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Securing and Optimizing Blockchain Performance in Financial Services Using Artificial Intelligence and Deep Learning

Hodjat. Hamidi[1], Farhad. Fathi[2*], Shahriar. Mohammadi[3]

[1] Associate Professor, IT Group - Faculty of Industrial Engineering, K.N. Toosi University of Technology, Tehran, Iran
[2] PhD Student, IT Group - Faculty of Industrial Engineering, K.N. Toosi University of Technology, Tehran, Iran
[3] Associate Professor, IT Group - Faculty of Industrial Engineering, K.N. Toosi University of Technology, Tehran, Iran

*** Corresponding author email address**: h_hamidi@kntu.ac.ir

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A B S T R A C T

Advancements in artificial intelligence (AI) and deep learning (DL) have transformed how we interact with money and finance. AI plays a key role in predictive analytics, machine learning, and automating financial transactions. By integrating AI, financial institutions can analyze data, assess risks, make real-time decisions, streamline processes, and improve efficiency. Meanwhile, blockchain—a decentralized, tamper-resistant ledger—has brought about a significant shift in financial transactions. Its ability to create an unalterable record ensures data integrity, providing unmatched security. This makes blockchain a powerful tool for strengthening financial systems against cyber threats and fraud. This research primarily examines the impacts of AI and DL on financial services. Integrating AI with blockchain enhances fraud detection, risk management, and early identification of potential threats, ensuring greater protection for financial institutions and their customers. Today, the adoption of these technologies has been widely embraced, leading to a new era of innovation in the financial sector. Their combined use not only addresses existing challenges but also opens the door to more efficient and innovative financial ecosystems. In conclusion, combining AI with blockchain technology offers significant potential for improving security within financial services.

Keywords: *Blockchain, Artificial Intelligence, Deep Learning, Security, Financial service.*

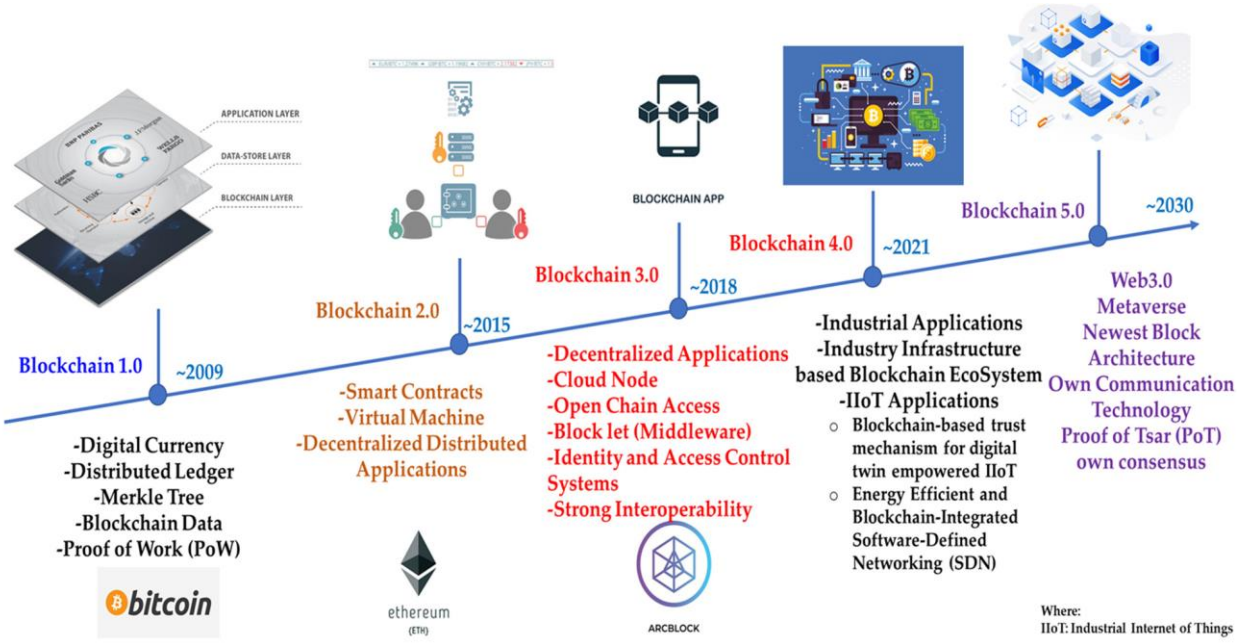
1. Introduction

In recent years, Artificial Intelligence (AI) has seen remarkable advancements, significantly influencing both academic and industrial sectors. Machine Learning (ML) algorithms, especially Deep Learning (DL) models, have demonstrated outstanding results in a variety of tasks when adequate data is available. As a result, these technologies have become integral to many everyday applications. At the same time, Blockchain Technology has risen in popularity due to its benefits such as decentralization, transparency, and immutability, which make it ideal for secure data storage (Ressi et al., 2024). Blockchain is a digital record system that securely stores financial transactions and some other data in a chain of

encrypted blocks (Adisa, 2024). This makes it possible to carry out transactions without an intermediary (Ahmed, 2024; Zhang & Huang, 2021). This technology was first introduced in 2008 by a person or group with the pseudonym Satoshi Nakamoto as the main author of the Bitcoin White Paper. Each block contains a hash code to verify the validity of the data in it and is automatically encrypted (Nakamoto, 2008). Figure 1 shows the evolution of blockchain technology from 2009 to this year, as well as the forecast until 2030. The first generation started mostly in the field of digital currency and blockchain network structure and the introduction of Bitcoin digital currency. Then, in the second generation, smart contracts were introduced along with decentralized applications. In this generation, Ethereum digital currency was introduced to perform smart contracts. which led to the emergence of a new world in digital currencies. It emerged in the third generation where decentralized applications for enterprise blockchain and identification and access control system for accessing the blockchain network emerged. The fourth generation has focused on the ability to interact and cooperate between organizations and use blockchain technology for inter-organizational interaction in order to facilitate inter-organizational communication and use blockchain technology to maintain cooperative organizations. And finally, the fifth generation, which is predicted as the future of blockchain technology for the coming years, has been raised in the field of metaverse, Web3.0 and the Internet of everything, which is expected to be in the coming years due to the progress made in this field. It is important that it be realized soon.

Figure 1

*Revolution from Blockchain 1.0 up to Blockchain 5.0 (*Shafay et al., 2023*)*



Many methods have been implemented to implement blockchain technology. Two of the most common implementation methods are public and private models. Both methods are implemented in a decentralized manner. with the difference that the public method is for public use and authentication is not required for access, but in the private blockchain, which is generally used to record and store the organization's data, people can connect to it after authentication and the data record and store in it (Shafay et al., 2023). Blockchain stores information in a way that makes it very difficult for hackers to change, manipulate or delete data. By design, blockchain technology is an overlapping network based on a peer-to-peer architecture for storing and processing transactions and data. Each block in the chain stores a set of transactions, ensuring that existing blocks are correctly linked to the newly created block. After a miner adds a block to its local chain, the newly added block is broadcast to all participating nodes to ensure data consistency. In the blockchain network, groups of miners are used to verify blockchain transactions. For example, Proof of Work and Proof of Stake are consensus protocols implemented by many blockchain platforms such as Bitcoin and Ethereum. One of the important capabilities of the blockchain network introduced in the second generation is smart contracts, which are another important feature of blockchain

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technology and are only implemented when predetermined criteria are met. Smart contracts aim to reduce the risk and cost of businesses. These features and key features of blockchain technology such as data immutability, smart contracts, consensus algorithms and decentralization help improve business effectiveness (Shafay et al., 2023). Artificial intelligence learning strategies are shown in Table 1 Each AI learning strategy has its own unique advantages and challenges that make them suitable for different types of tasks and data scenarios. The choice of strategy often depends on the specific needs of the project, including the availability of labeled data, the complexity of the task, and the desired results (Hussain & Al-Turjman, 2021).

Table 1

Comparison of AI Learning Strategies

Areas	Supervised Learning	Unsupervised Learning	Reinforcement Learning	Deep Learning	Natural Learning
Definition	It learns by utilizing labeled data.	It is trained on unlabeled data.	performing actions and leaning from the rewards or errors.	learn by imitating human brain.	interactions between computer and human languages.
Problem type	Classification and regression.	Clustering and association.	Based on rewards.	Based on rewards.	Based on understanding.
Data type	Labeled data.	Unlabeled data.	Absent of predefined data.	Large data.	Language data.
Training	External supervision.	No supervision.	No supervision.	Supervision.	Supervision.
Approach	Inputs being labeled are mapped to the known output.	Patterns are being understood and output is discovered.	Trial and error are being implemented.	A network in which artificial neurons are stacked at least several layers deep.	A mechanism where language can be fed to inanimate objects like computers.
Operation	ML.	ML.	ML.	Language.	Language.
Exploration	No exploration.	No exploration.	Adapts through exploration.	Adapts through exploration.	No exploration.
Strategy	Learning algorithm and data-dependent.	Classification and data-dependent.	Learns from.	Learns from experience from large data.	It understands language.

Today, artificial intelligence plays a crucial and indispensable role in financial services. This technology allows banks to leverage both human and machine capabilities to enhance operational efficiency, reduce costs, and deliver improved services. As AI becomes more integrated into the industry, banking leaders are actively striving to capitalize on these advantages. Additionally, AI has the ability to forecast future scenarios by analyzing historical behaviors. Some key features of artificial intelligence include the following (Choithani et al., 2022; Rane et al., 2023):

1- Successful Decision Making: These systems mimic expert human judgment, enabling bankers to offer superior solutions based on readily available information for tactical decision-making. The new data generated is then recorded and stored in a repository known as a knowledge database.

2- Enhanced Customer Understanding: AI develops a deeper understanding of customers and their behaviors by analyzing past interactions. This allows banks to offer personalized services and transparent interactions, fostering valuable customer engagement and building strong, long-lasting relationships. By combining these insights, banks can generate financial growth and improve customer satisfaction.

3- Direct Communication: Chatbots can identify situations and emotions in messages, responding in a logical manner. These intelligent tools not only allow banks to save time and enhance efficiency but also contribute to significant cost savings, ultimately resulting in substantial financial benefits.

4- Fraud Management: AI can detect suspicious data patterns within large datasets, enabling effective fraud management. By conducting advanced analyses, AI has been able to predict future behaviors of data points, assisting banks in increasing sales and enhancing cross-selling efforts.

5- Automated Process Adjustment: This feature enables the automatic adjustment of various costly and error-prone banking services, securing return on investment (ROI) and reducing costs. It ensures accurate and swift service processing at every stage. Through coherent procedural self-regulation, a series of functions are automated, continuously refining their performance through machine learning.

6- Attractive Interest Rate Determination: Artificial intelligence in banking enables customers to select loans with

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appealing interest rates. Banks can now leverage machine-driven mechanisms to analyze data and offer competitive rates tailored to individual needs.

The combination of AI and blockchain has attracted considerable attention recently, as integrating AI into blockchain-based systems offers numerous advantages, including improved security, optimization, and efficiency (Ressi et al., 2024). In the area of security, merging blockchain with ML has the potential to create innovative and dependable solutions (Figure 2). ML algorithms can enhance the security of blockchain networks by identifying patterns of fraudulent activities in financial transactions. They can also be employed to validate user identities through biometric data. Additionally, ML can be applied to analyze data for suspicious behaviors or potential security breaches in supply chain systems, assess the behavior of smart contracts, and detecting any possible security vulnerabilities (Taherdoost, 2023). On the other hand, public key infrastructure plays a crucial role in securing blockchain technology. The public key is accessible to all users within the network, while the private key is available only to the transaction recipients. This system allows transactions to be visible to all network participants via the public key, while the private key provides access to specific transaction details. This approach ensures the transparency of the system while simultaneously safeguarding the beneficiaries' private financial information (Javaid et al., 2022). The continuation of this research is set as follows. First, we talk about convergence of blockchain to AI. Then we will discuss about Application of deep learning and artificial intelligence for blockchain. After that, we talk about ai and dl applications in financial services. Finally, we will present about blockchain and AI integration in finance and banking services.

Figure 2

ML method to enhance data security of blockchain

Identifying fraudulent conduct	Immutable record of transactions
Identifying and stopping cyberattacks in real-time	Secure data storage
Validating user identities	Securely storing biometric data
Evaluating supply chain security data	Producing a safe and transparent record of every step in the supply chain
Analyzing smart contracts	Creating and executing them based on predefined conditions

2. Convergence of Blockchain to AI

The combination of artificial intelligence and blockchain has the potential to address many of the weaknesses of each technology. AI depends heavily on data for learning, decision-making, and improving its algorithms. It functions most effectively when it has access to reliable, secure, and trusted data sources. Blockchain, as a distributed ledger, provides this secure environment by ensuring that data is cryptographically secured, tokenized, and verified by all network participants. The integration of AI and blockchain can create a secure, decentralized, and immutable framework for managing sensitive data, which AI systems can then collect, store, and analyze. This has important implications for securing information in sectors like healthcare, finance, legal systems, and personal data management. As highlighted in Table 2 regarding the significance of utilizing blockchain for artificial intelligence, some key points can be summarized as follows (Hussain & Al-Turjman, 2021):

- **Collaborative decision-making:** In a structured system, specialists work together in coordination to achieve various objectives.

- **Enhanced data security:** Blockchain technology ensures the secure storage of data, safeguarding sensitive and personal information from risks.

- **Boosted productivity:** Multi-user business processes, which typically involve multiple stakeholders (such as customers, trading companies, and regulatory bodies), are streamlined due to blockchain's multi-party authentication of business transactions.

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- **Decentralized intelligence:** Intelligent decisions allow various operators to carry out different sub-tasks, leveraging distributed data for efficient preparation.

- **Increased trust:** Decisions made by AI systems lose value if customers or buyers struggle to comprehend or trust them, but blockchain can help reinforce that trust.

Table 2

Importance of blockchain to AI convergence

AI	Blockchain	Convergence importance
Knowledge and data centered	Attacks resilient	High efficiency
Probabilistic	Immutable	Collective decision-making
Changing	Deterministic	Improved trust on robotics
Volatile	Data Integrity	Decentralized intelligence
Centralized	Decentralized	Enhanced data security
Prediction	Scalability	High accuracy
Less data	Data security	Data management

In summary, the convergence of blockchain and AI creates a synergy that enhances the security, trust, and efficiency of both technologies, opening new possibilities for decentralized and intelligent systems across various industries.

3. Application of deep learning and blockchain

The combination of deep learning and blockchain offers significant potential across various industries, enhancing security, transparency, and efficiency. By leveraging the strengths of both technologies, organizations can create more robust solutions that address complex challenges. Deep learning models can be built using specific segments of the blockchain instead of relying on the entire dataset. The advantages of combining deep learning with blockchain include (Hussain & Al-Turjman, 2021):

- Blockchain networks, such as Ethereum, consist of numerous decentralized machines spread globally.
- Blockchain provides a high level of security and trust.
- User verification is essential for anyone requesting or executing a transaction within the blockchain network.
- Blockchain incorporates public deep learning models into smart contracts to ensure the enforcement of terms and conditions that were previously agreed upon.
- Deep learning models can be updated on the blockchain at a low cost or locally on a user's device without any fees.
- Blockchain supports the reliable implementation of a value-based system, encouraging users to contribute data.
- Payments are processed in real time with trust on the blockchain.
- Tamper-proof smart contracts can be evaluated by multiple machines, ensuring that deep learning models maintain their potential and produce accurate results as intended.

In summary, the fusion of deep learning and blockchain offers transformative potential across a wide range of industries. Deep learning's ability to analyze and make predictions from large datasets is enhanced by blockchain's security, transparency, and decentralization, creating innovative solutions that can solve complex real-world problems.

4. Artificial intelligence for blockchain

Integration between artificial intelligence and blockchain technology can occur at various components of a blockchain. Due to the intricate nature of the blockchain protocol, researchers have delineated distinct layers, often with slightly varying nomenclature. These layers can be broadly categorized as (Ressi et al., 2024):

- **Data Layer:** At the core of the blockchain architecture is the Data Layer. It consists of data blocks, each timestamped and linked using cryptographic hashes to create a continuous chain. Blocks are divided into headers containing metadata and bodies containing transactions. This layer ensures data integrity, immutability, and transparency.
- **Network Layer:** Above the Data Layer is the Network Layer, responsible for distributed communication among blockchain peers. This layer enables peer-to-peer networking, ensuring timely block distribution, forwarding, and verification. It facilitates the broadcasting of transactions, verification acknowledgments, and peer interactions.
- **Consensus Layer:** The consensus layer ensures that all participants in the blockchain network agree on the state of the blockchain. It determines how new transactions are added to the blockchain and how conflicts are resolved. Common consensus mechanisms include Proof of Work (PoW), Proof of Stake (PoS), and Practical Byzantine Fault Tolerance (PBFT).

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- **Incentive Layer:** The Incentive Layer introduces the concept of economic motivation within the blockchain network. In decentralized systems like Bitcoin, this layer rewards participants, often miners, for their contributions. Rewards, typically in cryptocurrency, incentivize participation and secure the network. Conversely, penalties and deposits can also be enforced.

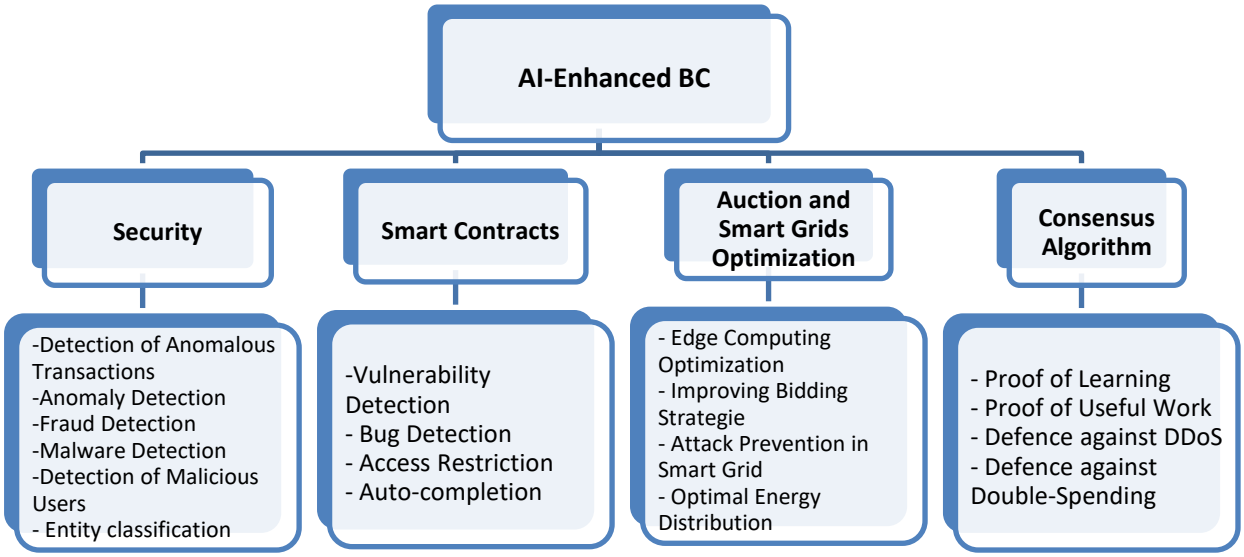
- **Contract Layer (Smart Contract):** The Contract Layer, also known as the Smart Contract Layer, brings programmability to the blockchain. It enables the creation of self-executing contracts, known as smart contracts, which automate processes based on predefined conditions. These contracts run on the network and are a cornerstone of decentralized applications, enabling dynamic interactions.

- **Application Layer:** The Application Layer represents the interface through which users interact with the blockchain network. It encompasses a wide range of use cases, including financial transactions, SCM, and identity verification. Decentralized applications are utilizing the underlying layers' functionalities to provide innovative solutions.

In this segment, we focus on what kind of advantage or property can benefit from injecting AI models and algorithms in such a structure. We have conducted a comprehensive analysis to identify macro areas where artificial intelligence can augment blockchain-based applications, as illustrated in Figure 3. We have identified four key domains where AI integration proves highly advantageous within the blockchain ecosystem: security, smart contracts, consensus mechanisms, and smart grid optimization. These AI techniques are strategically aimed at various layers within the blockchain's structural framework (Ressi et al., 2024).

Figure 3

Main contributions of AI algorithms to blockchain technology



machine learning most relevant contributions in mitigating such problems can be divided into two categories: either improve the overall security, or they contribute in optimizing blockchain protocol or applications using it (Figure 4). While these solutions represent important improvements and provide significant help to blockchain-based applications in exhibiting the best possible behavior, they barely tackle most of the above-mentioned limitations belonging to this technology. In particular, even if many AI-based alternative consensus protocols have been proposed, these can rarely be applied to many applications, or they also come with multiple problems (such as the need of a task supplier). Although deep learning solutions can help improving overall security in multiple ways, the same techniques can be used instead to perform various attacks, for example by using adversarial generative networks (Ressi et al., 2024).

Figure 4

Most significant AI contributions in improving blockchain technology

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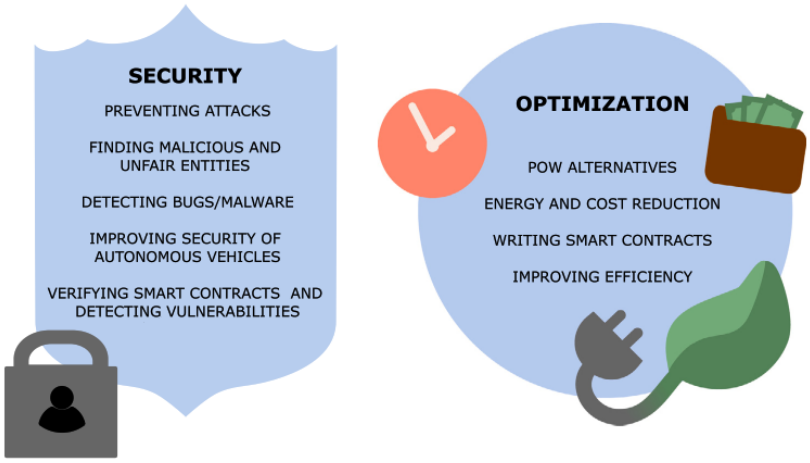

5. AI and DL Applications in Financial Services

Artificial intelligence enhances customer satisfaction in financial systems by offering innovative solutions, such as improving efficiency and accuracy. One key area is investment management, where AI algorithms analyze large datasets to detect patterns and trends, helping financial advisors and investors make better decisions. These algorithms process complex financial data faster and more accurately than humans, optimizing asset management, risk analysis, and evaluation. Regulatory technologies leverage AI to automate compliance tasks, monitor transactions, and adhere to regulations, reducing both the time and cost of compliance while minimizing human error. Thanks to machine learning's advanced capabilities, models can learn from new data, enhancing the detection of compliance issues and financial crimes like money laundering and insider trading (Paramesha et al., 2024). The emerging technologies of machine learning and deep learning have proven valuable in customer validation and loan approvals. Traditional credit scoring systems only considered a narrow set of factors, often excluding potential borrowers with limited credit histories. However, machine learning and deep learning models can assess a broader range of factors, such as social media activity, smartphone usage patterns, and transaction histories. This approach offers a more accurate and equitable assessment of creditworthiness, enhancing the precision of loan decisions. Today, deep learning algorithms are also applied in trading and market analysis, enabling the development of advanced trading strategies. These algorithms can process vast amounts of market data in real time, identify patterns, and predict price movements. Additionally, deep learning can analyze sentiment data, such as news articles, social media posts, and other textual information, to assess market sentiment and inform trading decisions. By automating routine tasks through machine learning and deep learning, banks can improve their operational efficiency. In conclusion, these technologies have the potential to significantly enhance financial and banking services. By refining predictive analytics, risk management, customer service, and automating processes, they can boost efficiency, security, and response times in financial institutions. It is anticipated that financial services will experience a new wave of innovation and growth as these technologies are increasingly adopted (Paramesha et al., 2024). Table 3 presents the applications of machine learning and deep learning in the finance and banking sectors. Also Figure 5 illustrates the percentage of companies currently utilizing AI in Banking and Financial Services (Choithani et al., 2022).

Table 3

Machine learning and deep learning in finance and banking services

Aspect	Machine Learning Applications	Deep Learning Applications
Predictive Analytics	Predicting stock prices, credit risk, and investment opportunities	Fraud detection, algorithmic trading
Risk Management	Predictive modelling for future trends	Real-time fraud detection
Customer Service	Chatbots and virtual assistants for customer queries	Natural language processing for customer interaction
Credit Scoring and Loan Approval	Evaluating wider data points for creditworthiness	Accurate and equitable loan decisions

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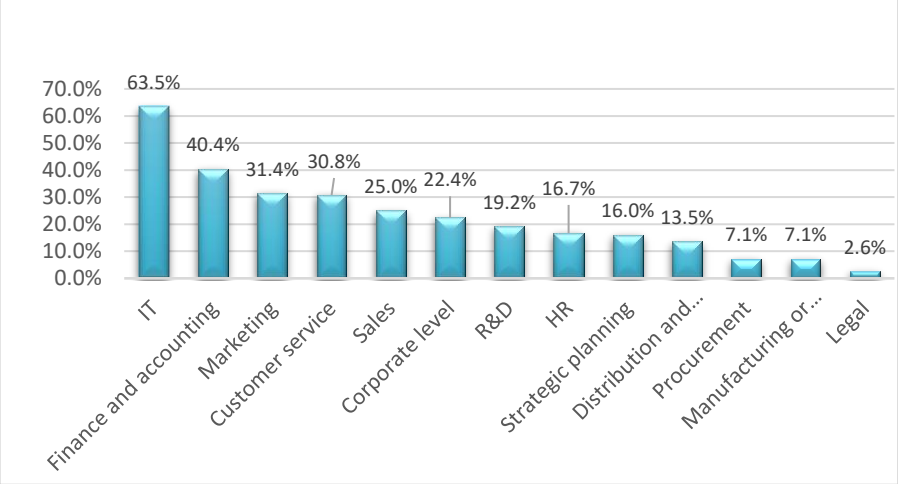
Trading and Market Analysis	Advanced trading strategies using market data	Sentiment analysis of news and social media
Operational Efficiency	Robotic process automation for routine tasks	Automation of repetitive tasks, improving productivity

Figure 5

Percentage of Companies Using AI Today in Each Function



6. Blockchain and AI Integration in Finance and Banking Services

The combination of blockchain and artificial intelligence has ushered in a new era for financial and banking services. Leveraging both technologies offers benefits such as enhanced security, faster transaction speeds, and the development of innovative financial solutions. Blockchain, with its decentralized and immutable structure, ensures greater transparency and security in transactions. Meanwhile, artificial intelligence, with its advanced data processing and analytical capabilities, enhances decision-making and operational efficiency. Together, these technologies transform various areas of financial services, including transaction processing and fraud detection. The integration of blockchain and AI significantly improves transaction handling by boosting both security and efficiency. Blockchain's decentralized ledger transparently and securely records every transaction, reducing the chances of fraud and error. AI algorithms, on the other hand, can quickly analyze transaction data in real time, identifying unusual patterns and potentially fraudulent activity. When combined with blockchain, financial institutions can achieve more effective fraud detection and prevention, protecting the integrity of financial transactions. By merging these two technologies, blockchain provides a secure and transparent platform for storing large volumes of financial data, while AI algorithms analyze this data to reveal key insights and trends. For instance, AI can predict market movements and customer behaviors by analyzing historical transaction data stored on the blockchain, enabling financial institutions to forecast future outcomes. This allows financial services to offer higher-quality products and services, make better decisions, and optimize investment strategies. Another key application in financial services is smart contracts, which are powered by blockchain and enhanced by AI. These self-executing contracts automatically enforce the terms of an agreement based on predefined conditions. AI can play a crucial role here by monitoring the conditions of the contracts, ensuring their proper and efficient execution (Paramesha et al., 2024).

The integration of blockchain and artificial intelligence offers significant applications in regulatory compliance. Blockchain's decentralized and transparent ledger allows financial services to meet legal requirements by conducting reliable audits of all financial transactions. This combination not only reduces the time and costs associated with regulatory compliance but also minimizes the risk of violations. Studies have shown that merging blockchain and AI enhances digital authentication processes, offering benefits like streamlining customer onboarding, boosting security, reducing the risk of identity theft and fraud, and providing customers with secure and seamless digital services. Moreover, the combination of blockchain and AI has spurred innovation in decentralized finance (DeFi). DeFi platforms utilize blockchain to create transparent and open financial systems that operate without traditional intermediaries. This integration supports financial inclusion by making financial services more accessible and available to a wider audience. Overall, the fusion of blockchain and AI in financial and banking services has introduced a new wave of innovation and

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efficiency. The increased security of transactions, improved data management, automated compliance processes, and the creation of new financial products have transformed the industry. As these technologies continue to advance, their combined impact is expected to drive further revolutionary changes, offering substantial benefits to both financial institutions and their customers (Paramesha et al., 2024). Table 4 represents Blockchain and AI integration in finance and banking services.

Table 4

Blockchain and AI integration in finance and banking services

Aspect	Blockchain Applications	AI Applications
Transaction Processing	Decentralized and secure ledger for transactions	Instant analysis of transaction data for fraud detection
Data Management	Secure and transparent platform for storing financial data	Analysis of stored data to reveal insights and trends
Predictive Analytics	Secure historical data storage	Forecasting market trends and consumer behavior
Smart Contracts	Self-enforcing contracts	Monitoring and executing contract terms
Regulatory Compliance	Reliable audit trail for transactions	Automating supervision and documentation of compliance tasks
Digital Identity Authentication	Immutable database of identity details	Fast and accurate verification of identity data
Decentralized Finance (DeFi)	Transparent and accessible financial systems	Advanced analytics, risk management, and automated decision-making
Innovation and Productivity	Enhancing transaction security and new financial products	Improving decision-making and operational efficiency

In addition to artificial intelligence and deep learning, quantum computing holds significant potential for enhancing fraud detection and bolstering cybersecurity in the financial sector. Thanks to their immense processing power and ability to analyze intricate patterns, quantum algorithms can more effectively identify and diagnose anomalies and potential fraud in financial transaction data. By efficiently evaluating complex financial products, quantum computing can also safeguard customer assets and data against cyber threats and fraudulent activities. Furthermore, quantum algorithms can simulate how financial instruments perform under various market conditions, enabling more precise and comprehensive risk assessments.

7. Conclusion

This review has pointed out the major impacts of artificial intelligence in various fields, including fraud detection and services provided by financial services. Machine learning and deep learning algorithms are at the forefront of predictive analytics and allow financial services to predict market trends while improving investment strategies. The secure and transparent decentralized distributed ledger of blockchain technology has a close relationship with artificial intelligence to ensure the integrity and efficiency of financial transactions. The collaboration between artificial intelligence and blockchain can be seen in the development of smart contracts and decentralized financial platforms. AI technologies such as machine learning, deep learning, and blockchain are revolutionizing traditional approaches by providing advanced tools for data analysis, risk assessment, and transaction processing. The combination of AI algorithms with blockchain's unchangeable ledger allows organizations to develop innovative solutions that effectively tackle various security challenges. Integrating AI with blockchain presents immense opportunities to enhance security and build trust in financial transactions.

Traditional financial systems often involve multiple intermediaries, which add complexity and drive-up transaction costs. Blockchain's decentralized structure eliminates the need for middlemen, leading to faster and more cost-efficient transactions. AI further contributes by automating processes, streamlining routine tasks, and optimizing resource allocation, which reduces operational expenses. Together, blockchain and AI are not only improving security and transparency but also reshaping how financial interactions take place.

Further exploration of advanced AI algorithms, including deep learning and reinforcement learning, can enhance the effectiveness of AI-driven solutions for securing financial services. These algorithms can boost the accuracy of fraud detection, identify new threats, and offer more personalized security measures for users. Additionally, research into privacy-preserving techniques, such as zero-knowledge proofs and homomorphic encryption, can help mitigate concerns regarding data privacy and security in the integration of AI and blockchain. Innovation in interoperability and scalability solutions for blockchain networks can enable seamless integration with AI-driven applications and other financial

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services (Odeyemi et al., 2024). Cooperation among government agencies, regulatory authorities, financial institutions, technology companies, and academic institutions can stimulate innovation and support the incorporation of AI and blockchain into the security of financial services.

Authors' Contributions

H. H. conceptualized the study, conducted the literature review, and contributed to the integration framework of AI and blockchain in financial services. F. F. was responsible for analyzing the security implications and optimization strategies using deep learning, contributing to data analysis and model evaluation. S. M. provided expertise in financial applications, risk management, and real-world implementation scenarios, ensuring the practical relevance of the study. All authors contributed to drafting, reviewing, and finalizing the manuscript, and approved the final version for submission.

Declaration

In order to correct and improve the academic writing of our paper, we have used the language model ChatGPT.

Transparency Statement

Data are available for research purposes upon reasonable request to the corresponding author.

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Declaration of Interest

The authors report no conflict of interest.

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Ethics Considerations

Ethical concerns were addressed by ensuring transparency in the selection and analysis of sources. Proper citations were maintained throughout the review to credit original authors and avoid plagiarism. Additionally, care was taken to evaluate the potential biases inherent in the reviewed materials, particularly when analyzing industry reports or whitepapers that may have vested interests.

References

Adisa, O. (2024). Decentralized Finance (DEFI) in the U. S. Economy: A Review: Assessing the Rise, Challenges, and Implications of Blockchain-Driven Financial Systems. *World Journal of Advanced Research and Reviews*, *21*(1), 2313-2328. https://doi.org/10.30574/wjarr.2024.21.1.0321

Ahmed, A. A. A. (2024). The Rise of DeFi: Transforming Traditional Finance With Blockchain Innovation. https://doi.org/10.20944/preprints202402.0738.v1

Choithani, T., Chowdhury, A., Patel, S., Patel, P., Patel, D., & Shah, M. (2022). A Comprehensive Study of Artificial Intelligence and Cybersecurity on Bitcoin, Crypto Currency and Banking System. *Annals of Data Science*. https://doi.org/10.1007/s40745-022-00433-5

Hussain, A. A., & Al-Turjman, F. (2021). Artificial intelligence and blockchain: A review. *Transactions on Emerging Telecommunications Technologies*, *32*(9). https://doi.org/10.1002/ett.4268

Javaid, M., Haleem, A., Singh, R. P., Suman, R., & Khan, S. (2022). A review of Blockchain Technology applications for financial services. *BenchCouncil Transactions on Benchmarks, Standards and Evaluations*, *2*(3), 100073. https://doi.org/10.1016/j.tbench.2022.100073

Nakamoto, S. (2008). *Bitcoin: A peer-to-peer electronic cash system*.

Odeyemi, O., Okoye, C. C., Ofodile, O. C., Adeoye, O. B., Addy, W. A., & Ajayi-Nifise, A. O. (2024). INTEGRATING AI WITH BLOCKCHAIN FOR ENHANCED FINANCIAL SERVICES SECURITY. *Finance & Accounting Research Journal*, *6*(3), 271-287. https://doi.org/10.51594/farj.v6i3.855

Paramesha, M., Rane, N. L., & Rane, J. (2024). Artificial Intelligence, Machine Learning, Deep Learning, and Blockchain in Financial and Banking Services: A Comprehensive Review. *Partners Universal Multidisciplinary Research Journal*, *1*(2), 51-67. https://doi.org/10.2139/ssrn.4855893

Rane, N., Choudhary, S., & Rane, J. (2023). Blockchain and Artificial Intelligence (AI) integration for revolutionizing security and transparency in finance. *Social Science Research Network*. https://doi.org/10.2139/ssrn.4644253

Ressi, D., Romanello, R., Piazza, C., & Rossi, S. (2024). AI-enhanced blockchain technology: A review of advancements and opportunities. *Journal of Network and Computer Applications*, *225*, 103858. https://doi.org/10.1016/j.jnca.2024.103858

Shafay, M., Ahmad, R. W., Salah, K., Yaqoob, I., Jayaraman, R., & Omar, M. (2023). Blockchain for deep learning: review and open challenges. *Cluster Computing*, *26*(1), 197-221. https://doi.org/10.1007/s10586-022-03582-7

Taherdoost, H. (2023). Blockchain and Machine Learning: A Critical Review on Security. *Information*, *14*(5), 295. https://doi.org/10.3390/info14050295

Zhang, T., & Huang, Z. (2021). Blockchain and central bank digital currency. *Ict Express*, *8*(2). https://doi.org/10.1016/j.icte.2021.09.014

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