A Systematic Literature Review on Heart Disease Prediction Using Block chain and Machine Learning Techniques

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Abstract- One of several major causes of death around the globe is heart disease. Blood pressure, cholesterol level, blood sugar level, heartbeat and body weight are several characteristics that may be monitored in a way to predict heart disease in the earlier stage by using emerging technologies in a better and secure manner that assists while saving lives. Emerging technologies like Machine Learning (ML) and blockchain are revolutionizing the existing healthcare infrastructure, which is a difficult task to securely and accurately forecast heart disease. Blockchain and ML are providing the best solutions to gather information while predicting heart disease. This study provides comprehensive reviews on different ML techniques (Support Vector Machine (SVM), Probabilistic neural network (PNN), Bayesian networks, Convolutional Neural Network (CNN), J48 and Artificial Neural Network (ANN)) in order to predict heart disease. This study proves that SVM works well compared to all other processes and achieves a maximum accuracy of 98.2%.

Keywords: *Blockchain Technology, Heart Disease, Disease Prediction, Machine Learning Techniques*

1 INTRODUCTION:

Heart disease is the prominent cause of death worldwide, reporting more than 17.3 million deaths yearly. Heart disease is a common condition that shortens lifespan and kills many people in the modern era. Life depends on the heart's ability to beat because it is a vital organ without which our bodies cannot function. Due to its effects on how the heart functions, heart disease can cause illness or even death in its victims. Calculating a person's likelihood of having inadequate heart blood flow is one of the main problems with heart disease. Building a forecast process can be aided by employing various longitudinal survey autonomous-regression assessments (Diwakar et al., 2020). Correct diagnosis and forecasting are essential concerns for practitioners as well as hospitals. These important issues should be taken into deliberation when predicting heart disease. Because of developments in computing technology, many services for real-time knowledge gathering and storage capacity are now feasible. As a result, a lot of health-related data is acquired, which is excellent for clinical research (Ketu and Mishra, 2022).

The healthcare sector undoubtedly makes a consistent effort to keep up with new technology and utilize it to improve patient services. As a result, blockchain technology has already initiated to be used in a range of businesses involving healthcare, interoperability, and privacy. Particularly in the intelligent healthcare sector context, there might be more synergies (Dagher et al., 2018). The smart healthcare industry expands both m- and e-health models by supplying context awareness of smart settings to deliver advanced healthcare services. As services adjust to their constantly changing environment, the quality of life for patients may be improved, resource allocation may be optimized, and costs may be reduced.

The authors demonstrated that within the next decade, medical institutions would have the right to effective medical IT policies built on an impending grouping of information management skills, including the blockchain (BC), the Internet of Things (IoT), and ML. While it happens to collecting and sharing health information, secrecy is a significant concern. Blockchain might be able to address issues like hacking and data theft because the current healthcare data storage systems are not highly secure. Interoperability is a characteristic of BC technology in the medical field that permits the safe exchange of healthcare information between the multiple processes and personnel concerned. It has several benefits, like enhanced interaction, period savings, and working effectiveness. The study estimates that because of issues like faults, repetitions, and erroneous billing, the use of BC technology for allegations settlement and billing administration functions will increase by 66.5 percent by 2025. BC technology can be used to solve each of these issues (Hassan, 2022).

ML, a branch of artificial intelligence (AI), is frequently used in medical diagnosis because it improves accuracy and lowers human error. Disease diagnosis is extremely accurate with the help of ML techniques. Machine learning techniques (SVM, Naive Bayes (NB), Decision Trees (DT), CNN, ANN, and Bayesian networks) are used to predict a variety of diseases, including heart disease, liver disease, diabetes, and tumours (Kavitha et al., 2021).

2 LITERATURE REVIEW:

Many excellent works have already been done in heart disease forecast employing ML algorithms, but these works have focused primarily on ML in healthcare sectors.

The authors used a variety of algorithms in this study(Benaddi et al., 2020) to predict connected heart disease. A regression model was used to investigate the efficacy of multiple linear regression in forecasting the threat of heart disease. The raw data set for the study consists of 1000 cases with ten distinct characteristics. The data is split into two phases, with 30% of the data being used for examination and 70% being used to train the system. The results show that, when compared to other algorithms, regression algorithms reach the most accurate conclusions.

Dixit and Kala developed a 1D CNN model to identify heart disease patients early on using a portable, affordable ECG sensor. Their main finding demonstrates that the model can accurately identify heart disease patients 93% of the time using data from 300 real patients(Dixit and Kala, 2021) .

In order to develop a more precise rule for heart disease detection, the author made particular rules based on the Particle Swarm Optimization (PSO) algorithm and assessed various rules. C 5.0 is utilized for the binary classification of diseases after the rules have been evaluated. Using data from the UCI repository for implementation, the author assessed maximum accuracy by employing PSO and the Decision Tree (DT) algorithm.

Another study presented that a CNN-based heartbeat segmentation method was suggested by Romdhane et al., and it was successful in 98.41% of cases where arrhythmia was detected (Romdhane et al., 2020).

The authors of this research emphasize that the health record is encrypted using fine-grained encryption technology, which also safeguards the access controls for each health record. The relationship between an individual user's private key and a set of ciphertext traits has to do with attribute-based access policies. If a doctor or patient tries to access the health record, the doctor should decrypt this ciphertext if their attribute complies with the access policy for the ciphertext (Khubrani, 2021).

This research demonstrates how the quick development of the medical IoT allows intelligent medical systems to support more sophisticated real-time facilities. Existing cloud-centric medical systems shouldn't be used to deliver electronic health records and medical services in a distributed healthcare system (Wang et al., 2022).

Most of the approaches have been used while employing and constructing several smart as well as intelligent frameworks like machine learning approaches(Ali et al., 2022, 2021; Ali Raza et al., 2022; Asif et al., 2021; Aslam et al., 2021; Chayal and Patel, 2021; Dekhil et al., 2019; Fatima et al., 2020; Ghazal et al., 2022; Khan et al., 2021; Muneer and Rasool, 2022; Saleem et al., 2022), Fuzzy Inference systems (Areej et al., 2019; Asadullah et al., 2020; Ihnaini et al., 2021; Saleem et al., 2019), Particle Swarm Optimization (PSO) (Iqbal et al., 2019), Fusion based approaches(Gai et al., 2020; Ma et al., 2020; Muneer and Raza, 2022; Sharma et al., 2021; Tabassum et al., 2021; Taher M. Ghazal, n.d.) ,cloud computing (Bukhari et al., 2022; Khan, 2022; Naseer, 2022; Siddiqui et al., 2021; Ubaid et al., 2022), transfer learning(Abbas et al., 2020) and MapReduce(Asif et al., 2021) that may provide assistance in designing emerging solutions for the rising challenges in designing smart cloud-based monitoring management systems.

3 CRITICAL ANALYSIS:

A Systematic Literature Review (SLR) is an analysis in which queries are expressed methodically, and explicit actions are utilized to find, select, and censoriously evaluate relevant research about heart disease to collect and assess knowledge from the works involved in the review, as shown in table 1.

Table 1: Performance of ML Algorithms to predict heart disease

References	Heart disease type	ML Algorithms	Data	Accuracy (%)
(Liu et al., 2012)	Cardiac arrest	SVM	1386 Patients	98.2
(Gokgoz and Subasi, 2015)	Heart disease (General)	Bayesian networks	39 Patients	93
(Vinitha Sree et al., 2012)	Cardiac arrhythmias	Probabilistic neural network (PNN)	90 Patients	85.6
(Acharya et al., 2017)	Arrhythmia diagnosis	CNN	MIT-BIH	84
(Daraei and Hamidi, 2017)	Myocardial infarction (MI)	J48	455 healthy and 295 myocardial infarction cases	82.57
(Dutta et al., 2020)	Coronary Heart Disease	CNN	National Health and Nutritional Examination Survey (NHANES)	79.5
(López-Martínez et al., 2020)	Hypertensive	ANN	National Health and Nutrition Examination Survey (2007–2016)	77

Table 1 shows the performance of different ML techniques. The SVM technique predicts cardiac arrest with a maximum accuracy of 98.2%, and the ANN technique predicts hypertensive disease with the lowest accuracy of 77%.

4 CONCLUSION AND FUTURE RECOMMENDATIONS:

This study presents comprehensive literature review on different ML techniques such as SVM (Liu et al., 2012), Bayesian networks (Gokgoz and Subasi, 2015) , PNN(Vinitha Sree et al., 2012) , CNN (Acharya et al., 2017; Daraei and Hamidi, 2017; Dutta et al., 2020) , J48 (Daraei and Hamidi, 2017)and ANN are applying on different dataset in order to predict multiple heart disease types. It is observed that SVM], Bayesian networks , PNN , CNN, J48 and ANN (López-Martínez et al., 2020)are achieving accuracies 98.2%, 93%, 85.6%, 84%, 82.57%, 79.5% and 77% respectively. By comparing all these techniques it is clearly seen that (Liu et al., 2012) achieves maximum accuracy of 98.2% and (López-Martínez et al., 2020) achieves lowest accuracy of 77%. In the future, SVM technique will also be applied to lungs disease prediction and may be show better performance.

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