFi transactions which are essentially private transactions. The first paper sorts common public blockchain systems into categories based on scale, security, and adoption. The paper coins a term called a "blockchain frontier," which is used to map out which blockchain-based program is best for the user. Knowing this can help scope out the main benefits of some of the most commonly used blockchain cryptocurrencies since evaluating all of them would be unrealistic. Regarding the data set for this paper, the advantages include how there are multiple uses for cryptocurrencies and how each platform is unique. For example, Bitcoin is used for simple payments while other platforms like Ethereum handle DeFi transactions. For the more niche uses of crypto, EOS, and TRON are there to supplement gambling and gaming purposes. As for the disadvantages, Bitcoin is not user-friendly even though it handles simple payments and it lacks DeFi transactions, gaming, gambling and data storage. This is significant because Bitcoin is the largest known cryptocurrency in the world as of now. As for the other crypto platforms on the “blockchain frontier,” collectively, they seem to have issues with security and DeFi transactions in general (Irresberger et al. 2021). The second paper aims to evaluate public blockchains based on how meaningful they are. First-level indicators are used to map out their functionality. From the data, Bitcoin, Ethereum, and EOS are the top three public blockchain platforms. The advantages mentioned in this paper are how major blockchain platforms have a security installation

that does not require centralized authority. Both Bitcoin and Ethereum use Proof of Work (PoW), which is a consensus algorithm that requires all peers on the blockchain network to agree on the present state of the distributed ledger (GeeksforGeeks 2022). Though this has been proven to be a secure method of transferring currency, the article mentions how this method is inefficient due to conflicts such as how the group of nodes controlling the digital ledgers do not trust each other. Moreover, the global nodes have to go through the process of solving complex math puzzles and approving them which can cause a prolonged period of time before the next block can be added to the network on the blockchain (Tang et al. 2018). The last work performs a systematic analysis of the underlying consensus algorithms that govern blockchain technology systems and control security. The advantages mentioned in this paper are how blockchain technology has potential and can revolutionize currency. The disadvantages highlight specific issues regarding consensus algorithms and how there is potential for unresponsive bugs in the nodes to appear creating hardware or software failure, in turn, increasing response time and decreasing efficiency (Ferdous et al. 2021). With data and insights from both blockchain and AI domains, a comparative analysis was conducted. The findings were systematically organized to highlight the strengths, weaknesses, and potential contrasts between blockchain technology and AI solutions, creating a comprehensive understanding of their mutual benefits and possibilities.

DISCUSSION

Among the identified issues, three categories were identified: DeFi transactions, security, and efficiency. These seem to be the main areas of concern when it comes to blockchain technology. To address these issues, three articles on artificial intelligence were analyzed in order to find viable solutions to improve the weaker areas. The first paper tackled the issue of DeFi transactions and how AI is currently in the process of being integrated into DeFi software in order to increase efficiency and security. DeFi transactions are private transactions that allow people to make private payment transfers since it is a decentralized platform such that banks and governments are not involved (Sharma 2023). As technological innovations progress, DeFi transactions are on the rise causing large corporations to want knowledge of this information. The paper discusses how there are experiments and tests being done on how AI programs can be created that combat this issue without the need for centralized power. This will allow maximum confidentiality and no association or opportunity for banks and governments to profit (Sadman et al. 2022). The second paper pertains to the imminent issue of security and how it is violated in many ways in regard to blockchain platforms. Blockchain technology's purpose was to create a decentralized platform with maximum security. However, there are reports of security breaches on blockchain platforms and many researchers are proposing the use of AI. This paper mentions how some studies are detecting fraud behavior, malware, and attacks through new platforms. The paper proposes new algorithms using AI integration to improve security features on blockchain platforms. The convergence of this technology with blockchain can significantly improve the status of security as of now (Ekramifard et al. 1970). The last paper discusses the issue of efficiency and how AI can aid in this area. As previously mentioned, many blockchain technology platforms use consensus algorithms in order to ensure the security of the transactions. One common algorithm is called Proof of Work (POW), which is used in Bitcoin, Ethereum, and many other blockchain platforms. These algorithms are essentially global nodes that have to solve a complex math puzzle in order to create the next hash for the transactions to go through (GeeksforGeeks 2022). This poses an issue due to the inefficiency of this method as security breaches are still possible. This article mentions how scientists are currently working on creating predictive software using AI in order to monitor security rather than keeping the POW system (Xu et al. 2017). Overall, AI has the potential to successfully support these main areas of concern in blockchain technology and hopefully revolutionize currency as we know it.

LIMITATIONS

Some of the key limitations involved in this study were the lack of recent data on blockchain technology as a whole due to its recent uprise. There was a lack of papers discussing blockchain and AI as a unit and how they could potentially aid each other. Due to this predicament, not many papers were compared and contrasted in order to receive adequate results.

REFERENCES

"Consensus Algorithms in Blockchain." *GeeksforGeeks*, 22 Dec. 2022, www.geeksforgeeks.org/consensus-algorithms-in-blockchain/.

Ekramifard, Ala, et al. "A Systematic Literature Review of Integration of Blockchain and Artificial Intelligence." *SpringerLink*, 1 Jan. 1970, link.springer.com/chapter/10.1007/978-3-030-38181-3_8#Sec7.

Ferdous, Md Sadek, et al. "A Survey of Consensus Algorithms in Public Blockchain Systems for Crypto-Currencies." *Journal of Network and Computer Applications*, vol. 182, 2021, p. 103035, https://doi.org/10.1016/j.jnca.2021.103035.

Irresberger, Felix and John, Kose and Mueller, Peter and Saleh, Fahad, The Public Blockchain Ecosystem: An Empirical Analysis (April 18, 2021). NYU Stern School of Business, Available at SSRN: https://ssrn.com/abstract=3592849 or http://dx.doi.org/10.2139/ssrn.3592849

N. N. Y. Vo and G. Xu, "The volatility of Bitcoin returns and its correlation to financial markets," *2017 International Conference on Behavioral, Economic, Socio-cultural Computing (BESC)*, Krakow, Poland, 2017, pp. 1-6, doi: 10.1109/BESC.2017.8256365.

Sadman, Nafiz, et al. "Promise of AI in DeFi, a Systematic Review." *Digital*, vol. 2, no. 1, Mar. 2022, pp. 88–103. *Crossref*, https://doi.org/10.3390/digital2010006.

Sharma, Rakesh. "What Is Decentralized Finance (DEFI) and How Does It Work?" *Investopedia*, 10 Jan. 2023, www.investopedia.com/decentralized-finance-defi-5113835.

Tang Huimin a e, et al. "Public Blockchain Evaluation Using Entropy and Topsis." *Expert Systems with Applications*, 24 Sept. 2018, www.sciencedirect.com/science/article/pii/S0957417418306250.