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Neuravolt: Blockchain-Enabled AI Model Marketplaces for Secure and Transparent AI Asset Trading

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Abstract
Many machine learning models have been developed in a variety of industries, including healthcare, finance, transportation, and e-commerce, as a result of the quick development of artificial intelligence (AI). Through AI model marketplaces, these models are valuable digital assets that can be shared, reused, and made profitable. However, the majority of current AI model marketplaces operate on centralised infrastructures that present a number of difficulties, such as a lack of transparency, theft of intellectual property, unlawful redistribution, and unequal revenue distribution. Once models are uploaded to centralised platforms, developers frequently have little control over how their models are used or accessed. Blockchain technology, which offers decentralised trust, immutability, and transparent transaction management, has recently surfaced as a promising way to overcome these constraints. Building safe and open marketplaces for trading AI models is made possible by combining blockchain technology with decentralised storage systems like the Interplanetary File System (IPFS) and smart contracts. Verifiable ownership, tamper-proof model storage, automated payment settlements, and equitable developer compensation are all made possible by these technologies. This paper provides a thorough analysis of previous studies on decentralised digital asset trading systems and blockchain-enabled AI model marketplaces. The study examines various strategies put forth in current literature with an emphasis on their architecture, security features, scalability issues, and usefulness. Key issues like latency, blockchain transaction costs, storage efficiency, and system complexity are also identified in the review. In order to create scalable, secure, and decentralised AI model marketplaces that encourage openness, justice, and cooperation within the global AI ecosystem, the paper concludes by outlining possible research avenues.

Keywords: *Blockchain, Artificial Intelligence, AI Model Marketplace, Smart Contracts, IPFS, Web3.*

1. Introduction
By facilitating intelligent automation, data-driven decision-making, and sophisticated predictive systems, artificial intelligence (AI) has drastically changed contemporary (LeCun et al., 2015; Jordan & Mitchell, 2015) industries. Platforms that enable effective model sharing, reuse, and monetization are becoming more and more necessary as the number of trained machine learning models keeps rising. Due to their centralized nature, traditional AI model marketplaces present a number of difficulties, including a lack of transparency, a lack of trust, the possibility of intellectual property theft, and an unfair distribution of revenue. Because block chain technology offers decentralization, immutability, and transparent transaction mechanisms, it has emerged (Nakamoto, 2008; Buterin, 2014) as a promising solution to these problems. It allows for controlled access to AI models, secure storage, and verifiable ownership when paired with decentralized storage systems like IPFS. (Shah et al., 2024; Al Jasem et al., 2025) [1]- [3]

2. Related Work
2.1.AI Model Marketplaces and Model Sharing Platforms
With the rapid growth of artificial intelligence across various industries, there is an increasing need for

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platforms that allow easy sharing and reuse of trained machine learning models. AI model marketplaces have emerged as a key solution, enabling developers to publish their models while allowing organizations to access and use them for different applications. Well-known centralized platforms such as TensorFlow Hub, Hugging Face, (Abadi et al., 2016; Wolf et al., 2020). and OpenAI repositories provide large collections of reusable models. Recent studies have also analyzed how such platforms document datasets, bias, and licensing practices (Pepe, 2024). [4]- [8] These platforms help developers distribute their work efficiently and allow researchers to speed up development by using pre-trained models. Despite their advantages, centralized AI marketplaces come with several challenges. Researchers have pointed out issues such as weak intellectual property protection, lack of clear ownership verification, and the risk of unauthorized model redistribution. Recent studies suggest that many centralized repositories do not have strong mechanisms to ensure fair compensation for developers or to prevent misuse of shared models. As AI models become valuable digital assets, these concerns are becoming more significant. To address these limitations, researchers have started exploring decentralized approaches for AI model sharing. For instance, Gupta & Singh (2023) proposed a decentralized machine learning model marketplace based on blockchain technology. Their approach ensures transparent ownership verification and enables secure transactions between developers and users. This work demonstrates how decentralized systems can reduce dependence on centralized platforms while building greater trust among participants.

2.2.Blockchain for Digital Asset Ownership and Intellectual Property Protection

Blockchain technology has gained significant attention (Casino et al., 2019; Zheng et al., 2017) as an effective solution for managing digital assets and protecting intellectual property rights. Its decentralized and immutable nature allows secure storage of transactions, ownership details, and metadata related to digital assets. Because of these features, many researchers have explored the use of blockchain in managing digital content, software assets, and data ownership. For example, Zhang & Chen (2023) proposed a blockchain-based system for intellectual property management of AI models. Their approach records ownership and licensing information on a distributed ledger, making it possible to trace and verify the complete ownership history of a model without depending on any central authority. In a similar direction, Patel et al. (2024) introduced a blockchain powered digital content marketplace where smart contracts are used to automatically handle licensing agreements and revenue sharing among creators. Recent advancements also include multi-agent decentralized AI systems, where autonomous agents interact within blockchain-based ecosystems (Wooldridge et al., 2025; Xu, 2026). One of the key advantages of blockchain is its ability to support transparent and secure payment systems. Using cryptocurrencies and programmable smart contracts, transactions can be executed automatically based on predefined conditions. These smart contracts ensure proper payment distribution, control access to digital assets, and enforce licensing rules. As a result, blockchain-based marketplaces can provide fair compensation to creators while minimizing risks such as fraud or unauthorized use of assets. In addition, recent research has focused on concepts like tokenization and decentralized identity management within digital marketplaces. These approaches allow developers to establish clear and verifiable ownership of their digital assets, while also enabling secure and trustless interactions between participants in a decentralized ecosystem. [9]- [12]

2.3.Decentralized Storage and Secure Data Sharing using IPFS

While blockchain technology provides transparency and immutability, it is not suitable for storing large files like AI models due to its limited storage capacity and high transaction costs. To overcome this limitation, many decentralized systems combine blockchain with distributed storage solutions such as Interplanetary File System. IPFS is a peer-to-peer distributed (Benet, 2014) file system that stores data using cryptographic content identifiers (CIDs). Unlike traditional systems that rely on centralized servers, IPFS distributes files across multiple nodes in the network. This approach improves data availability and makes the system more resistant to failures and censorship. When a file is uploaded to

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IPFS, it is assigned a unique cryptographic hash, which acts as its identifier. Any change to the file results in a different hash, ensuring data integrity and preventing tampering. Rahman et al. (2024) proposed a secure data-sharing framework that combines blockchain with IPFS to achieve both transparency and efficient storage. In their model, the blockchain is used to store metadata, ownership details, and access permissions, while IPFS handles the storage of actual data files. This separation allows the system to maintain security and trust without overloading the blockchain. Similar solutions have been explored in areas such as decentralized content distribution, supply chain management, and digital asset marketplaces. These studies show that integrating blockchain with distributed storage technologies can greatly enhance the security, reliability, and scalability of decentralized applications. Similar blockchain-based AI integrations have also been explored in domains such as construction and industrial systems (Automation in Construction Research Group, 2024).

2.4.Insights and Limitations Identified Across Literature

The reviewed studies highlight both the potential and the challenges of using blockchain in AI model marketplaces. Overall, they show that while blockchain introduces important improvements in trust, security, and transparency, there are still practical limitations that need to be addressed. [13]

2.4.1. Strengths

The literature consistently emphasizes several key advantages of blockchain-based AI marketplaces. One of the most important benefits is decentralized ownership verification, which allows developers to prove and protect their model ownership without relying on a central authority. Additionally, blockchain ensures that all transactions are transparent and tamper-proof, increasing accountability within the system. Another major strength is the use of smart contracts, which automate payment processes and licensing agreements. This not only reduces manual intervention but also ensures fair and timely compensation for developers. Furthermore, these systems improve intellectual property protection and help build trust between buyers and sellers in AI marketplaces. Decentralized data marketplaces such as D2M further explore privacy-preserving and incentive-compatible data sharing for collaborative AI systems (Srivastava et al., 2025).

2.4.2. Limitations

Despite these benefits, the studies also identify several challenges. Public blockchain platforms often involve high transaction costs, which can limit their practicality for frequent interactions. There is also latency introduced by consensus mechanisms, which can slow down transaction processing. Scalability remains another major concern, especially when dealing with large numbers of users and AI models. Integrating blockchain with AI systems can also be complex, requiring additional technical expertise and infrastructure. Moreover, storing large AI model files efficiently is still a challenge, even when using complementary technologies like distributed storage systems. [14]

2.4.3. Conclusion from Literature

These observations suggest that while blockchain-based AI marketplaces offer a strong foundation for secure and transparent model trading, they are not yet fully optimized for large-scale adoption. Future research should focus on improving scalability, reducing costs, and designing more efficient system architectures that can support a growing number of users and increasingly complex AI models.

3. Review Methodology/Analysis

3.1.Literature Selection Criteria

The literature used in this review was collected **(**Zheng et al., 2017). from well-known and reliable research databases such as IEEE Xplore, Springer Link, Elsevier Science Direct, ACM Digital Library, and Google Scholar. Preference was given to peer-reviewed journal articles, conference papers, and survey studies published in recent years to ensure that the review reflects current trends and advancements in blockchain technology and AI marketplaces. The selection process mainly focused on research papers related to key areas such as AI model marketplaces, decentralized storage systems like IPFS, smart contract-based platforms, and secure data sharing with ownership verification. These areas are directly connected to the concept of decentralized AI model

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trading. Papers were shortlisted based on their relevance to the topic, clarity of methodology, system architecture, and real-world applicability. In addition, studies discussing important aspects such as blockchain scalability, digital asset ownership, and decentralized application development were also included to provide a broader and more comprehensive understanding of the subject. [15]

3.2.Review Framework

To ensure a structured and comprehensive review, the selected studies were analyzed using a set of well-defined evaluation parameters. These parameters were chosen to highlight the key features of decentralized AI marketplaces and the technologies that support them. The evaluation mainly focused on several important aspects. First, the system architecture was examined to understand whether a solution follows a centralized, federated, or decentralized approach. Next, security mechanisms were analyzed, including how each system ensures data integrity, verifies ownership, and secures transactions. Another important factor was the storage mechanism, which looks at whether the system relies on traditional centralized servers or uses distributed storage solutions such as InterPlanetary File System. The review also considered transparency and trust, particularly the ability of systems to provide verifiable and tamper-proof transactions. Finally, scalability was evaluated to determine how well these architectures can handle a large number of users and AI models in real-world scenarios. The analysis was carried out using both qualitative and conceptual approaches to identify common patterns, strengths, and limitations across different studies. This framework allowed for a clear and structured comparison between traditional AI marketplaces and blockchain-based decentralized marketplaces. [16]

3.3.Classification of Approaches

The reviewed literature can be grouped into different categories based on the technologies used for AI model sharing and digital asset management. The first category includes centralized AI model marketplaces, where a single platform is responsible for managing storage, transactions, and access control. While these systems are easy to use and widely adopted, they often lack transparency and provide limited protection for intellectual property. The second category consists of blockchain-based digital asset marketplaces. As Shown in Table 1.

Table 1 Comparative summary table of Centralized Marketplace and Decentralized Marketplace

Dimension	Centralised Marketplace(CM)	Decentralised Marketplace(DM)
Ownership Control	Platform controlled	Developer controlled
Transparency	Limited	High
Security	Moderate	High (Immutable Ledger)
Payment Mechanism	Platform managed	Smart contract based
Intellectual Property Protection	Limited	Strong
Data Integrity	Moderate	Tamper-proof
Trust Model	Centralized authority	Decentralized trust
Scalability	High	Medium (blockchain dependent)
Transaction Transparency	Low	High

These platforms use blockchain technology to enable decentralized ownership verification and maintain transparent, tamper-proof transaction records through smart contracts. This approach improves trust and accountability compared to centralized systems. The third category focuses on decentralized storage solutions, such as InterPlanetary File System. These systems are designed to store large files in a distributed manner, ensuring better data availability, security, and integrity without relying on centralized servers.

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3.4.Analysis Strategy

To better understand the different approaches, a comparative analysis was carried out across all identified categories. Each study was carefully examined based on key factors such as system design, implementation approach, security mechanisms, and overall operational efficiency. The analysis also focused on identifying common challenges highlighted in the literature. These include issues like scalability limitations, high transaction overhead in blockchain systems, and the complexity involved in integrating artificial intelligence with decentralized infrastructures. By considering both the strengths and limitations of existing solutions, this review provides a clearer understanding of the current state of decentralized AI marketplaces. It also helps in identifying important research gaps and potential areas for future improvement, especially in building more scalable, efficient, and practical systems. [17]

4. Comparative Discussion

Research on AI model marketplaces and decentralized digital asset platforms typically evaluates systems using several key dimensions. These dimensions help in comparing blockchain-based marketplaces with traditional centralized platforms and in understanding their practical benefits and limitations.

4.1.Ownership and Intellectual Property Protection

In centralized AI marketplaces, developers depend on the platform provider to manage ownership records and licensing. This dependency can create risks such as intellectual property theft or unauthorized redistribution of models. [18] In contrast, blockchain-based marketplaces store ownership information on an immutable ledger, allowing developers to maintain clear and verifiable proof of ownership without relying on a central authority.

4.2.Trust and Transparency

Centralized platforms often lack transparency in how transactions are processed or how revenue is shared. Blockchain technology addresses this issue by providing transparent and publicly verifiable transaction records. Additionally, smart contracts automate agreements between buyers and sellers, reducing the need for intermediaries and increasing overall trust in the system.

4.3.Security and Data Integrity

Traditional AI marketplaces typically use centralized databases, which may be vulnerable to data breaches or unauthorized modifications. Blockchain systems, on the other hand, use cryptographic techniques and immutable records to ensure that data cannot be altered without detection, thereby improving security and maintaining data integrity.

4.4.Payment and Revenue Distribution

In many centralized systems, the platform controls payment processing and often charges high service fees. Blockchain-enabled marketplaces use smart contracts to automate payments directly between buyers and developers. This approach ensures faster, fairer, and more transparent revenue distribution.

4.5.Scalability and Performance

While blockchain offers strong advantages in terms of security and transparency, it also introduces challenges. Consensus mechanisms and transaction validation processes can add computational overhead, which may affect system performance. As a result, scalability remains a key concern for large-scale decentralized marketplaces. These observations are consistent with prior studies on blockchain systems and decentralized applications (Casino et al., 2019; Zyskind et al., 2015). [19]

Conclusion

The rapid advancement of artificial intelligence accelerate innovation across different domains (Jordan & Mitchell, 2015) that has led to a growing need for platforms that support efficient sharing, distribution, and monetization of machine learning models. AI model marketplaces have emerged as important ecosystems where developers and organizations can exchange trained models and accelerate innovation across different domains. However, most existing marketplaces are built on centralized infrastructures, which often result in issues such as limited transparency, reduced trust among users, risks of intellectual property misuse, and unfair revenue distribution. To overcome these challenges, blockchain technology has gained attention as a promising solution. Its decentralized nature, along with features like immutable transaction records and smart contract automation, enables more secure and transparent systems. When

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combined with decentralized storage solutions such as InterPlanetary File System, these systems can efficiently store large AI models while ensuring data integrity and availability. Such architectures allow developers to retain control over their models, while users can access verified and trustworthy assets in a secure environment. This review examined existing research on AI model marketplaces, blockchain-based digital asset systems, decentralized storage technologies, and integrated blockchain-AI frameworks. The analysis shows that decentralized marketplaces offer several advantages, including improved transparency, stronger intellectual property protection, automated and fair revenue distribution, and increased trust between participants. At the same time, it also highlights important challenges that limit real-world adoption, such as scalability issues, high transaction costs on public blockchains, delays caused by consensus mechanisms, and the complexity of integrating AI systems with decentralized technologies. Looking ahead, future research should focus on building more scalable and efficient blockchain architectures that can support large-scale AI marketplaces. Hybrid approaches that combine off-chain processing with on-chain verification could help reduce transaction overhead while still maintaining security and transparency. In addition, privacy-enhancing techniques like secure multi-party computation, differential privacy, and homomorphic encryption have the potential to further protect sensitive data associated with AI models. Another important direction is the development of standardized frameworks that ensure interoperability between different blockchain networks and AI platforms. Enhancing governance models, introducing developer reputation systems, and using token-based incentives could also improve participation and trust within decentralized ecosystems. Overall, blockchain-enabled AI model marketplaces represent a strong step toward creating secure, transparent, and decentralized infrastructures for AI model sharing. With continued research and technological advancements, these systems have the potential to overcome current limitations and achieve widespread adoption in the future. Achieve widespread adoption in the future (Zyskind et al., 2015; Xu et al., 2019).

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