Block chain-Based Healthcare Model to Predict Heart Disease Using a Machine Learning Techniques

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Abstract: Heart disease is a leading source of death globally, and early detection is crucial for saving lives. Characteristics such as blood pressure, cholesterol levels, blood sugar levels, heart rate, and body mass can be analyzed to predict heart disease in its early stages, and emerging technologies like machine learning (ML) and blockchain can help achieve this. This paper proposes a blockchain-based intelligent healthcare model that uses artificial neural networks (ANNs) to accurately predict heart disease while improving the protection level of the medical system. By combining the strengths of blockchain (BC) and ML, this model provides a secure, decentralized, and accurate solution for predicting heart disease. BC technology is utilized to store information from various sources securely and tamper-proof, protecting patient privacy and information security. ANNs are used to analyze complex data patterns and make predictions with high accuracy.

The model also provides a platform for medical professionals to collaborate and share information, leading to a better understanding of a patient's health status and better treatment options. The decentralized nature of blockchain reduces the risk of data breaches, increasing the overall security of the healthcare system. At the end, the proposed blockchain-based intelligent healthcare model has the ability to change the current medical infrastructure by providing a secure, decentralized, and accurate solution for predicting heart disease. It is a step towards a more intelligent and efficient healthcare system that prioritizes patient privacy and needs.

Keywords: Blockchain technology (BCT); healthcare model; heart disease; machine learning

1 Introduction

Globally, more than 17.3 million individuals die from heart disease every year, making it the prominent reason for death. In the modern era, heart disease is a prevalent condition that shortens lifespan and dies many people. The heart is a vital section of our body; without that, life is impractical, so life depends on the heart's ability to beat. Heart disease can make a person sick or even kill them because it affects how their hearts work. One of the main problems with heart disease is estimating a person's likelihood of having inadequate blood flow to the heart. Applying various longitudinal study autonomous-regression analyses can help build a prediction method [1]. Correct diagnosis and forecasting are essential concerns for practitioners as well as hospitals. While developing an intelligent healthcare solution, these crucial issues should be addressed. Numerous real-time information gathering and collecting services are now possible due to advancements in computing technology. As a result, a vast amount of health data is gathered, which is very helpful for clinical research [2].

Without a doubt, the healthcare industry constantly tries to keep up with new technology and use it to enhance the services offered to patients. Thus, blockchain technology has already started to be applied in many fields, such as healthcare data management, interoperability, and privacy. There may be more synergies, especially in the context of the intelligent healthcare sector [3]. By providing context awareness of intelligent settings to provide advanced healthcare services, the intelligent healthcare sector expands both e- and m-health models. The quality of life for patients may be improved, resource allocation may be optimized, and costs may be decreased as services adapt to their constantly changing environment.

According to Frost & Sullivan, incorporated health IT policies built on an impending cluster of data administration technologies, like BC, the Internet of Things (IoT), and ML, will be available to healthcare companies within the next five to ten years. Privacy is a major issue when storing and exchanging health data. Since present medical information gathering systems lack top-notch protection, BC might provide result in flaws like slashing and information theft. Among the various systems and employees involved, interoperability is a function of BC technology in the healthcare field that supports the safe exchange of healthcare data. It has several advantages, including improved interaction, time reserves, and operative efficiency. Corresponding to the study, the use of BC technology for allegations settlement and billing executive applications is anticipated to grow by 66.5 percent by 2025 due to challenges like faults, replications, and imprecise billing. All of these problems can be resolved using blockchain [4].

ML, a subset of artificial intelligence (AI), is used widely in medical diagnosis because it increases accuracy and reduces manual error. With the help of ML techniques, disease diagnosis is incredibly accurate. ML techniques predict diseases like heart disease, liver disease, diabetes, and tumours. Regression algorithms, such as Random forest (RF), lasso regressions, and logistic regressions, were utilized in medical diagnosis. Classification algorithms include Decision Trees (DT), Naive Bayes (NB), and Support Vector Machine (SVM) [5].

2 Literature Review

A Many excellent works have already been done in heart disease forecast utilizing ML algorithms, but these works have focused mainly on ML in medical laboratories.

In this research [6] Using various algorithms, related heart disease was predicted by K. Polara j et al. The effectiveness of multiple linear regression in predicting the threat of heart disease was examined using a regression model. 1000 cases with ten different characteristics are used as the raw data set for the study. The data is divided into two phases, with 70% of the data being utilized to train the machine and 30% being used for examination. As can be seen from the results, the regression algorithms come to the most accurate conclusions compared to other algorithms.

The author produced particular laws built on this Particle Swarm Optimization (PSO) process and assessed various rules to make further correct laws for heart disease detection. After assessing the rules, C 5.0 is utilized for the binary classification of diseases. The author assessed high precision using PSO and the DT process and used data from the UCI repository for implementation.

The authors suggested an intelligent heart disease detection process and employed ML approaches like NB, DT, and Artificial Neural Network (ANN). The NB predictive model achieved an accuracy of 86%. The second best discerning model was ANN which achieved an accuracy of 88%. The DT classifier achieved 80% accuracy [7].

Authors concentrated on the potential for cardiovascular disease throughout the COVID-19 outbreak. The government has had to enact some lockdown measures as a result of the nationwide quarantine in

order to stop the spread of COVID-19. All citizens stay at home due to these restrictions, which leads to physical inactivity. On the other hand, severe quarantine has increased the threat of cardiovascular mortality even though the WHO has created clear policies on the amount of natural activity needed to keep adequate health. Adverse health effects are seen after quarantine. The authors' suggestion that physical activity should be maintained even during quarantine in order to prevent adverse cardiovascular effects has influenced the design of the current research study [8].

In this research, the authors highlight that the health record is encrypted using fine-grained encryption technology, which also protects each health record's access controls. A user's private key is connected to a group of characteristics in ciphertext, which has to do with attribute-based access policies. If the doctor's attribute satisfies the access policy for the ciphertext, the doctor should decrypt this ciphertext, for instance, if a doctor or patient tries to access the health record [9].

This research shows that intelligent healthcare systems can offer more complex real-time services because of the fast-moving development of the medical IoT. For a distributed healthcare system, existing cloud-centric healthcare systems shouldn't rely on cloud computing to deliver electronic health records and medical services [10].

Most of the techniques have been utilized while utilizing and constructing many smart and intelligent frameworks such ML approaches [11-16], MapReduce and Explainable Artificial Intelligence (XAI) that may assist assistance in designing developing solutions for the rising issues in designing smart cloud-based monitoring management systems.

3 Proposed Methodology

The proposed model is based on a combination of Machine Learning and Blockchain technology to ensure the accuracy and reliability of the results. This approach will also help to prevent any tampering or manipulation of the medical data, as the blockchain provides a secure and tamper-proof environment. The model is trained on the UCI Machine Learning Heart Disease dataset, which contains various medical features of patients with heart disease. The model uses these features to predict the likelihood of a patient having heart disease. The evaluation of the model is performed using various performance metrics such as accuracy, precision, recall, and F1-score to ensure the robustness of the model.

In addition to the ML-based algorithm, the proposed model also incorporates a blockchain-based system to monitor and store the medical data of patients. This system will help to ensure the privacy and security of the patient's data and also provide a real-time tracking of the patient's health status. The system will also enable the patients to have control over their medical data and share it with authorized medical professionals as per their discretion. Moreover, the proposed model also includes a mobile application that can be used by patients to monitor their health status and keep track of their medical records. This application will provide real-time notifications to the patients regarding any changes in their health status, enabling them to take timely action. The application will also provide various health-related tips and recommendations based on the patient's medical history and current health status.

In conclusion, the proposed ML and blockchain-based intelligent healthcare model can provide an efficient and secure solution for monitoring heart disease. The model can help medical professionals to diagnose heart diseases accurately and provide timely treatment, which can save lives and prevent serious health problems. The model will also provide patients with a secure and convenient way to monitor their health status and keep track of their medical records.

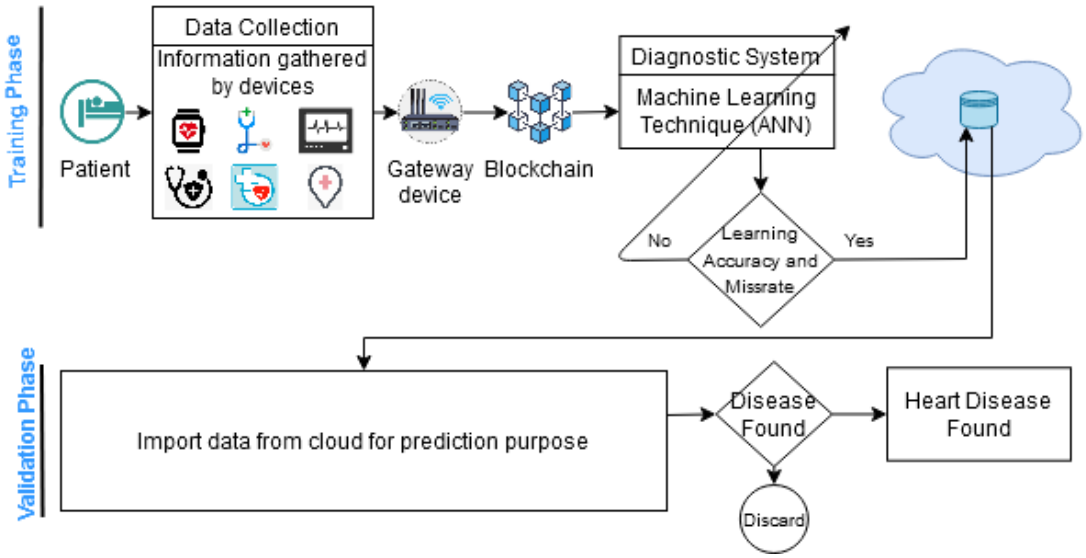

Figure 1: Proposed model

Figure 1 describes the proposed model, which consists of training and validation phases. The training phase is data collection from the patient using multiple digital medical devices and forwarding these values to the blockchain layer via the gateway device. A BC link is utilized in the healthcare process to maintain and replace patient information through hospitals, diagnostic labs, pharmacy firms, and physicians. It is critical to healthcare for some reasons. Firstly, it allows private information to be securely shared without copying it, which can help reduce mistakes in healthcare records. The data is also time-stamped, which gives it greater security. After proceeding learning technique and check whether the learning accuracy and miss rate are found. In the case of no, the diagnosis system will be retrained, whereas yes, the trained outcome will be stored on the cloud. The diagnostic system's input, hidden, and output layers are used in machine learning-based ANN architecture. The trained data saved on the cloud is imported in the validation phase using the ML technique for prediction purposes. It is checked whether the disease is found or not. In the case of no, the operation is discarded, whereas in the case of Yes, the notification will state that the disease has been found.

4 Limitations & Future Suggestions

The use of machine learning techniques to predict heart disease accurately has become a hot topic in the field of healthcare. As traditional healthcare systems are faced with many challenges, such as high energy consumption, limited access to resources and data security problems, there is a need for a smarter healthcare model that is capable of accurately predicting heart disease. In this research, a blockchain-based intelligent healthcare model was proposed that employs the Artificial Neural Network (ANN) technique for accurate heart disease prediction. This model has the potential to overcome all the issues faced by traditional healthcare systems. It also ensures a higher degree of security for medical records and could potentially provide better treatment for patients in the future. Furthermore, blockchain technology ensures that the data is immutable, which makes the system even more secure. This model could be of great benefit to medical professionals and patients alike, as it would enable them to accurately predict heart disease and provide better healthcare services.

5 Conclusion

The use of blockchain technology in healthcare is truly revolutionary, with potential applications far beyond what is currently being explored. With the help of advanced machine learning techniques, this technology can be used to accurately predict and diagnose heart disease and other chronic illnesses, while making healthcare more secure, transparent and cost-effective. Through blockchain-based healthcare models, patient data can be stored more securely, eliminating the possibility of data breaches and protecting user privacy. In addition, financial transactions can be made more secure, immutable and transparent, while online voting systems can be safeguarded against manipulation. The possibilities of blockchain-based healthcare models are vast and its potential to revolutionize the healthcare system is undeniable. By creating a system that is more reliable, secure and cost-effective, this technology can make healthcare more accessible to people all over the world, drastically reducing costs and improving the quality of care. In the long term, the use of blockchain-based healthcare models can revolutionize the way medical treatment is delivered and ensure the safety, security and affordability of healthcare for everyone.

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