Integrating Artificial Intelligence and Machine Learning with Blockchain Security

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Edited by

D. Jeya Mala and R. Ganesan

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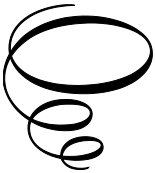

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We respectfully dedicate this book to all readers who desire to secure software application security through the use of an extensive and knowledgeable risk management system.

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Last but not least, we would like to thank all the reviewers and proofreaders who contributed to the high caliber of this book.

PREFACE

The notion of Blockchain security has experienced a significant surge in popularity in recent times. The utility of this technology arises from its capacity to construct a reliable and immutable network for conducting financial transactions. The inception of the Blockchain system can be traced back to 2008, when it was originally developed to support the functioning of the digital currency known as Bitcoin. However, it is worth noting that Blockchain technology possesses potential applications that extend beyond the realm of money exchanges. Currently, Blockchain technology is being utilized in a wide range of applications, encompassing areas such as identity verification and supply chain management.

The emergence of Blockchain technology has significantly impacted various aspects of the global landscape. Nevertheless, the vast potential of blockchain technology necessitates a significant level of responsibility, and ensuring the security of blockchain systems is of utmost importance. As the adoption of Blockchain technology increases among enterprises, it becomes imperative to address the concerns pertaining to data security. When making a determination about a Blockchain solution for a corporation, it is imperative to consider a multitude of security measures.

The process of ensuring the security of a Blockchain network include the identification and mitigation of any vulnerabilities that may arise within the distributed ledger of the Blockchain. The design for safeguarding the aforementioned elements is encapsulated in a Blockchain security architecture. The development of a robust security model for Blockchain is crucial in ensuring adequate safeguards for products that rely on this technology.

The administrators of a Blockchain solution require a comprehensive risk model that encompasses all potential threats to the system, encompassing those originating from various organizations, the governance structure, the technology, and the procedures involved. Subsequently, it is important to create a threat model for the Blockchain solution subsequent to a comprehensive evaluation of the associated hazards. In light of the aforementioned insights, there is a pressing need for a book that specifically concentrates on this particular subject matter.

Moreover, the paper titled "Integrating Artificial Intelligence and Machine Learning in Blockchain Security" is specifically focused on the subject of ensuring security inside the realm of Blockchain technology, particularly in relation to its real-world implementations. Each successive chapter of this study examines several application scenarios pertaining to the current advancements in this particular subject. The prioritization of methods that utilize artificial intelligence (AI) and machine learning (ML) for enhancing security in real-time domains is observed.

The chapters have primarily focused on various application domains, including healthcare, supply chain management, computer vision, enterprise resource management, authorization and authentication mechanisms, digital currency, business transactions, operating system level vulnerabilities, internet of things systems security, and fifth-generation wireless communication security. Therefore, this book will serve as a valuable resource for scholars and practitioners seeking to delve deeper into the utilization of artificial intelligence (AI) and machine learning (ML) methodologies in order to bolster the security of Blockchain technology.

CHAPTER 1

BLOCKCHAIN IN HEALTHCARE SECURITY WITH ARTIFICIAL INTELLIGENCE

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Abstract

In today's world blockchain is the rapid advancement technology and it provides various opportunities for professionals. As a result, various application sectors are looking for personnel with the competence required to manage this new technology. It is also significant in fields such as healthcare, infrastructure security, digital advertising, and many more. A peer-to-peer network's entire transactions are logged in a blockchain, a type of digital ledger. Participants can validate transactions using this technology without the necessity for a central clearing organization. The major highlights of this chapter are to concentrate in the field of healthcare utilizing blockchain's implications and functions. Blockchain has a major impact on how clinical trial fraud is handled for better patient outcomes. There is a threat in handling the medical documents of patients digitally. With recurring new waves of the pandemic wreaking havoc in the country, more patients prefer to avoid physical touchpoints and are opting to consult doctors online. This section focuses on how Artificial Intelligence can effectively access the blockchain to review the patient's medical data. As a result of integrating the most recent breakthroughs in these technologies, the medical system will have improved service efficiency, cheaper operating costs and decentralized healthcare.

Keywords: Artificial intelligence, blockchain, digital ledger, healthcare, Clinical trial fraud, Patient medical records

Introduction

Blockchain is a decentralised, immutable database that enables asset monitoring and transaction recording across corporate networks. Almost everything of value may be recorded and sold on the blockchain network, minimising risk and increasing efficiency for all parties. Blockchain technology may be integrated into a variety of sectors. Blockchains [1] are mostly utilised as a distributed ledger for monetary transactions. It holds immense promise in a wide range of corporate applications, including banking, finance, government, healthcare, insurance, media and entertainment, retail, and so on.

The advantage of using machine learning (ML) algorithms and other cognitive techniques in the medical field is referred to as "AI" in this context. AI can be easily defined as the ability of computers and other devices to replicate human perception and learn to think, make decisions, and act. A good way to forecast particular results, AI in healthcare frequently refers to the employment of machines to evaluate clinical facts and take action.

Blockchain in e-Health

The rate of development is accelerating in the healthcare sector [2]. There is a desire for superior medical facilities supported by the latest and most advanced technology. This is where blockchain could revolutionise the healthcare industry. Additionally, the healthcare system landscape is shifting to a patient-centric strategy that emphasises two key elements of these readily available services: adequate medical resources and blockchain technology, which can help healthcare organisations provide adequate patient care and world-class medical facilities. With this technology, you can quickly solve the time-consuming and repetitive process of sharing health information that drives high medical costs. Citizens can participate in health research initiatives using blockchain technology.

The treatment of various groups will also be improved by improved research and shared data on public well-being. The whole healthcare system and groups are managed using a centralised database. Unreliable facts, data protection, and interoperability troubles [3] have historically been the largest challenges in populace fitness care. The blockchain era is dependent on this particular problem. The right use of this generation improves security, record sharing, interoperability, integrity, real-time

updates, and access. Statistical safety is also a chief subject, mainly in the areas of the wearable era and personalised medicine. The blockchain era is being used to cope with these problems. This is because sufferers and scientific staff need easy and secure approaches to accumulate, transmit, and query information over networks without demanding approximate safety.

Blockchain security

Blockchain Security is a comprehensive risk management system for blockchain networks, including assurance services, cybersecurity policies, and best practises to mitigate the risk of fraud and cyberattacks.

Blockchain technology data structures have built-in security features such as consensus, encryption, and decentralisation. Each new data block is linked to all the old blocks, making manipulation almost impossible. Additionally, the consensus process (approved users) validates and accepts all transactions, ensuring the truthfulness and accuracy of each transaction. Since users cannot alter transaction records, there is no single point of failure. However, blockchain security goes even further than its built-in security features.

Healthcare will be impacted by blockchain in three key ways:

The word of the year is "blockchain.". As this new technology slowly evolves, it is becoming clear that disruption awaits everything from banking to supply chain operations. The blockchain revolution has a huge opportunity to disrupt and drive digital transformation [4]. There are many ways to use this technology, from medical records to pharmaceutical supply chains and smart contracts to distributing payments.

1. **Health records:** All modern medical systems are based on electronic patient files. But every time you visit the doctor, your medical records lengthen and become more complicated. Healthcare professionals find it difficult to get them because each hospital and doctor's office has a unique method of storing them. Many businesses already exist, including Patient, Medibloc, and the Medical Chain The objective is to offer patients control over their full medical history and to give both patients and doctors one place to access it. In addition to streamlining and improving access, the blockchain would also improve data security [5].

2. **Supply chain:** With one of the highest demands for product safety, protection, and stability, the pharmaceutical business is susceptible to. For example, blockchain technology can track supply chain management securely and openly [6]. This greatly reduces human error and time delays. Additionally, it can be used to track costs, labour, and even waste emissions at any stage of the supply chain. In addition, it can be used to trace products to their origin to confirm their potency and combat the $200 billion annual market loss caused by counterfeit medicines. More effective blockchain logistics solutions are already being developed by businesses like Chronicled, Block Pharma, and Modum. In particular, Modum complies with EU regulations prohibiting pharmaceutical exposure to situations, particularly temperatures, that could impair its quality. The answer provided by Modum was to create a sensor that can capture environmental data while physical goods are being transported and store it permanently on the blockchain.
   • Safeguarding patient data
   • Location of care for genomics administration
   • Management of personal health record data
   • Management of electronic health record data
   • Data management for electronic medical records (EMR)
   • Electronic health records that are interoperable
   • Disease prevention and outbreaks
   • Genomics Protection
      - **Genomic market:** Agencies like EncrypGen and Nebula Genomics are building blockchain platforms that permit people to safely proportion genomic facts in new and rising markets. You're betting that the possibilities surrounding individual genome sequencing will create a billion-dollar data market in the future. Blockchain is the best technology to solve the data security problem and ensure data moves from a source to an end user without These companies target companies that want to use blockchain technology to improve genomic data protection, enable buyers to efficiently collect genomic data, and address the challenges of genomic big data. I'm here. These companies are just a few of the dozens of startups aiming to use blockchain to disrupt healthcare.

Applications of blockchain healthcare

1. Electronic Health Records (EHR):

Over the past ten years, the need for digitising medical records has grown as healthcare professionals and practitioners have become more dependent on quick access to patient data. Electronic health records (EHRs) are digital representations of data that allow authorised healthcare providers to access these records at any time with enhanced security. Electronic health records (EHRs) include patient histories, diagnostic reports, medication information, treatment plans, and test results. Electronic health records are where the blockchain is most frequently used in healthcare systems to increase data security and dependability. Before blockchain technology, the drawback of electronic health records was that patient data was dispersed among different healthcare providers based on the patient's condition, and old data was inaccessible even within EHR systems. Many experts have recommended blockchain as a novel way to store patient EHRs so that their history and present information are safe forever and can be retrieved at any time.

2.Medical supply chain:

One area of the pharmaceutical industry [7] where blockchain might profit from the distinctive qualities and fundamental ideas of technology is the medication supply chain. The pharmaceutical supply chain is considered the most important when implementing technology-driven solutions and use cases. The global market for counterfeit and counterfeit goods is worth up to US$200 billion annually, and counterfeit medicines are a particular problem as the global black market sells such medicines to people without their consent. It is impossible to understate the growing danger that counterfeit drugs and medications pose to human life.

The pharmaceutical business faces serious issues with counterfeiting, which should be looked at as a potential alternative. Blockchain technology has the potential to transform the healthcare supply chain and prevent fraud by improving quality control in the manufacturing and distribution of medicines and drugs. Utilising blockchain technology, it is possible to track the production and distribution of pharmaceuticals as well as the entire lifetime of prescriptions and medications, right down to the individual dose. Several businesses, including Block Pharma, TIERION, CHRONICLED, and the U.S. Centres for Disease Control and Prevention, have adopted blockchain technology for the secure digital labelling of

medicines, allowing them to be safely and reliably tracked through their life cycle (CDC).

3. Clinical Research and Development:

Clinical trials involve particularly sensitive aspects of data privacy, integrity, sharing, record keeping, and patient enrollment, and a variety of privacy and security issues could arise. Blockchain, the upcoming internet generation, offers workable solutions to these issues. With the use of blockchain technology, several academics in the field of healthcare are attempting to address the constraints and problems in clinical records.

With the implementation and integration of the blockchain, artificial intelligence (AI), and machine learning techniques, the healthcare sector will undergo even more radical change. Systems to deal with the problem of patient enrolment employ an Ethereum protocol with smart contract capability for clinical data management. They suggested using Ethereum smart contracts for data management system transparency and security in clinical trials and research since they are faster at processing transactions than Bitcoin. Therefore, one of the most widely used current applications of this technology in clinical research and trials is the enrolment of patients via blockchain. A blockchain-based framework was used in another study's implementation to securely track and preserve patients' informed consent. These documents will be safe. These documents will be highly unrealistic, robust, and globally verifiable.

4. Genomic Market:

Genomic data generated by human genomic projects is being heavily utilised in the fields of industry and medical research. However, gene sequencing technologies are also rapidly improving in throughput, giving scientists the ability to speed up the genome sequencing process and reap huge cost savings. By 2025, it is expected that the genomes of 15% of the world's population will be sequenced, generating zettabytes of data. However, no reliable and secure data source can store large amounts of genomic and clinical data. Therefore, there is a need for technologies and tools that can aid in the processing and analysis of genetic data accessible to healthcare professionals, researchers, pharmaceutical companies, and other healthcare providers.

5. Pharmaceutical Medicine

The healthcare industry's fastest-growing and most important area is the pharmaceutical and medical sectors. To give patients the right medication when they need it, the pharmaceutical industry introduces new and potentially effective medications and pharmaceuticals based on current research on a range of patient health concerns [7]. Additionally, it helps to guarantee the legitimacy and safety of medications and other products offered directly to consumers. The pharmaceutical industry also aids in the analysis and preparation of secure medications and pharmaceuticals to hasten patient recuperation. In some typical situations, drug and pharmaceutical corporations are unable to track their medical products promptly because fraudulent or compromised medications may enter the system. The development and distribution of counterfeit drugs and medications via black markets pose a threat to public health on a global scale. Blockchain technology can assess, monitor, and guarantee the security and safety of drug and medical production.

6. Neuroscience Studies

Neuroscience is also an emerging field in healthcare, with new neural techniques exploring new paradigms for controlling data and devices using brain instructions rather than mechanical interactions. The brain's patterns are interpreted by these neural devices, which then convert them into helpful instructions that are utilised to control the external devices. Based on the information they collect from the brain, these gadgets also keep an eye on a person's mental health. Neural interface devices use a variety of sensitive sensors, computation processors, and wireless connectivity to complete the unique task of reading and converting brain impulses. These gadgets interpret electrical signals from your brain and send them to controlled gears. This gear is a device attached to a person's head. All this brain processing is powered by sophisticated algorithms and big data analytics, intended to record these brain signals into a neural interface device using blockchain technology.

In numerous neuroscience applications, including brain augmentation, brain stimulation, and brain thinking, blockchain technology is anticipated to be used as information technology. Blockchain technology offers the capability of brain data storage, which is required for digitising and storing all of the brain's data securely and reliably.

Challenges in Blockchain

The application of blockchain technology [8], which is still in its infancy, is spreading across a variety of industries and has the potential to alter the digital space. However, the technology is still in its infancy and faces some difficulties that will need to be overcome in the deployments to come. Here are some of the significant issues that are covered:

Interoperability: Interoperability is one of the main issues with blockchain technology. Because interoperability allows different users to send and share data and transactions over the network without the need for an intermediary, blockchain design sometimes breaks standards to make the network more flexible. It leads to interoperability and communication issues in blockchain networks.

Uncertainty: The blockchain idea is still in its infancy and cannot be put to use without explicit guidelines and assurance. Currently, a few effective efforts are making use of this contemporary technology. This difficulty must be taken into account if blockchain is to be successfully implemented in ambiguous circumstances.

Storage capacity: The healthcare industry has an enormous amount of medical data, photos, documents, and test results, and storing all these types of data requires a significant amount of storage space. Every node in a blockchain network has a copy of every record, which can exhaust the storage capacity of current blockchain technology.

Cost: Many businesses don't know how much it will cost to set up and maintain healthcare records using blockchain technology, and nobody can use the technology without understanding the precise costs involved.

Use cases for blockchain in the development of digital health

1. Supply chain transparency

Verifying the provenance of pharmaceuticals to validate their efficacy is a major concern not only for the healthcare industry but for many other industries [9]. Using a blockchain-based system to track items at every stage of the supply chain, from the moment they are manufactured, gives customers complete insight and transparency into the products they purchase.

This is a significant problem for the sector, especially in developing countries where tens of thousands of deaths occur each year due to counterfeit prescription drugs. It is also becoming increasingly important for medical devices. Medical devices are rapidly becoming popular with the spread of remote health monitoring and are attracting the attention of malicious attackers.

Blockchain's main advantages, when combined with AI, are:

- **Customer assurance**: The client's ability to follow a package's origins from beginning to end, with integration with producers, wholesalers, transportation.
- **Compliance:** To ensure patient safety, pharmaceutical companies and medical device manufacturers must submit many reports. Combining supply chain data in one system makes it easier to comply with.
- **Supply chain improvement**: Once all data is in one place, companies use AI to better predict demand and optimise supply while preventing criminal intent.

2. Patient-centric electronic health records:

Healthcare systems in every country and region are grappling with the data warehouse problem, which leaves patients and their healthcare professionals with an incomplete picture of their medical history. According to data from Johns Hopkins University released in 2016, medical errors are caused by poorly coordinated care, such as planned actions not being carried out as planned or omissions in a patient's record. It is the third-leading cause of death in the United States.

These are the main advantages of blockchain-enabled EMRs:

- A single source of truth and comprehensiveness for patient medical records improves the experience for both patients and healthcare providers.
- Patients can monitor when their medical records are updated and expressly consent to sharing this data with other individuals or medical professionals. Patients may also limit how long third parties have access to their medical information.
- Allows health insurers to quickly receive verified confirmation of medical benefits from patients without the time and expense of intermediaries.

3. Verifying the credentials of medical staff

Blockchain technology can be used to track the experience of medical professionals and the provenance of medical assets. Reputable healthcare organisations and institutions can log employee credentials, streamlining the recruitment process for these organisations.

The blockchain system's main advantages are:

- Quicker credentialing during the recruiting process for healthcare organisations.
- A chance for medical facilities, insurers, and healthcare providers to monetize their current credential information on former and current employees.
- Assurance and openness to partners.

4. Remote monitoring with IoT security

The use of remote monitoring solutions, in which various sensors track patients' vital signs, is one of the greatest advances in digital health, giving doctors a more accurate picture of a patient's health and enabling more proactive and preventive care. It's one of the trends. A previous article on 5G and edge computing in digital health presented some interesting use cases for remote monitoring.

Artificial Intelligence in e-Health

The vital role that healthcare plays in an affluent and productive society makes healthcare one of the most important industries in a larger big data environment. The use of AI [10–12] in the healthcare industry could mean the difference between life and death. AI can support doctors, nurses, and other healthcare workers in their daily work. AI in healthcare can improve overall patient outcomes, improve prevention and quality of life, and create more accurate diagnostics and treatment strategies.

AI can help predict and monitor infectious disease outbreaks by examining data from the public sector, the healthcare industry, and other sources. As a result, AI could become a key component of global public health efforts to combat pandemics and epidemics. Using ML and other cognitive fields for medical diagnosis is an important application of AI in healthcare.

AI can help doctors and other healthcare professionals use patient data and other information to make more accurate diagnoses and treatment recommendations. Additionally, AI can help make healthcare more proactive and predictable. AI can also help make healthcare delivery more proactive and predictive by analysing big data and suggesting better preventive measures for patients.

Features of AI in e-Health

1. Advanced-Data Analytics

In recent years, the process of gathering data in healthcare [13–15] settings has been streamlined. The data may now be used more successfully in predictive modelling, which will help to improve daily operations and patient care. Instead of concentrating only on historical or current data, we can use both datasets to monitor patterns and generate forecasts.

The practise of supplying healthcare on a price-for-carrier basis is hastily disappearing. In recent years, there has been a tremendous shift towards predictive and preventative interventions in terms of public fitness because of the extended need for patient-centric, or fee-primarily-based, hospital therapy. This is made possible through statistics. Practitioners can identify people who are in high danger of obtaining chronic illnesses and assist in addressing a hassle before it appears instead of just treating the symptoms once they appear. Because preventative care may additionally help to keep off high-priced hospital stays and lengthy-term issues, this lowers costs for the physician, coverage provider, and patient.

2. Chatbots in healthcare

The use of new technology is being driven by emerging trends like expanding service demand, a shift in emphasis toward overall well-being, and rising costs of high-quality care. Medical institutions are changing the rules of patient contact by utilising the power of conversational AI. The healthcare industry is witnessing a rapid increase in the creation and application of numerous AI solutions. The number of technology companies developing AI models and algorithms to improve the quality of healthcare is exploding.

Medical or healthcare chatbots [16] can be used for a variety of purposes, from improving the patient experience and assisting healthcare professionals to streamlining healthcare processes and generating useful insights. Medical

Chatbots are one of the most advanced and impactful AI-powered healthcare solutions ever developed, transforming the way payers, providers, and patients communicate with each other.

AI software tools can detect symptoms, guide medications, and help with long-term health problems. They help patients arrange appointments with specialists and provide appropriate advice for serious illnesses. Over the past decade, chatbot technology has evolved significantly, and both other AI tools have seen tremendous growth.

3. Data Privacy

The application of artificial intelligence (AI) in healthcare is expanding rapidly. The use of AI often revolves around access to medical patient data. As more medical information is shared between patients, doctors, and medical teams via AI products, they are protecting personal information.

The increasing use of AI in healthcare has drawn greater attention to underlying data security and privacy threats, the precautions that have to be taken, and prompted increased oversight and enforcement. Companies that use or sell AI-based healthcare products should comply with the data collection and use rules and regulations governing the retention and use of patient data and other common practicalities. AI-based healthcare products face problems that should be considered.

Radiology Applications

Artificial intelligence in medical diagnosis is not only a powerful tool for minimising physician fatigue but also provides tremendous support for radiology professionals to cope with potentially increasing workloads. To do. Radiologists must work at unprecedented speeds while managing enormous and ever-growing image volumes [17–19]. Today, they must prioritise the most urgent photos, sort through the volume of images, and coordinate patient care.

AI and deep learning solutions can help radiologists manage these high volumes of images by streamlining processes, saving time, increasing capacity, and improving diagnostic accuracy. This considerably lessens the radiologist's workload. Solutions like Aidoc search through enormous amounts of images and flag any that the AI deems to be of concern. The radiologist can then evaluate the highlighted images with the highest

priority, identifying urgent cases more quickly without sacrificing their current workload or cases.

Screening for Common Cancers

In routine preventive screenings for malignancies like breast cancer, medical imaging is frequently employed. It can frequently be challenging to definitively determine whether tissue microcalcification in breast cancer is aggressive or benign. False positives result in pointless intrusive testing or treatment, whereas undetected malignancies might cause a delay in diagnosis and worse consequences.

To more effectively classify micro-calcifications by the degree of suspicion for ductal carcinoma in situ (DCIS), AI can help increase accuracy and employ quantitative imaging features, potentially lowering the rate of unnecessary benign biopsies. It can frequently be challenging to definitively determine whether tissue micro-calcification in breast cancer is aggressive or benign. False positives could result in pointless intrusive testing or treatment, whereas undetected malignancies might cause a delay in diagnosis and worse consequences.

Medical Diagnosis

In medical diagnostics, artificial intelligence facilitates medical administration, automation, management, and workflow. Finds acute anomalies, marks significant discoveries in clinical images, supports radiologists in prioritising life-threatening conditions, becomes aware of cardiac arrhythmias, anticipates stroke outcomes, and helps regulate disorders. Rich in data, algorithms, analytics, in-depth knowledge, neural networks, and perceptive machine intelligence, the discipline is constantly growing and changing to meet the demands of the healthcare industry and its customers [20].

AI in drug discovery

AI algorithms can identify uses for new drugs and track their toxicity potential and mechanism of action. This technology has led to the creation of a drug discovery platform that allows the company to repurpose existing pharmaceuticals and bioactive compounds.

The platform's creators may produce more than 80 gigabytes of biological data each week, which is then examined by tools in 1.5 million trials to automate and advance the best facets of biology, data science, and chemical AI research. The potential for human bias is reduced by using machine intelligence methods to extract insights from biological datasets that are too complex for human interpretation. Large pharmaceutical companies are attracted to this strategy because it is less expensive to reuse and redeploy existing drugs than to develop them from scratch [21].

Virtual Care Assistants

Virtual care assistants help the healthcare sector save $20 billion annually by communicating with patients and directing them to the most appropriate care facility. It can monitor patients and respond to queries to provide timely, real-time responses. Most of the virtual care assistant applications available today enable frequent and consistent communication between patients and healthcare professionals. Inadvertent hospitalisations and readmissions are less likely since they happen between patient visits to the clinic. In addition to scheduling doctor visits and tracking patient health, AI-powered virtual assistants can provide patients with a personalized experience to help identify ailments based on symptoms. A virtual nurse will support you during treatment. The AI tool is used to improve patient participation and hone their self-management abilities to prevent serious illnesses from getting worse. The first virtual nurse assistant was Care Angel, which can conduct health checks using voice and AI.

Blockchain and AI Integration in Healthcare

Embedding AI capabilities in the healthcare sector is beneficial, as blockchain can provide security and trust. AI is now mainly used to detect abnormalities in X-rays and CT scans. This is a task that AI can perform at least as effectively as humans and provide more highly personalised treatment [22–26]. Experts predict that important inventions will emerge with huge benefits that can be achieved by reducing the cost of healthcare.

As a result, Google, Microsoft, Apple, Amazon, and many startups are launching new medical applications to make more effective use of patient data, improve certain diagnostic accuracy, etc., and provide relevant recommendations. We are actively investigating AI based on scientific evidence and research results. These apps complement improved surgical

care and virtual consultations via mobile apps. Complex algorithms, massive data sets, and efficient machines combine to create a modern approach to integrating medical technology.

Medical records and other data can be transferred to the blockchain via EHR systems. If this data were to be processed directly on the blockchain network, the small block size would increase the amount of computation and memory pressure. Moreover, such data is often subject to invasion of privacy. To solve these challenges, the most important analysis and implementation is to use frameworks to use responsible third parties (e.g., cloud computing) and blockchain for on-chain storage to store large amounts of data. Manage secure original information. Combining next-generation blockchain and artificial intelligence technology to decentralise and accelerate biomedical research and healthcare, deep learning is successfully used in medical diagnosis, cell image analysis, chemical synthesis, and drug classification.

Conclusion

Healthcare workers access blockchain to view patient medical information. AI makes extensive use of data, various proposed algorithms, and decision-making tools. Therefore, healthcare systems will increase service effectiveness, cut costs, and decentralise healthcare by incorporating the most recent innovations into these technologies. Blockchain enables AI to maintain the necessary cryptographic records.

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CHAPTER 2

A SYSTEMATIC REVIEW OF THE INTEGRATION OF BLOCKCHAIN AND KNOWLEDGE GRAPHS IN SUPPLYCHAIN TRANSACTIONS

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Abstract

Inefficiencies and disruptions plague the current supply chain. It was fairly obvious during the COVID-19 pandemic. The pandemic exemplified how simple it is to disrupt the entire supply chain. In this scenario, the primary cause of the disorder was a shortage of personnel. Supply chain management refers to the process of optimising the supply chain to reduce transport costs and ensure on-time delivery of the product. Enhancing the supply chain is a crucial aspect of business optimisation. The supply chain can be made more transparent and traceable by utilising blockchain technology. This would be even more crucial in the absence of a central authority based on trust. By means of knowledge graphs, the material transparency throughout the supply chain is increased.The knowledge graphs enable a more comprehensive view of the logistical system. Through this review article, we aim to determine the current state of the literature and identify the system's weaknesses and strengths in order to enhance them.

Keywords: Blockchain, Knowledge Graphs, Supplychain, Transparency, Transactions