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DETERMINING THE CAPABILITIES OF ARTIFICIAL INTELLIGENCE ON THE DEVELOPMENT OF CRYPTOTRADING AND BLOCKCHAIN TECHNOLOGY

The object of research is crypto trading and blockchain technologies, including the development of trading bots and the implementation of automated risk management systems. AI includes the development of trading bots, the implementation of automated risk management systems, and the use of predictive analytics tools that optimize trading operations. This is important, as AI technology plays a crucial role in the rapid analysis of huge amounts of data to predict market prices and trading opportunities, thereby increasing the efficiency of investments. In addition, AI provides investors with real-time information and assists in risk management. However, there are objective difficulties, and crypto fraudsters study different scenarios and adapt to changing market conditions using AI. By using the methods of observation, generalization, systematization and comparison, the authors have achieved results in determining the significance of implementation. In particular, the integration of artificial intelligence and cryptocurrencies can be applied, which aims to use the capabilities of big data processing and continuous learning to create a more efficient trading environment and financial services. The results presented in this paper give grounds to assert that it is possible to implement in the real business and technological environment (exchanges, crypto-exchanges, cryptocurrency operations, IT infrastructure, big data, AI). The article proposes innovative models and applications of artificial intelligence for use in trading business operations, where the main tool for users is generative artificial intelligence and interfaces. This method makes it possible to define generative artificial intelligence and natural language interfaces as the main means for trading operations that will be carried out using cryptocurrencies. As a result, real-time cryptocurrency trading and investment strategies based on data and algorithms have become possible.

Keywords: *artificial intelligence, trading, trading bots, blockchain technology, smart contract automation, cryptocurrency projects, crypto fraud.*

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1. Introduction

The cryptocurrency industry is experiencing a rapid surge in AI-driven solutions, which include the development of trading bots, the implementation of automated risk management systems, and the use of predictive analytics tools that optimize investment strategies for both beginners and experienced investors. These AI innovations are shaping the future of crypto trading and blockchain technology. The integration of AI and cryptocurrency is aimed at harnessing the power of big data processing and continuous learning to create a more efficient trading environment and services [1].

In particular, within the highly volatile cryptocurrency market, AI technology has gained attention for its ability to autonomously collect and analyze data, making timely decisions without human intervention. Some experts compare this trend to the 19th-century gold rush, where people rushed to mining sites in pursuit of wealth, although opinions differ on whether this analogy is widely accepted or merely a speculative comparison.

In the context of modern research, the issue of theoretical and methodological comprehension of the analysis of the impact of artificial intelligence technologies on the global financial industry has sparked interest from both domestic and international scientific communities, as well as leading research organizations. Scientific works are dedicated to the possibilities of using artificial neural networks for analyzing financial markets, assessing borrowers' creditworthiness, and predicting the likelihood of financial crises [2]. Furthermore, particular attention deserves the scientific explorations of foreign scholars who propose considering a wide range of machine learning methods as tools for enhancing the efficiency of systemic risk management and qualitatively transforming the structure of the financial sector through in-depth data analysis [3].

According to the results of a study conducted by experts from the company Mercer, which involved over 150 financial managers and asset managers and lasted from December 2023 to January 2024, more than half of the respondents (54%) report using AI within investment strategies or for researching asset classes. Although more than a third of managers (36%) do not use AI in an investment or research context today, they plan to do so in the future. Only 9% of respondents do not plan to use AI for investment strategy and research [4].

Interestingly, financial experts expect that AI will enhance the efficiency of the global financial market, and this will be accompanied by a simultaneous increase in market concentration – a phenomenon that is typically a consequence of inefficient herd mentality and certain cognitive biases [5].

The dynamic development of artificial intelligence raises more concerns among those who have not yet implemented AI, highlighting the risks associated with the pace of AI development outpacing its practical implementation [6]. Discrepancies in AI regulation are seen as a significant risk factor for its integration [7].

Artificial intelligence is positioning itself as the primary user of blockchain networks, potentially displacing humans from the cryptocurrency space. Following the revolutionary AI-related announcements by NVIDIA at CES 2025, experts have begun discussing radical changes in the industry [8]. NVIDIA's revenue – perhaps the best indicator of capital expenditures on AI – is expected to exceed 100 billion USD in 2024, more than doubling from 2023 and over four times higher than the previous year.

As the synergy between artificial intelligence and financial technologies continues to evolve, the future likely depends not so much on whether AI can replace humans, but rather on their collaboration. Therefore, a comprehensive review of contemporary scientific literature by leading experts in artificial intelligence and the identification of innovative AI models and programs for use in trading business operations is highly relevant.

Thus, *the aim of this research* is to determine the impact of artificial intelligence on the development of crypto trading and blockchain technology, which includes the development of trading bots, the implementation of automated risk management systems, and the use of predictive analytics tools that optimize trading operations.

2. Materials and Methods

The primary objective of this research is to amalgamate existing knowledge, pinpoint key trends, and evaluate the present state of research at the intersection of blockchain technology, cryptotrading and AI. *The object of research* is crypto trading and blockchain technologies, which includes the development of trading bots, the implementation of automated risk management systems.

The methodological foundation of this study is based on the following set of approaches:

– using analysis and synthesis methods, the essence of artificial intelligence has been studied in relation to the key stages, principles, and methodological approaches affecting its impact on the development of crypto trading and blockchain technology;

– the method of critical analysis and generalization allowed identifying key problems, shortcomings, and gaps in practical approaches to the reality of AI-driven crypto trading and blockchain technology development, leading to a structured understanding of the obtained results and the formulation of relevant conclusions;

– the graphical method visually illustrates the relationships between key elements of crypto trading, blockchain, and artificial intelligence;

– the algorithmic approach has been applied to develop smart contract management technology and to implement blockchain in a regional integrated energy trading system;

– using the expert method, promising directions for AI-based crypto trading and blockchain technology have been identified and justified, and recommendations have been developed to improve the efficiency of artificial intelligence utilization based on expert assessments;

– component analysis in defining a practical guide to implementing blockchain in a regional integrated energy trading system.

The analysis centered on comprehending the scholarly impact of key publications and discerning collaboration patterns among researchers in the field.

3. Results and Discussion

It is necessary to know five AI technologies:

1. *Artificial intelligence* (AI) makes it possible for machines to learn from experience, adjust to new inputs and perform human-like tasks. Most AI examples that you hear about today – from chess-playing computers to self-driving cars – rely heavily on deep learning and natural language processing. Using these technologies, computers can be trained to accomplish specific tasks by processing large amounts of data and recognizing patterns in the data.

2. *Machine learning* is a method of data analysis that automates analytical model building. It is a branch of artificial intelligence based on the idea that systems can learn from data, identify patterns and make decisions with minimal human intervention. While artificial intelligence (AI) is the broad science of mimicking human abilities, machine learning is a specific subset of AI that trains a machine how to learn.

3. *Deep learning* is a type of machine learning that trains a computer to perform human-like tasks, such as recognizing speech, identifying images or making predictions. Instead of organizing data to run through predefined equations, deep learning sets up basic parameters about the data and trains the computer to learn on its own by recognizing patterns using many layers of processing.

4. *Natural language processing* (NLP) is a branch of artificial intelligence that helps computers understand, interpret and manipulate human language. NLP helps computers communicate with humans in their own language, making it possible for computers to read text, hear speech, interpret it, measure sentiment and determine which parts are important.

5. *Computer vision* is a field of artificial intelligence that trains computers to interpret and understand the visual world. Using digital images from cameras and videos and deep learning models, machines can accurately identify and classify objects – and then react to what they "see". From recognizing faces to processing the live action of a football game, computer vision rivals and surpasses human visual abilities in many areas.

Transactions follow a specific technology, depending on the blockchain. For example, on Bitcoin's blockchain, if to initiate a transaction using cryptocurrency wallet the application that provides an interface for the blockchain – it starts a sequence of events (Fig. 1).

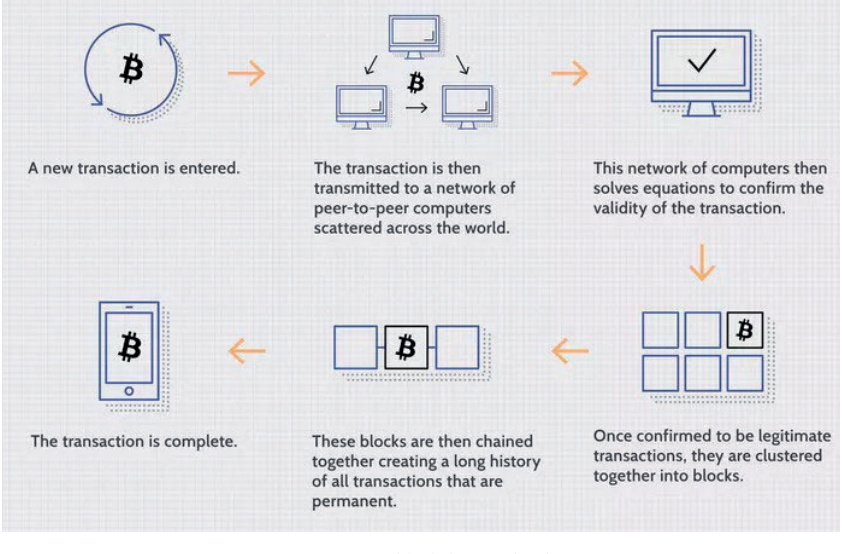

Fig. 1. Bitcoin's blockchain technology

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In Bitcoin, transaction is sent to a memory pool, where it is stored and queued until a miner picks it up. Once it is entered into a block and the block fills up with transactions, it is closed, and the mining begins.

AI agents are autonomous artificial intelligence systems capable of making independent decisions and acting without human intervention [9]. Unlike generative AI, which simply responds to user queries, AI agents can analyze situations and execute operations on their own initiative.

Let's imagine a smart trading robot that monitors the market around the clock, assesses risks, and instantly reacts to the slightest price changes. "AI agents will appear in blockchain before we see a billion human users in the space", stated Evan, head of the Monad ecosystem and a former McKinsey analyst [10]. According to him, cryptocurrency projects are often not user-friendly for regular users, but these inconveniences do not matter to machines. Indeed, while people struggle with complex passwords and mnemonic phrases, AI agents easily handle any technical difficulties.

Real-time AI-based cryptocurrency trading improves market efficiency. Recently, cryptocurrency investors have been using AI agent-based coins and tokens to automate trades and execute intelligent, data-driven investment strategies, leading to increased efficiency in the cryptocurrency market. AI agents integrate artificial intelligence with blockchain technology to enable decentralized network development and smart contract automation. AI technology plays a crucial role in rapidly analyzing vast amounts of data to forecast market prices and trading opportunities, enhancing investment efficiency. Furthermore, it provides investors with timely insights and assists in real-time risk management [11]. Unlike traditional trading bots, AI-powered solutions continuously learn from various scenarios and adapt to evolving market conditions. As a result, real-time data- and algorithm-driven cryptocurrency trading and investment strategies have become possible [12].

AI technology significantly enhances the efficiency and security of smart contracts executed within blockchain networks. Smart contracts are self-executing code deployed on a blockchain that activates and executes predefined conditions only upon receiving an incoming transaction [13]. This ensures controlled and deterministic execution of contract terms embedded in the code. An external transaction acts as a "trigger" that activates the smart contract and initiates its logic, similar to how pressing a button can turn on a light. A more detailed visualization of this process is presented in Fig. 2 [14].

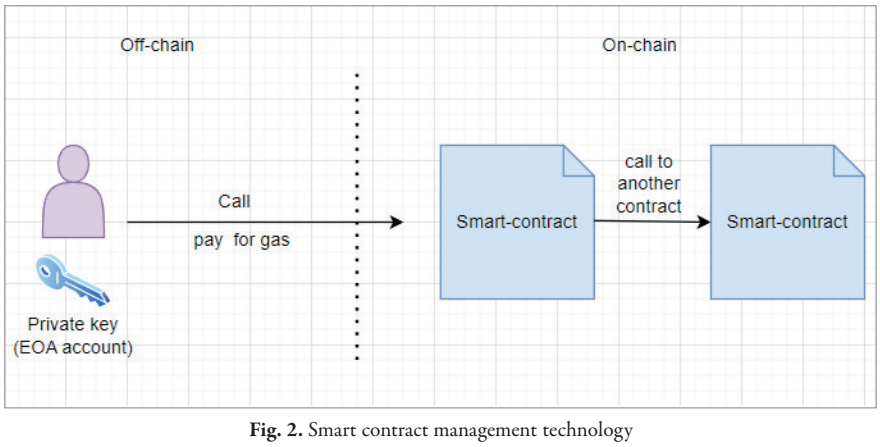

Fig. 2. Smart contract management technology

Projects like ChainGPT and Fetch.ai are already leveraging AI to optimize smart contract execution, automate processes, and detect potential vulnerabilities in decentralized applications. By continuously monitoring the system and identifying potential risks, AI automates various tasks, ensuring reliable services [15]. This enables investors to make quick and strategic decisions in rapidly changing markets. Additionally, smart contract automation simplifies processes, reduces repetitive tasks, and enhances operational efficiency. As a result, investors save time and costs while optimizing the effectiveness of their investments [16]. The integration of AI and cryptocurrency showcases the potential to revolutionize financial transactions in the future.

Crypto Security: Fraud Detection and Risk Mitigation using artificial intelligence

Some investors express concerns about cryptocurrency security, especially in light of recent high-profile breaches, such as the 600 million USD Ronin Network hack and the 320 million USD Wormhole exploit. According to [17], cryptocurrency fraud cases have increased over the past year, highlighting the importance of AI-driven security solutions (Fig. 3) [18].

These incidents reveal vulnerabilities in the crypto space, reinforcing the need for advanced AI-driven security solutions. As the cryptocurrency industry grows, fraud schemes such as phishing and scams are becoming increasingly sophisticated [19].

AI technology plays a crucial role in identifying suspicious patterns and activities to detect fraud and enhance security. Through continuous learning, AI analyzes deceptive tactics and proactively develops countermeasures, maintaining a high level of security. As a result, it helps protect investors, sustain trust, and provide effective solutions against cyber threats [20].

AI and Blockchain: Building a Decentralized and Transparent Trading Network

Beyond AI-driven trading strategies, another significant area where artificial intelligence proves beneficial is the development of decentralized trading environments [21]. The integration of AI with blockchain enables the creation of a decentralized trading ecosystem that operates independently of major financial institutions or corporations.

Some authors highlighted the advantages of early standardization in the blockchain industry [22]. According to these authors, blockchain has the potential to reshape the digital economy, and its success depends on the technology's ability to be standardized. They proposed a framework, as shown in Fig. 4 [23], which can serve as a best-practice guide for blockchain adoption to understand the scope and limits of blockchain immutability.

By distributing data and creating a self-learning autonomous system, transactions can operate independently of centralized entities. This forms the foundation for fair decision-making while simultaneously enhancing the security, efficiency, and transparency of cryptocurrency transactions. Furthermore, blockchain technology records all activities, ensuring a stable and reliable trading environment [24].

AI-Based Cryptocurrency: Unlocking New Opportunities in the Digital Economy

In September of last year, the research team at Delphi Labs [25] published an analysis of AI's impact on the cryptocurrency industry. Experts warn that if no action is taken, control over AI will become concentrated in the hands of large tech companies and governments. Cryptocurrency technologies can prevent such monopolization by providing a decentralized infrastructure for AI development.

Some projects are already working toward this goal. For example, Wayfinder is developing functionality for autonomous AI-agent interaction with blockchain networks [26].

This could be the first step toward creating self-organizing digital ecosystems where artificial intelligence operates independently of human control.

Philosopher and programmer Yuk Hui reassures that machines will not completely replace humans [27]. In his view, such a replacement "may take longer than the extinction of humanity". Instead, machine intelligence will transform humans beyond recognition.

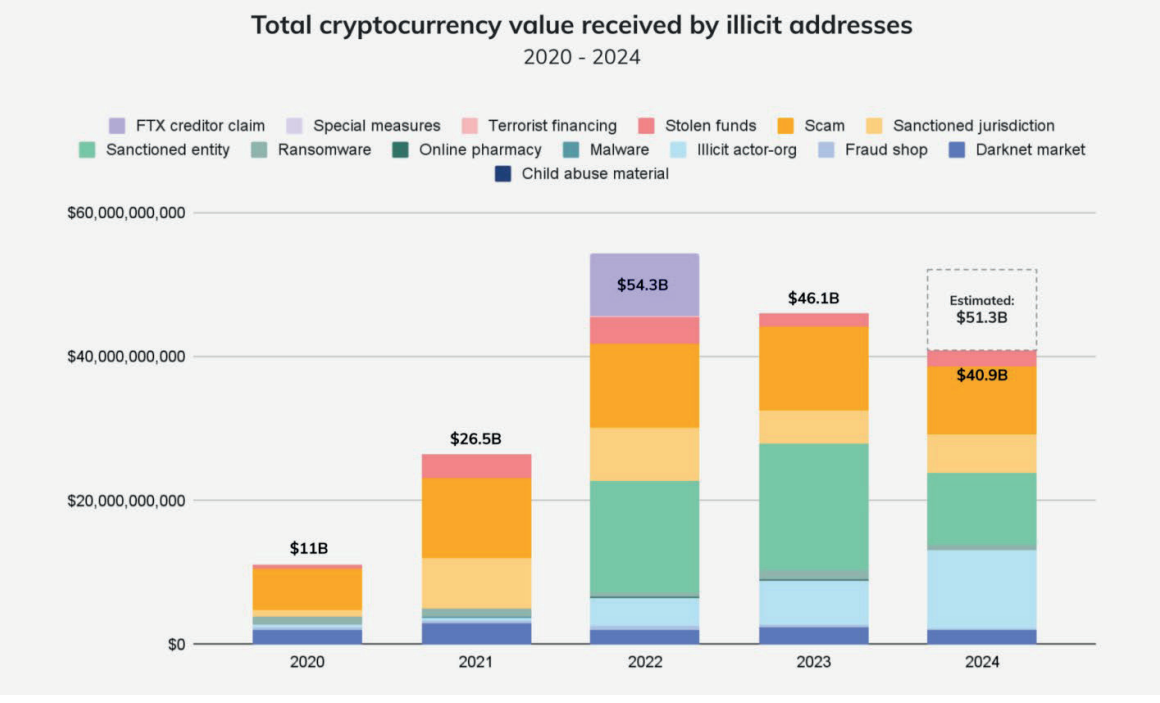

Fig. 3. Total value of cryptocurrency obtained illegally 2020–2024

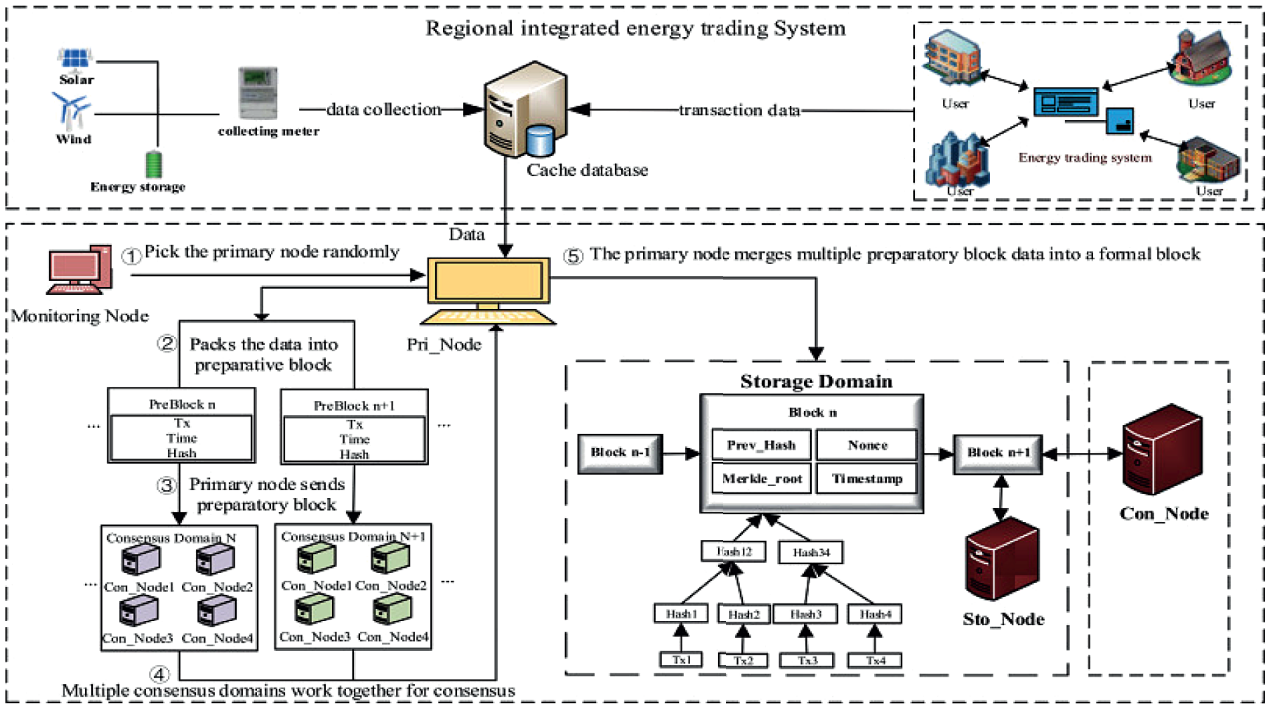

Fig. 4. Foremost practice guide for implementing blockchain in a regional integrated energy trading system

Given that AI capabilities typically scale exponentially with the computing power applied to them, it is highly likely that within a decade, let's reach something akin to AGI (Fig. 5) [28].

Sundar Pichai on AI Investments

Google CEO Sundar Pichai on investing in AI: "The risk of underinvestment here is significantly higher than the risk of over-investment". At the same time, startups recognize AI as a disruptive force that allows them to challenge long-established industry leaders. Over the past 18 months, an estimated 83 billion USD has been invested in AI startups.

AGI

Over the past year in San Francisco, funding has shifted from 10 billion USD computing clusters to 100 billion USD clusters and beyond, reaching trillion-dollar clusters. Every six months, another zero is added to corporate boardroom plans [29]. Behind the scenes, there is an intense battle for every available energy contract before the end of the decade, for every voltage transformer that might still be acquired.

American big business is preparing to invest trillions of dollars in an industrial mobilization unseen in decades.

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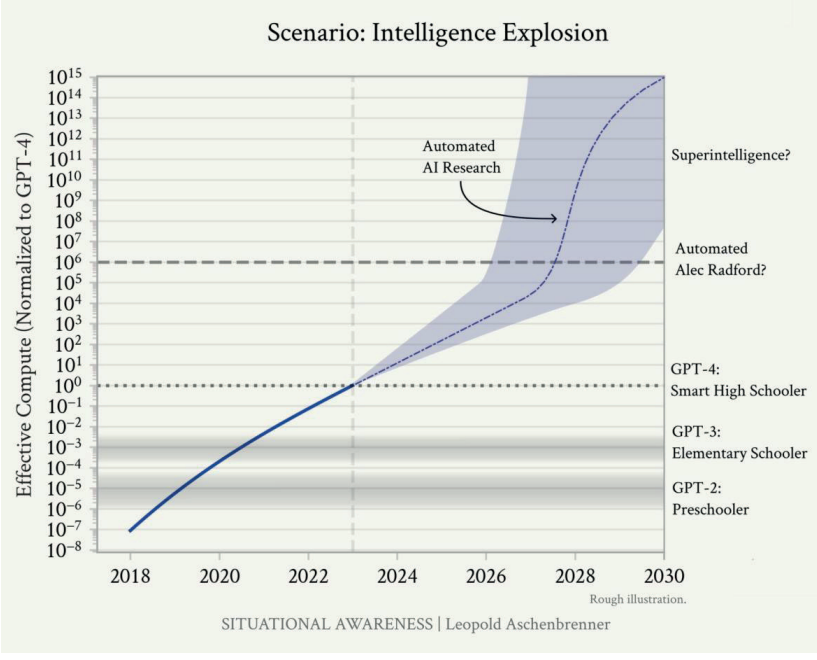

Fig. 5. Reality and forecast of basic scaling of efficient computing

By the end of the decade, U.S. electricity production will increase by tens of percent; from Pennsylvania's shale fields to Nevada's solar farms, hundreds of millions of GPUs will be in operation.

The AGI race has begun. Machines are created that can think and reason. By 2025/26, these machines will surpass many college graduates (Fig. 6) [30]. By the end of the decade, they will be smarter than we; there is a true superintelligence. Along the way, national security forces not seen in half a century will come into play, and soon, the Project will begin. If we're lucky, we'll find ourselves in an all-out race with the CCP; if we're unlucky, in an all-out war.

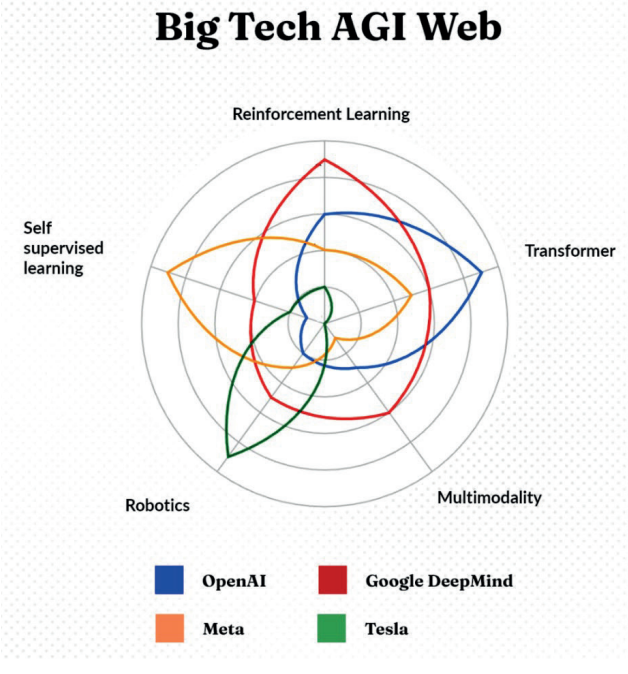

Fig. 6. AGI's big technical network

Right now, everyone is talking about AI, but very few have even the faintest glimpse of what's coming. Nvidia analysts still believe that 2025 might mark a peak. At this moment, there may only be a few hundred people – most of them in San Francisco and AI labs – who possess real situational awareness.

God-model vs many-models

We are now heading toward a world where a few major, vertically integrated tech companies produce "God models" (Fig. 7) [24] that overshadow all other technologies [31].

Key Reasons for Continued Development in This Direction:

1. *Risk of Fraud*: Organizations, entrepreneurs, and developers building AI-driven experiences do not want to depend on a single closed-source company that can modify the model, change terms of use, or even discontinue service entirely [32].

2. *Trade-off Between Cost and Performance*: Extremely large, generalized models preferred by major tech companies are significantly more expensive to train and operate. As AI scales, cost optimization will become a priority, making large models less competitive for many tasks. Research shows that smaller, specialized models often outperform generalized ones in areas such as medical image diagnostics, fraud detection, and speech recognition [33]. Vertical integration, as demonstrated by Apple, often leads to superior products.

3. *Ambitious Entrepreneurs Seeking Competitive Edge*: AI-driven startups will aim to gain an advantage by developing their own specialized models, increasing their value and attracting more investment [34].

4. *Privacy Concerns*: AI will be deeply integrated into organizational workflows, making many organizations hesitant to entrust their confidential data to centralized models.

For these reasons, it is possible to believe the future is more likely to consist of many smaller, specialized models that are cost-effective and tailored for specific use cases. Developers and application users will rely on open-source models, such as LLaMA or MistralAI models, as a foundation for fine-tuning their own AI solutions, often using proprietary data. While many models will continue running on servers, smaller and privacy-sensitive applications will operate locally on client devices, and censorship-resistant ones may leverage decentralized computing networks [35].

This is the "modular AI Lego world", where developers and entrepreneurs compete to provide value, and users can mix and match services based on their needs [36]. New infrastructure – including routing, orchestration, synthesis, and payments – will need to be built to break apart the "God model" stack and serve this emerging AI economy, where crypto will thrive.

Crypto x AI

The AI market has grown significantly and attracted investments: over the past five years, venture capital firms have invested approximately 290 billion USD in this sector. The World Economic Forum suggests [37] that AI technologies could increase the annual GDP growth of the United States by 0.5–1.5% over the next decade. AI applications are gaining real traction, with applications like ChatGPT-4 setting new records for user growth. However, as the AI market rapidly evolves, a number of issues arise, including data privacy concerns, ethical considerations, risks of centralization, and the increasing use of deepfake technology. These issues shape the current discourse around the intersection of cryptocurrencies and AI (Fig. 8) [38].

However, the hype around Crypto x AI has led to a significant allocation of capital in this area by often insufficiently informed investors. Similar to an infrastructure bubble, many Crypto x AI projects are being funded and built that perhaps should not exist [39].

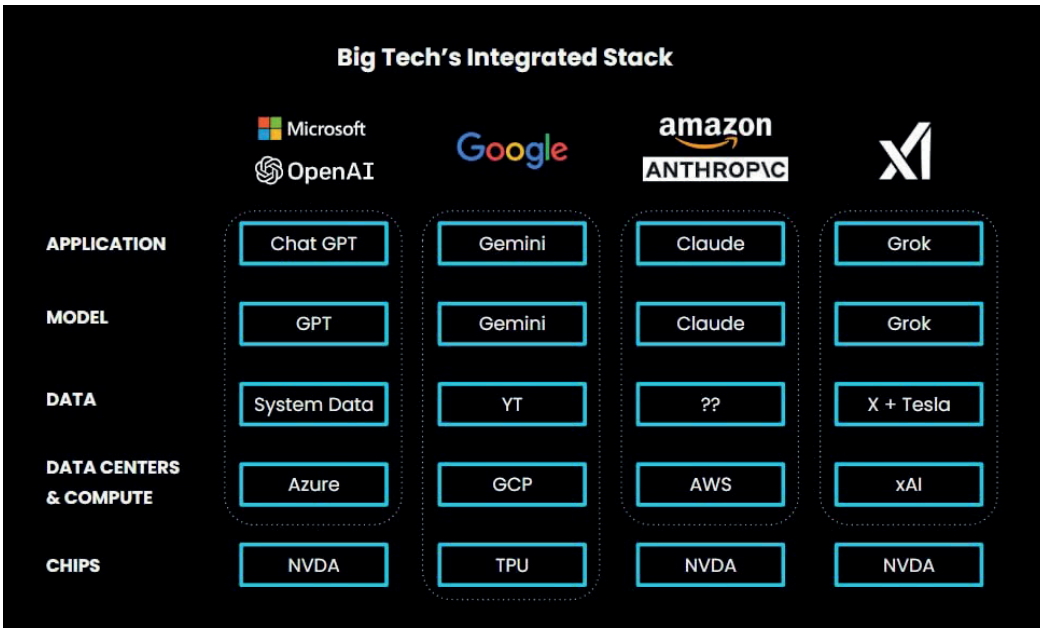

Fig. 7. Big vertically integrated technology companies producing "God models"

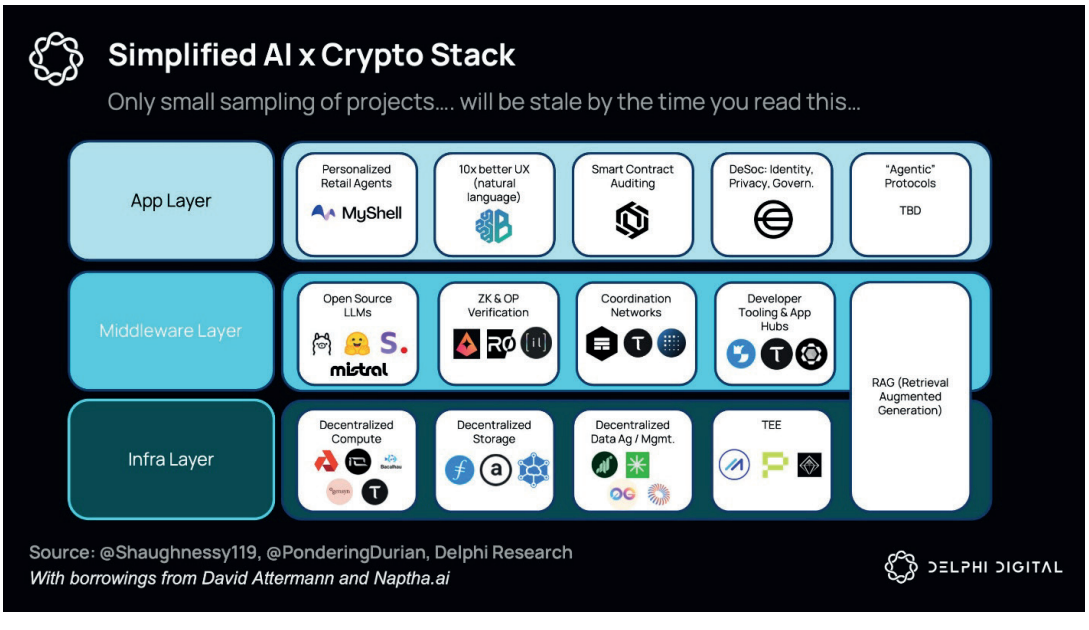

Fig. 8. Simplified AI x crypto stack

As a result, it is not easy to determine which subsectors in the Crypto x AI space truly have value, leading many to dismiss the entire space as a meme without fundamental worth.

One area particularly interesting in Crypto and AI is the concept of AI agents operating on crypto-infrastructure rails (Fig. 9) [24]. This integration aims to create an "Agentic Web", a paradigm-shifting transformation that could enhance security, efficiency, and collaboration in AI-driven economies, backed by robust incentive structures and cryptographic primitives [40, 41]. It is possible to believe that AI agents could become significant drivers of economic activity and growth, as well as the predominant "users" of applications (both on-chain and off-chain), gradually moving away from human users in the medium and long term. This paradigm shift will push many internet firms to rethink their core assumptions about the future and provide the necessary products, services, and business models to best serve an economy largely based on agents [42]. Crypto could play a crucial role in enabling greater decentralization, verifiability, censorship resistance, and native payment rails for AI, while also benefiting from AI mechanisms to support a new user experience online.

The future of AI may be built on blockchain technology, as cryptography can help enhance accessibility, transparency, and use cases within the new technological landscape. The convergence of cryptographic efficiency, its borderless nature, and programmability with AI has the potential to transform how humans and machines interact with the digital economy, including by granting users sovereignty over their personal data [43–45]. This includes the rise of the "agentic network", where AI agents operating on crypto-infrastructure can drive economic activity and growth.

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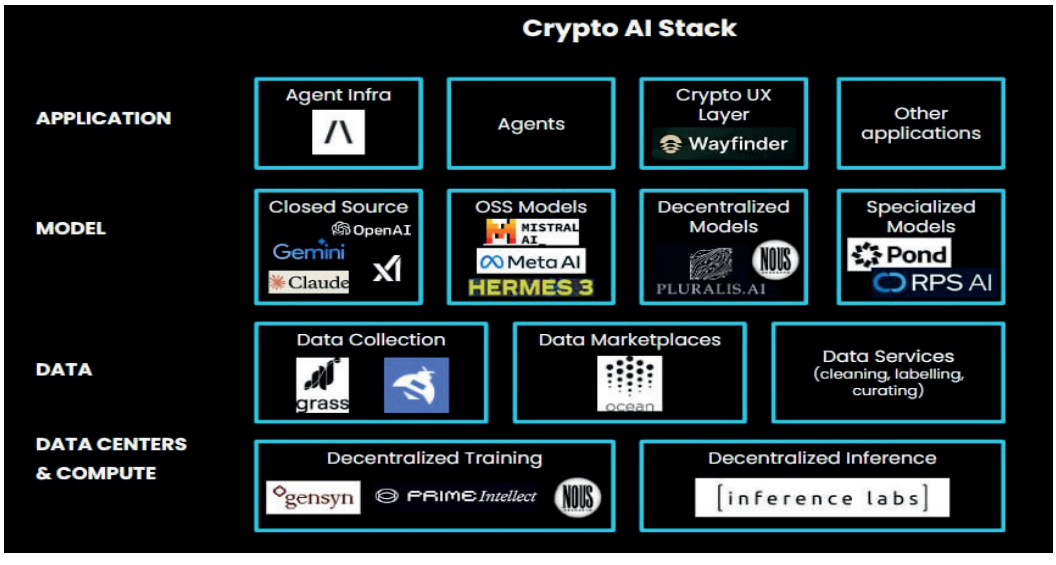

Fig. 9. Crypto AI stack

Artificial intelligence has a rich history dating back to the mid-20th century. What began as theoretical models and rule-based systems has evolved into the modern landscape of neural networks, generative AI, and autonomous decision-making [46, 47]. From chatbots to self-driving cars, AI systems are solving increasingly complex problems, demonstrating capabilities that were once confined to science fiction [48–50]. However, with this rapid progress comes a range of limitations and dangers. AI models are often opaque, leading to concerns about bias and accountability. Moreover, their reliance on vast amounts of data raises ethical questions about privacy and data ownership. Recent headlines also highlight risks such as the misuse of generative AI for creating disinformation or deepfakes.

As a result of this research, based on the analysis of the main advantages and disadvantages of the current state of practical application of crypto trading and blockchain technology, artificial intelligence has emerged as a key tool for users. Its application enables the identification of effective smart contract management technology for use in trading operations [51]. This means that the obtained approval for the implementation of crypto trading and blockchain technology into an integrated system is both practically interesting and highly modern for application.

However, despite progressive steps in this direction, issues surrounding the ethical use of artificial intelligence in financial services and addressing data privacy concerns are becoming increasingly relevant. Establishing the right balance between innovation and responsible implementation will be crucial for building trust among stakeholders and clients in the global financial industry. It is worth noting that when implementing AI solutions in the financial sector, in addition to important aspects such as navigating complex regulatory landscapes and adhering to principles of data privacy, security, and ethics, attention should also be paid to issues such as the "transparency" of AI initiatives and sustainable development. One of the limitations is the high energy consumption required by artificial intelligence, which means that sustainability issues also require urgent resolution, especially in the context of the global community's aim to achieve net-zero emissions.

As the synergy between artificial intelligence and financial technologies continues to evolve, the future likely depends not so much on whether AI can replace humans, but rather on their collaboration. AI is unlikely to fully replace humans in: relationship management – where human touch and empathy are necessary for client interaction; complex decision-making, where human intuition and experience are required; and creativity, which is essential in developing new financial products and strategies (again, AI can already provide necessary data and suggestions, but human strategic heuristics remain significantly more advanced and play a crucial role). In wartime conditions, the use of artificial intelligence in education can provide a range of opportunities to improve access to learning and ensure the safety of students and educational staff.

However, artificial intelligence has a dualistic nature: it can not only undermine stability but also be used to achieve and enhance it. Additionally, leading experts in the global financial industry need to find and retain talent with the right combination of technical and domain-specific skills to integrate artificial intelligence into their platforms. It is expected that artificial intelligence will play an increasingly important role in shaping the financial services landscape, indicating improvements in efficiency, innovation, and a more comprehensive consideration of individual user needs.

Problem solving, particularly in artificial intelligence, may be characterized as a systematic search through a range of possible actions in order to reach some predefined goal or solution. Problem-solving methods divide into special purpose and general purpose. A special-purpose method is tailor-made for a particular problem and often exploits very specific features of the situation in which the problem is embedded. In contrast, a general-purpose method is applicable to a wide variety of problems (Fig. 10). One general-purpose technique used in AI is means-end analysis a step-by-step, or incremental, reduction of the difference between the current state and the final goal.

Many diverse problems have been solved by artificial intelligence programs. Some examples are finding the winning move (or sequence of moves) in a board game, devising mathematical proofs, and manipulating "virtual objects" in a computer-generated world.

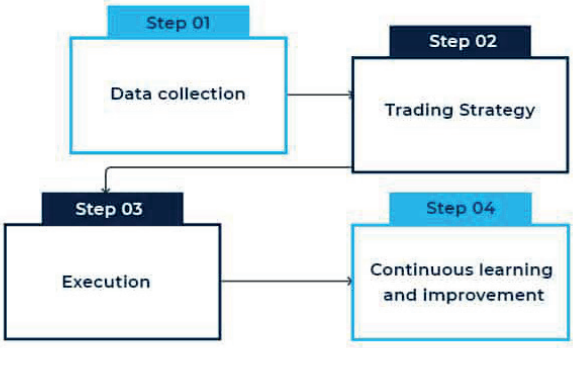

Fig. 10. AI crypto coins leverage artificial intelligence

Here is a step-by-step explanation of how they operate:

Step 1: Data collection

– AI-powered cryptocurrencies gather information from a variety of sources, including news articles, social media, and market patterns.

– This data is then analyzed using machine learning algorithms to find trends and forecast market behavior.

Step 2: Trading strategy

– The AI system develops a trading plan, including when to purchase, sell, or hold the cryptocurrency.

– This decision-making process is carried out automatically, without human input.

Step 3: Execution

– Once the AI system has chosen a trading strategy, it uses smart contracts to carry out trades on the blockchain network.

– These automated agreements self-execute and run autonomously when specific criteria are met.

Step 4: Continuous learning and improvement

– AI cryptocurrencies use machine learning algorithms to continuously learn and improve their performance.

– The system can review the outcomes of previous transactions and modify its tactics as necessary to enhance success in the future.

The proposed technology is essentially built on the idea of exploiting AI and blockchain advantages to design a more robust and resilient system ensuring high-level of security and scalability.

Typical public blockchain solution presents multiple draw backs which keep it far away of being used for generic IoT platforms due to the limited resources and computation power of IoT devices. In fact, this limitation prevents those devices from being effective miners in the blockchain network. Also, due to the massive deployment of those devices and their basic security levels, the blockchain network can be manipulated if more than half of these nodes were accessed by unauthorized entities. For those reasons, it is proposed to employ a novel permissioned blockchain network technology combined with AI as illustrated in Fig. 11 [52].

In traditional IoT environment, hackers may exploit firmware and hardware vulnerabilities present in gateways, servers, and IoT devices such that they can manipulate them and use their amassed power to achieve different cyberattacks such as DDos which may lead to temporary denial of service in the network. However, in the proposed technology, AI modules integrated in the IoT environment can detect suspicious and abnormal activities occurring in the network as well as protect those devices from different cyber-attacks.

By exploring how artificial intelligence is shaping the future of cryptocurrency and blockchain technology, from innovations in trading to improved security, and identifying key opportunities, let's outline the challenges of the future.

Consequently, our findings imply some recommendations for practitioners and regulators. Private investors should be aware that increased restrictions on sales and issues of domestic assets can lead to higher demand for alternative assets like BTC, which may impact market dynamics and investment opportunities. Moreover, investors should monitor and consider the impact of economic governance and capital restrictions on crypto-asset markets when making investment decisions. These factors may affect the potential returns and risks associated with such investments.

Institutional investors like banks and investment funds should acknowledge the growing interest in DEX platforms and crypto-assets, as these may provide opportunities for portfolio diversification and risk management. Traditional financial institutions may face increased competition from DEXs and other blockchain-based financial services, which could challenge their market dominance and revenue streams. Crypto-asset transactions on DEXs can be difficult to trace, posing potential challenges for banks and investment funds in complying with AML and KYC regulations. Therefore, institutional investors should consider exploring opportunities in the blockchain and crypto-asset space, including offering crypto-asset-related products and services to their clients, such as crypto custody, trading, and investment solutions (such as the recent approval of BTC and ETH ETFs by the SEC), alongside their more traditional financial products. Moreover, collaboration with regulators and other stakeholders is crucial for banks and investment funds to establish industry standards and best practices for dealing with the risks associated with DEXs and crypto-assets, such as fraud, market manipulation, and cyber threats.

Concerning regulators, these agents should carefully consider the potential consequences of implementing heavy tax burdens and loose monetary governance, as they may incentivize users to turn to unregulated platforms like DEXs. Furthermore, restrictions on the holding and transactions of crypto-assets (and even more so, outright bans) can also incentivize users to fly to unregulated DEXs. All banned or implemented strict restrictions on the holding, selling, trading, mining, and issuing of crypto-assets. Our results suggest that people use DEX precisely to circumvent restrictive regulations and poor institutions. In this regard, the case of Nigeria is enlightening. An outright ban on decentralized technology is doomed to fail because people can easily circumvent the ban.

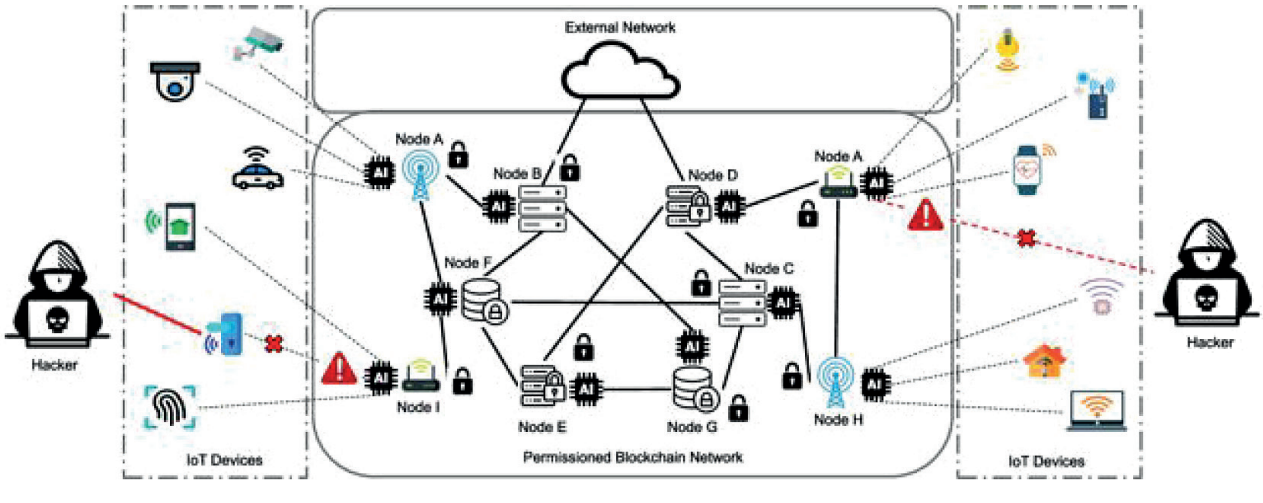

Fig. 11. Artificial intelligence technology on the blockchain development. The solid lines refer to connection and communication links between nodes participating into the blockchain. The dashed line reflects the communication links between devices and edge nodes. Red lines (solid and dashed) represent vulnerable connections and suspected communications

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A policy implication is that rather than wasting resources to try to ban unbannable technology, financial authorities should instead devote resources to nurture a sound institutional framework for crypto-assets with relevant and supportive regulation, with straightforward, easy-to-implement and enforce rules to deter illicit activities, support innovation, protect customers, maintain financial stability, and collect taxes.

To maintain stability in the crypto-asset markets and protect investors, regulators should monitor the relationship between economic governance, capital restrictions, and the use of DEXs.

A policy implication is that rather than wasting resources to try to ban unbannable technology, financial authorities should instead devote resources to nurture a sound institutional framework for crypto-assets with relevant and supportive regulation, with straightforward, easy-to-implement and enforce rules to deter illicit activities, support innovation, protect customers, maintain financial stability, and collect taxes.

To maintain stability in the crypto-asset markets and protect investors, regulators should monitor the relationship between economic governance, capital restrictions. Striking a balance between promoting economic freedom and ensuring proper oversight is crucial. In this manner, regulators in institutionally strong countries may significantly influence the global regulatory landscape for crypto-assets, setting examples and guidelines for other nations to follow. Indeed, they typically have more resources and expertise available to address challenges related to crypto-asset regulation, allowing them to develop more comprehensive and effective policies. Regulators from institutionally strong countries can thus encourage collaboration with regulators from institutionally weak countries to share best practices, resources, and knowledge, fostering a more consistent and coordinated global approach to crypto-asset regulation. These measures can help balance protecting investors, preventing illicit activities, and fostering a competitive environment that promotes innovation in the crypto-asset and blockchain sectors.

Concomitantly, regulators in institutionally weak countries may face more significant challenges in developing and enforcing crypto-asset regulations, including limited resources, expertise, and a potentially weaker legal framework. The potential for higher corruption levels and weaker governance in institutionally weak countries may lead to increased use crypto-assets to evade poor institutional frameworks, making regulation even more critical. Indeed, ill-designed and poorly implemented regulatory frameworks may imply high platform compliance costs and user administrative burdens, leading to detrimental consequences. This flight toward onion routing networks and obfuscation tools would be at odds with regulators' initial purposes and with the technology-neutral approach of regulation and the 'same activity, same risk, same regulation' principle as advocated by international regulatory authorities (such as the Financial Stability Board, the FATF, and the IMF). Therefore, regulators in institutionally weak countries should prioritize building capacity and expertise in the crypto-asset and blockchain sectors. They could thus seek partnerships and collaborations with regulators from institutionally strong countries, international organizations, and industry stakeholders to access resources, expertise, and support in developing and implementing effective regulatory frameworks.

4. Conclusions

The integration of AI and cryptocurrency is transforming the financial landscape, offering unprecedented efficiency, security, and investment opportunities. While challenges remain, the rapid development of AI-based tools is shaping a smarter and more autonomous cryptocurrency market. Investors who adapt to these innovations will be in a better position to navigate the changing landscape, capitalize on new trends, and optimize their strategies in this rapidly evolving digital economy. The novelty of this research is that it proposes the application of artificial intelligence in crypto trading and blockchain technology through a comprehensive review of modern scientific literature from leading experts and the proposal of innovative artificial intelligence models and programs for use in trading business operations.

The research revealed promising areas of crypto trading and blockchain technology based on artificial intelligence:

1. Cryptocurrency will become the preferred medium of exchange for transactions between agents and people, as well as between agents: cryptocurrency is internet-programmable money that has several advantages for supporting an agent-based economy. As AI agents become more autonomous and engage in microtransactions at scale (outcome measures: payment for withdrawals, data, API access, decentralized computing, or data resources, etc.), the efficiency, boundlessness, and programmability of cryptocurrency will make it the preferred medium of exchange compared to traditional fiat currencies. Additionally, agents will require unique, verifiable identifiers (e. g., "Know Your Agent") to ensure compliance with regulatory rules and requirements when transacting with businesses and end-users. Low-fee blockchains, smart contracts, self-custody wallets (e. g., Coinbase AI wallets), and stablecoins can help optimize and reduce costs for complex financial agreements between agents, while the verifiability and immutability of decentralized networks will provide trust and verifiability for AI agent transactions.

2. Generative AI and natural language interfaces will become the primary means for users to conduct transactions on-chain: as the speed of natural language processing and contextual understanding of AI for cryptocurrencies improves, in-chain interaction via conversational interfaces will become the standard user norm and expectation in line with current web2 trends (e. g., ChatGPT). Users will simply describe their desired transaction intent in natural language (e. g., "Swap X for Y"), and AI agents will translate these intents into verifiable smart contract code, offering the most efficient and cost-effective way to execute the transaction:

– By 2026, AI for generative design will automate up to 60% of the development process for new websites and mobile apps.

– By 2026, more than 100 million people will interact with robot colleagues in their collaboration.

– By 2027, about 15% of new apps will be automatically generated by AI without human involvement, which is almost unheard of at the moment.

– By 2025, more than 55% of all data analysis by deep neural networks will occur at the edge, while in 2021 this figure was less than 10%.

3. AI will generate the majority of all software code (including smart contracts), leading to a Cambrian explosion of on-chain applications and experiences: AI code generation capabilities are rapidly evolving in web2 (e. g., Devin, Replit) and radically changing software development paradigms. It is possible to believe that this shift will soon take center stage in cryptocurrency, with a near-term focus on significantly lowering the entry barrier for new and existing developers. However, the future state consists of AI "software agents" generating smart contracts and hyper-personalized applications from scratch in real time, based on user preferences stored and verified on-chain. AI performance KPIs focus on how well the AI system itself performs, using metrics such as accuracy, precision, and recall. Accuracy is a metric that measures how accurately an AI model identifies true positives (instances where the model correctly identifies an object or condition as it was designed to do). For example, in a face recognition system, a true positive would occur when the system correctly recognizes and identifies the face of the person it was trained to detect. Recall helps measure the ability of an AI model to detect all relevant cases, or true positives, in a data set. It shows how well an AI system can catch all real instances of the condition or object it is designed to detect. The Precision-Recall curve shows the relationship between these two metrics at different thresholds. By analyzing this curve, it is possible to determine the sweet spot at which the model performs best for specific use case. Understanding this tradeoff helps when fine-tuning AI models to perform optimally for their intended use cases.

Conflict of interest

The authors declare that they have no conflict of interest in relation to this research, including financial, personal, authorship or other, which could affect the research and its results presented in this article.

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Data availability

The manuscript has no associated data.

Use of artificial intelligence

The authors confirm that they did not use artificial intelligence technologies when creating the presented work.

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