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# Application of Blockchain in Different Machine Learning Technology and Health Care System

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**Abstract**

In current years, Bitcoin and its underlying technology Blockchain have become popular. The distributed database in Block chain highlights privacy and information security. Blockchain incorporates novel ideas from various fields such as public key encryption and distributed systems. A reader often comes across resources that explain the Blockchain technology from a certain perspective only, leaving the reader with more questions than before. Blockchain is heralded as a paradigm that will be as powerful as Big Data, Cloud Computing and Machine learning. In some issues, information inquiry is expected on blockchain based protected information. Machine Learning includes the levelheaded measure of information to pursue exact choices Information unwavering quality and its sharing are exceptionally urgent in Machine Learning to work on the accuracy of results. Both the combination of Machine Learning and Blockchain Technology, can give remarkablypreciseresults. In this paper, we have discuss different applications of blockchain inMachine learning. There are different customary Machine Learning techniques which show how the two technologies can be useful in various smart applications. Also provide an application of blockchain in health care system.

**Keywords :** blockchain, machine learning, smart applications, healthcare.

## 1. INTRODUCTION:

### Blockchain Technology:

Now a days, in recent technologies, various skills are embracing innovative tools with different benefits. The new technologies such as blockchain and machine learning are presenting massive progress and development in the different fields and also useful in several disciplines.Blockchain innovation is a design that stores value-based records, otherwise called the block, of people in general in a few data sets, known as the "chain," in an organization associated through distributed hubs. Blockchain Technology got recognition from Bitcoincryptocurrency which was described in Satoshi Nakamoto's whitepaper in 2008[1]. Each exchange in this record is approved by the digitalized signature of the holder, which confirms the exchange and shields it from altering. Consequently, the data the advanced record contains is exceptionally secure. Blockchain is an arising innovation with many benefits in an undeniably advanced world. Blockchain can be understood as a ledger that is public and every transaction is stored in blocks. There is series of blocks grows when new information is added and chain continuously grows. The important characteristics of Blockchain include persistency in nature, decentralized in structure, anonymity in feature and audibility[2]. The different advantages of Blockchain technologies are-

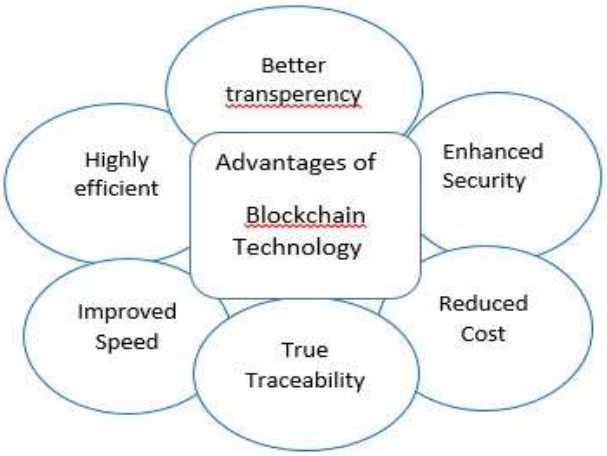


**Figure 1: Advantages of Blockchain Technology**

**Machine Learning:**
Machine Learning focuses in the various changes in the task performing systems those are associated with Artificial Intelligence. Artificial Intelligence or AI refers the ability of a machine to possess intelligence like human. The various tasks that are mentioned in Machine learning involves the diagnosis, planning, recognition, controlling of robots, forecasting and prediction .These "changes" involves the evolution of new system or enhancement of existing systems[3].

**Types of Blockchain:**
There are two basic types of blockchains: Public and Private. Also, there are many differences too, like Hybrid and Consortium blockchains. The different typesblockchain are shown in Fig-2.

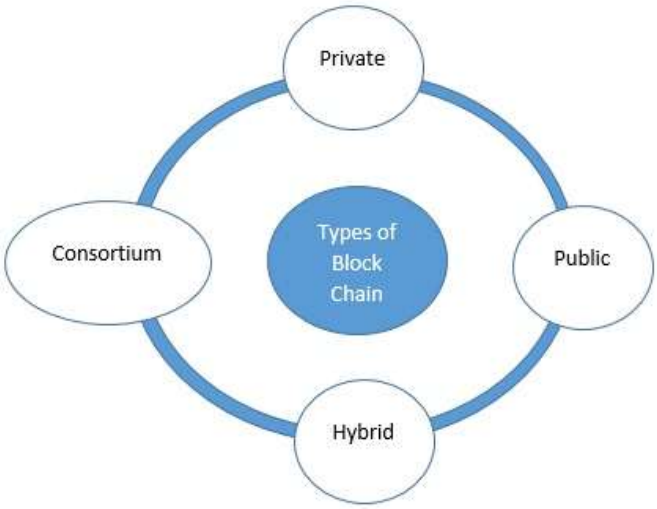


**Figure 2: Types of Blockchain**

**Related Works:**
A well-known information technology company, IBM announced that it will make a blockchain-based healthcare system to address this problem in 2018 [4]. In this research, they were concentrating on a healthcare echo-system with health insurance corporations. The main objective of this product based research is to minimize the data breaches based on health insurance data[5].ShrivastavaVeenet et al[6] have been discussed the various aspects of the

utilization of the Blockchain technology framework in the context of machine learning. The application areas of Machine learning where the implementation of Blockchain is beneficial are also explored. To secure the health care data and minimize the data breaches in both data sharing and data storing components are proposed by Mahima K.T.Y. et al[7]. In a paper published by Francisca in 2018, the importance of big data in Machine learning is mentioned. In this paper, the author recognizes the fact that due to tremendous growth in data everyday it is not possible to store data on local storage. Distributed storage can help to rectify this problem .Also author focused on various machine-learning algorithms for prediction, classification of data[8]. The Blockchain technology is also helpful in the biomedical and healthcare applications. In a paper published by Tsung-Ting Kuo the use of properties of BlockChain is discussed in the field of health base applications. The author discussed about the management of medical records and insurance claim property may be achieved with BlockChaintechnology[9]. The impact of Blockchain technology and Machine learning in various professions are also a factor to study .A paper published by John Flood studies the effect of these technologies in various professions. The author discusses about the various type of smart contracts that can be legally advised to the consumers[10].

**Proposed Works:**

**Blockchain and Machine Learning model:**

ML is one of the best trending technologies with remarkable capabilities on the other hand Blockchain is the soul of all cryptocurrencies. Day-by-day Blockchain technology is becoming very popular as this allows any user to directly deal with others through a highly secure decentralized system without requiring any intermediatory.The capabilities of the machine learning algorithm can be applied in blockchain to make the chain work smarter and better. Some of the points are point out bellow-

i) Blockchain can increase the security of the distributed leader of block the blockchainCombined with Machine leaning.
ii) The computation power of Machine learning can be used in the cut off the time taken to find the nonce and the Machine learning can be unutilized for sharing data routes easier.
iii) The enhance models of machine learning can be built by use the decentralized data architecture of blockchain technology.
iv) For building the prediction or for the examination of data in the blockchain network to store data are reasonably beneficial in machine learning models.For an example, In smart blockchainTechnology data are gathering by different sources like as sensors, smart devices, IoT devices and the other other major parts of blockchain where machine learning model can be applied for real time data analytics or predictions.

Architecture for machine learning adaptation in a Blockchain Technology based application:

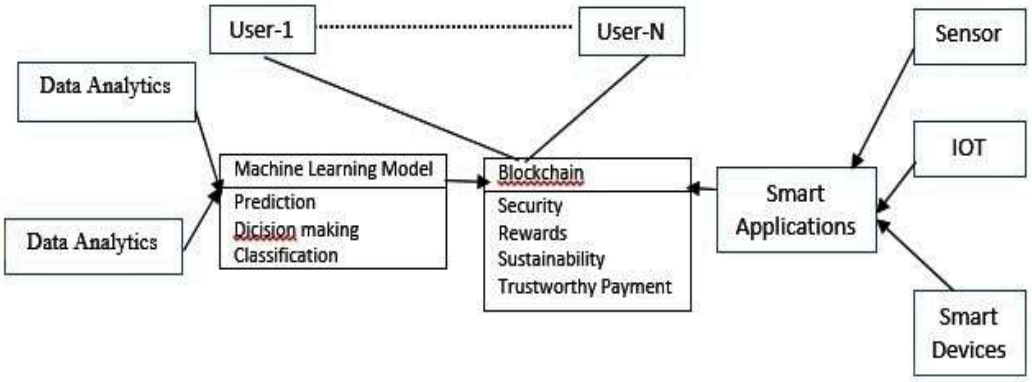


**Figure -3: Block Chain and Machine Learning model for Applications**

Maintaining the data in the network of blockchain will reduce the errors of the ML models due to:- As the data in the network will not have missing values, duplicates, or noise in it; machine learning model will give higher accurate results, as it is the fundamental requirements for it which is a primary requirement for the machine learning model for giving the higher accuracy.

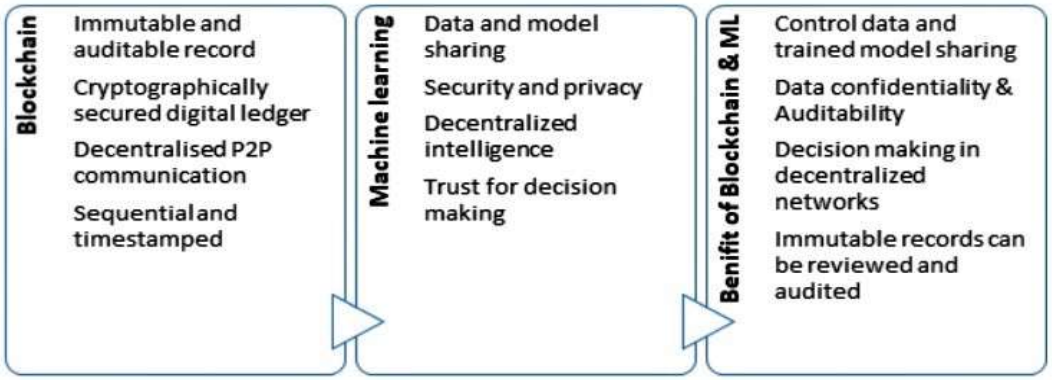


**Figure 4: Benefits of Blockchain and Machine Learning model**

**Applications Blockchain and ML:**

Blockchain and Machine learning based systems can be used in a variety of ways. The following are the applications: -

Data trading: For data transaction, Companies use blockchain in all over the world which can speed up the process of machine learning model. The work of the machine learning models is to control the data's trading routes. Also, they can be used for data validation and encryption.

Enhanced Client Service: In a company customer gratification is a highest priority to serves customer. Through a machine learning model or an AutoML framework with a Blockchain-based application, which can develop the efficiency and computerization of the service.

Industry Automation: To offer visibility, productivity, safety, and legal checks, Companies are currently depending on smart contracts and bitcoinblockchain-based operations as part of the manufacturing process. The different types of Machine learning's predictive algorithms are being used to develop reliable plans as an alternative of typical set machine maintenance schedules. Testing process and quality assurance have also become increasingly automated.

Smart cities: In smart cities blockchain andmachine learning technologies play a vital role to improving people living standard. For example, machine learning algorithms can monitor smart homes, and device personalization based on the blockchain can improve the quality of life.
Monitoring: Now a days increasing the crime rate and peoples are very much concerned about their safety. For inspection, ML and BT can be employed, with BT being used to manage continuous data and ML being used to analysis the information.
Logistics and Food: By providing transparency and accuracy, machine learning and blockchain are gradually eliminating end-to-end supply chain difficulties in the food business. Tracing the source of food and managing related financial activities has become easy due to blockchain.

**Block chain Used in Health Science:**
In healthcare system tosecure and improve flexibility for the future extensions in both data sharing and storing components a blockchain and graph-based application can be implement. Mainly the blockchain technology is proposed for the data-sharing component and the graph database is propose for data storing process.
In present digitalize healthcare systemsdata breaching is a major problem. There were millions of healthcare data breaches happen in a year and this will be increasing day by day. The different researchers did numerous research works to reduce the effect of data breaching problem.When we have studied different research work observe that most of problem arise in the data security and transaction time.

Healthcare systems store data in RDBMS or encrypted RDBMS databases. But the security and the flexibility of those database systems are low [11]. However, in this research, the authors proposed a graph- based database, which is able to store all the details of the healthcare sector, and it is able to extend for future requirements easily without worrying about data security. The authors chose a graph database since the graph databases are more secured than the traditional databases[11]. Moreover, the flexibility for future extensions of a graph database is high. To improve the security of the proposed graph database here authors store the encrypted data.
Here we have studied the healthcare system manually and visit some healthcare system and collect some data. On the basis of the study we have propose a graph base blockchain model and describe it.

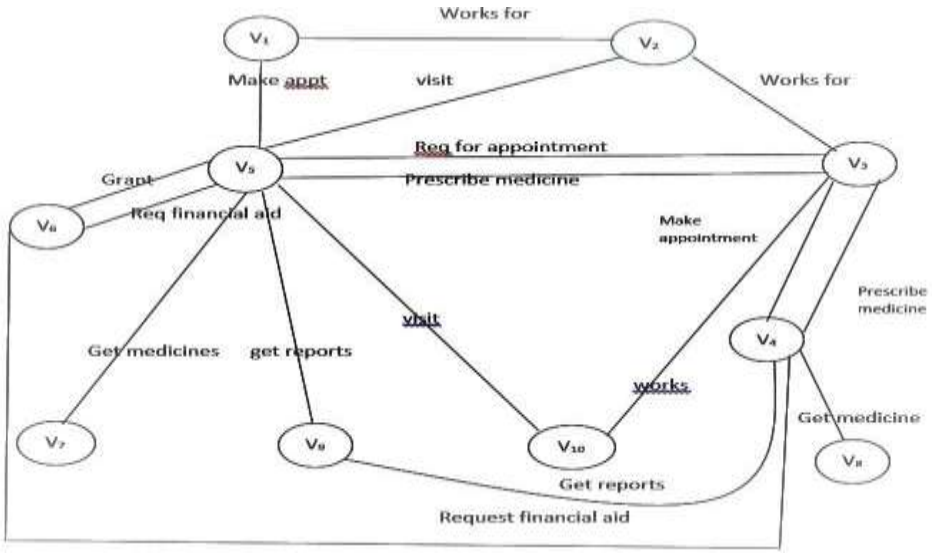


**Figure-5: Database Graph**

The bellow table (figure-) describe the vertices of the Database graph in figure-5.

| Node Name | Description |
|---|---|
| $V_1$ | Doctor N1 |
| $V_2$ | Hospital N1 |
| $V_3$ | Doctor N2 |
| $V_4$ | Patient N1 |
| $V_5$ | Patient N2 |
| $V_6$ | Financial Comp N1 |
| $V_7$ | Pharmacy N1 |
| $V_8$ | Pharmacy N2 |
| $V_9$ | Laboratory N1 |
| $V_{10}$ | Hospital N2 |

**Table-1- Various Nodes name in Healthcare System**

In the health care system in Figure 5 shows the nodes and edges which shows the relationship of the different nodes. The each node use as a store nodes. The nodes are store the details of a patent, doctors, hospitals, laboratory, pharmacy and financial company. They have a relationship. The relationship is represent by edges.The above table 1 clearly describes the nodes name.
In the system when a patient, doctor or an organization login then nodes or vertices are collect the data. In the proposed graph database when store the data, the security of the healthcare system is increased.In future in the system one can simply add the nodes and also mapping the nodes easily.

As mentioned earlier these data will stores after encryption via the proposed blockchain system. In addition to that this prosed blockchain will improve the security of the database via the hash id mapping process into the encrypted data. In the proposed solution blockchain technology is used mainly to improve health data security in the data sharing stage. Moreover, this blockchain system will be used to improve the security of the above-discussed graph database system. The complete flow of the research will describe briefly by below figure 6.

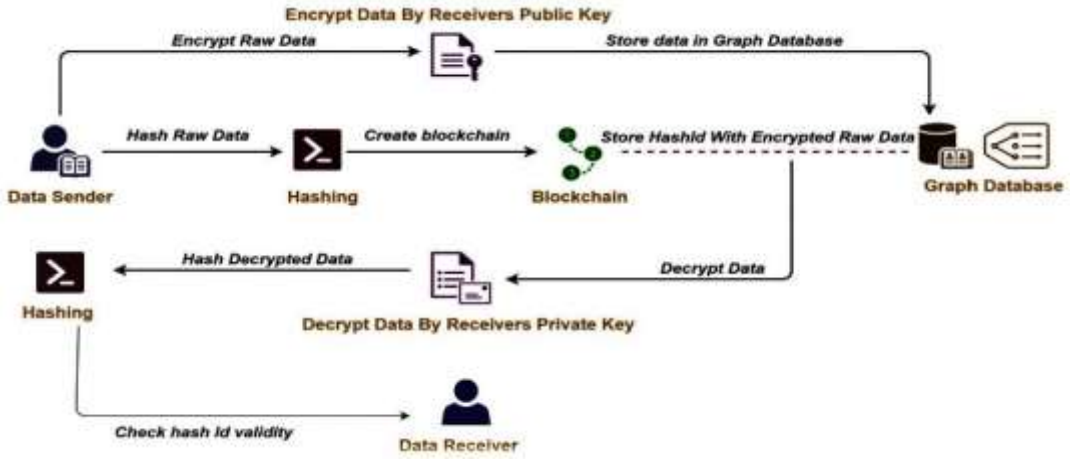


**Figure-6 –Block Chain System**

In this system when a user want to share and store some healthcare data to another node through the system at first the raw data is hashed and Encrypted by the receive nodes public key at the same time. After generating the hash encrypted data the data will be added to the blockchain. Then the encrypted raw data will store in the proposed graph database with the generated hash key. After creating hash key initially the encrypted data will send to the receiver and receiver will decrypted the data with private key.Thereafter to verify that the data is breached or changed the decrypted data will be hashed again and compare it to the hash in the assigned transaction in the blockchain.After verifying the validity of the data it will send to the receiver. Here also used public-key cryptography methodology.
For better application process of the graph database, one can use the Neo4J graph database management system. Because Neo4J graph database will provide better security in data sharing and storage.In this system we want to increase the data security through graph database blockchain system.

## 2. DISCUSSION:

The Biggest advantage of the fusion of Blockchain technology and machine learning is attaining to process large amount of data intelligently. In Machine learning scenarios till now not lot of work is done under the development of the structure of the AI system with the involvement of Blockchain Technology it get a trustable and framework that helps in various learning algorithms to grow up. The Disadvantage comes on the fact that this fusion between Blockchain and AI is only reliable if there is large database and information is available so that machine algorithms can get more training data and performs accurate results. The work on privacy is also to be done in the Blockchain Utilization.
The main objective of this research is to minimize the data breaching in healthcare systems in both data sharing and storing sectors and improve the systems flexibility for future extensions. As mentioned in the introduction section there were 200 million patients data were breached in 2019. Therefore to address this problem authors proposed a blockchain and graph-based system which is able to secure the patients' data in sharing and storing time. Moreover, this proposed system will be able to change for the future extensions easily

## 3. CONCLUSION

In the paper we propose that the combination of blockchain and machine learning is very beneficial. They are the two fundamental principles that will support future advances. These two are destined to make ground-breaking accomplishments when they work together, and they would also improve the safety. There is also the possibility of improving security by governing the chain with machine learning and artificial intelligence. ML also useful in analysing vast amounts of data. As a result, by exploiting the decentralised nature of blockchains, it gives an opportunity to construct stronger models. In this paper we have designed a model BT and ML model. We can use machine learning to make BT give a high level of security and trust. Integration of machine learning models can aid in the long-term viability of previously established terms and conditions. We can create an updated ML model based on the BT chain environment. Models can assist in the extraction of useful data from the user's end. Which may be calculated on a continuous basis and based on which we can award benefits to the user. This can be used to analyse the hardware of different machines using the BT's traceability so that ML models do not deviate from the learning path that they are allotted in the environment. In the blockchain ecosystem, construct a real-time, trustworthy payment mechanism are feasible. As well as in health care system blockcahin based graph database system increase the data security through encryption and decryption system.

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