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NON INVASIVE APPROACH FOR HEART DISEASE DETECTION, CLASIFICATION AND PREVENTION USING MACHINE LEARNING TECHNIQUES

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Abstract
Heart disease is a common condition that may be fatal in older people and those who don't lead healthy lifestyles. They may somewhat avoid it with regular diagnostic tests, proper eating habits, and regular checkups. A lot of patient data is produced by hospitals, including x-rays, lung tests, heart pain tests, chest pain tests; personal health records (PHRs), and so on. The symptoms—more precisely, the qualities needed for prediction—are used to create the decision tree classifier. Using the decision tree approach, we can pinpoint specific characteristics that are the best and result in a better prediction of the datasets. Hospital data collection is not being used effectively. Some of these technologies are utilized to get information from the heart disease detection database, while other uses are prohibited. This study determines whether or not individuals have cardiac ailments based on the data in their records by using a optimization techniques Machine Learning algorithms, and health care data. To determine if the patient has heart illness, try using the data as a model.

Introduction
A person's health is a fundamental need. According to World Health Organization data, heart disease is responsible for 24 percent of fatalities in India and 33 percent of deaths worldwide. Heart disease is the leading cause of death worldwide, affecting around 17 million people annually. Heart disease is among the world's leading killers. Predicting the onset of chronic illness might be challenging for a physical consultant. Traditional medical history has been deemed unreliable as a means of illness diagnosis for a number of reasons. Non-invasive solutions based on machine learning algorithms for illness prediction are accurate and practical. Safe and reliable BSN (Body Sensor Network)-based Internet-of-Things healthcare solution. Data may be collected and sent across the network by the IoT and BSN components without human intervention. When it comes to the safety of sending sensitive (life-critical) data over the internet, BSN-Care has you covered. The patient data is analyzed, and suggestions for diseases are provided. We use data from a variety of sensors to track vital signs and other patient metrics in our system. According to the latest statistics, cardiac causes of death are rapidly rising. Therefore, an intelligent cardiac disease prediction system is needed to reduce death rates. Heart disease may have several causes, including changes in one's way of life, increased levels of stress, and so on. Thus, cardiac disease prognosis is crucial to meeting basic human requirements. Several data mining methods have been applied to the problem of cardiac disease prediction, as we have seen in the scholarly literature. Vitals like blood pressure, heart rate, cholesterol levels, pulse rate, and so on are all taken into account while designing experiments. Large amounts of new medical data are being created every day, making it difficult to glean useful insights. When a person's heart is healthy, they are generally in excellent physical condition.

Literature Review

In Senthilkumar Mohan et. al. [1] proposed hybrid machine learning technique for an Effective prediction of heart disease. They implemented a new method which finds major features to improve the accuracy in the cardiovascular prediction by applying machine learning techniques. The prediction model is introduced with different features combinations and several known classification techniques. Machine learning techniques were used in this work to process raw data and provided a new and novel discernment towards heart disease.

In Amin Ul Haq et. al. [2] used seven well known machine learning algorithms, cross-validation method, 3 feature selection algorithms, and evaluation metrics for performance of classifiers like accuracy, sensitivity, specificity, execution time and Matthews' correlation coefficient. All classifiers' performances checked on all features in terms of accuracy and execution time. These classifiers' performances were checked by feature selection (FS) algorithms like LASSO with k-fold cross-validation, mRMR, and Relief on selected features.

In Li Yang et. al.[3] several methods were used to build prediction model. Consistent follow-up was managed using electronic health record system. They Provided a three years risk assessment prediction model based on huge population with high risk in eastern China for CVD (Cardio Vascular Disease).

In Fahd Saleh Alotaibi [4] to increase the prior accuracy score and forecast heart disease, researchers employed the Rapid miner tool and several machine learning algorithms. The cardiac disease dataset from UC Irvine was examined. The suggested approach enhanced the accuracy score previously obtained.

In Lewlyn L. R. Rodrigues [5] proposed for data analysis, use the Structural Equation Modeling approach using the Partial Least Square method. They used machine learning to investigate the effects of BMI, age, systolic and diastolic blood pressure, cigarettes smoked per day, and alcohol drunk per week on hypertension and coronary heart disease. Except for age, SBP, and BMI, the researchers observed that the rest of the characteristics were linked to CHD (coronary heart disease) and hypertension. These findings aided academics and medical practitioners in ML who are attempting to find correlations between these factors.

In Mohd Ashraf et. al. [6] Researchers suggested using the Deep Neural Network technology to develop an automated system for predicting heart attacks. Multiple datasets were used to evaluate ML algorithms for accuracy. The proposed solution used an automated data preparation strategy to eliminate abnormalities from the system.

Sumit Sharma and Mahesh Parmar [7] introduced the Talos Hyper-parameter optimization framework for cardiac and heart disease prediction. Heart illness is an important area where Deep Neural Networks may help improve overall heart classification consistency. SVM, Nave Bayes, and Random Forest all fared differently regarding classification. The Talos High energy Optimization outperformed the other classification algorithms in the UCI heart attack Dataset.

In Asma Baccouche et. al. [8] proposed an ensemble-learning framework based on unidirectional and bidirectional BiLSTM or BiGRU model with a CNN and achieved the accuracy of 91% for different types of heart disease. A data preprocessing with feature selection is implemented to improve the classifier performance.

Researchers in N. Sowri Raja Pillai et al. [9] employed a learning algorithm strategy for improvement goals outcome using patient diagnostic narratives using based on deep neural networks (RNNs), i.e. (PPRNN). Multiple RNNs are used in the hypothesized PP-RNN to learn from patient diagnostic code combinations in order to forecast the incidence of high-risk illnesses. Finally, the suggested strategy improved accuracy.

A new Cloud and IoT-based Medical application has been created by M. Ganesan and Dr. N. Sivakumar [10] to monitor and detect critical disorders. The svm classifier is trained employing data from the validation set during the training phase. During the system testing, real patient records was utilised to detect illness and the presence of disease.

Table 1: Summary of the Healthcare System methods

Author and Year	**Title**	**Advantages**	**Disadvantages**
Sunil S.Khatal ,Dr.Yogesh kumar Sharma *2019*[11]	"Health Care Patient Monitoring using IoT and Machine Learning,"	It has the potential to provide online patient monitoring data around the clock.	It may be technically difficult to keep up with the ever-evolving nature of machine learning and the Internet of Things.
Khatal, Sunil S., and Monika D. Rokade 2023[12]	"An Detection of Cardiovascular Disease using Deep Learning"	Patient-specific data, such as genetics, medical history, and lifestyle characteristics, may be analyzed using deep learning to provide individualized treatment regimens.	Due to a lack of appropriate training data, deep learning algorithms may be unable to recognize uncommon cardiovascular illnesses.
Khatal, Sunil S., and Yogesh Kumar Sharma 2020 [13]	"Analyzing the role of heart disease prediction system using IoT and machine learning"	Information is collected, stored, and shared across the devices without any noticeable hiccups in the process, allowing for further analysis.	If a secure method is not employed while exchanging data, it is vulnerable to attacks across a network.

Yang, Li, et al. 2020 [14]	"Study of cardiovascular disease prediction model based on random forest in eastern China."	Removes the need for manual system monitoring and measurement	You need to make better use of time and put together more materials.
He, Qingyun, Angelika Maag, and Amr Elchouemi 2020 [15]	"Heart disease monitoring and predicting by using machine learning based on IoT technology."	Recent studies often integrate RF with other algorithms or strategies to improve accuracy, allowing the suggested model to perform better.	Flexible, high efficiency, system speed and power Consumption systems are essential.

Limitations of this study

- While there are various diagnostic tests available for detecting heart disease, their accuracy may sometimes be limited.
- Some advanced monitoring equipment, such as continuous ambulatory electrocardiography (Holter monitoring) or implantable loop recorders, can be expensive.
- Certain monitoring devices may have technological limitations, leading to challenges in the accuracy and reliability of the data collected.
- For instance, issues related to data transmission, signal interference, or device malfunction may impact the efficacy of monitoring.
- As heart disease monitoring systems often collect sensitive patient data, ensuring robust security measures to protect this information from unauthorized access or breaches is critical.
- The reliability and accuracy of sensors used in monitoring systems can significantly impact the quality of data collected.

Conclusion

Because it makes a common platform available to the ordinary man at a price he can pay in many industrial sectors, the Internet of Things Architecture is essentially a well-functioning technology. Healthcare as a topic of study is integral to and inextricable from the aforementioned context. When it comes to gathering sensory data within this medical area and transferring it into smart devices, IoT provides a superior arena. The impoverished have the finest supervision thanks to the extraordinarily smart people among us. This is where the intelligence (or "smarts") of android devices, if you will, really kick in. The invasive nature of most tests used in the traditional method causes patients distress and might lead to apathy or neglect of their health. It's

difficult for them to maintain equilibrium under such conditions. This research aims to fill that need by creating a platform from which all indigent patients may get the recommended non-invasive care. In this scenario, patients will be able to alert and contact the on-call doctor 24 hours a day, seven days a week over the internet. In addition to vascular age and cardiac index, the suggested approach allows us to regulate a plethora of additional factors crucial to my own heart health.

References

[1] Sunil S.Khatal ,Dr.Yogesh kumar Sharma, “Health Care Patient Monitoring using IoT and Machine Learning.”, IOSR Journal of Engineering (IOSR JEN), ISSN (e): 2250- 3021, ISSN (p): 2278-8719

[2] Khatal, Sunil S., and Monika D. Rokade. "." 2023 International Conference on Emerging Smart Computing and Informatics (ESCI). IEEE, 2023

[3] Khatal, Sunil S., and Yogesh Kumar Sharma. "Analyzing the role of heart disease prediction system using IoT and machine learning." International Journal of Advanced Science and Technology 29.9s (2020): 2340-2346.

[4] S. Mohan, C. Thirumalai and G. Srivastava, "Effective Heart Disease Prediction Using Hybrid Machine Learning Techniques," in *IEEE Access*, vol. 7, pp. 81542-81554, 2019, doi: 10.1109/ACCESS.2019.2923707.

[5] Amin Ul Haq and Jian Ping Li , Muhammad Hammad Memon , Shah Nazir , and Ruinan Sun , “A Hybrid Intelligent System Framework for the Prediction of Heart Disease Using Machine Learning Algorithms”, Hindawi Mobile Information Systems Volume 2018, Article ID 3860146, 21 pages .

[6] Li Yang, Haibin Wu, Xiaoqing Jin, and Pinpin Zheng4 et al., “Study of cardiovascular disease prediction model based on random forest in eastern China “,Scientific Reports (2020) 10:5245

[7] Fahd Saleh Alotaibi,” Implementation of Machine Learning Model to Predict Heart Failure Disease”, (IJACSA) International Journal of Advanced Computer Science and Applications,Vol. 10, No. 6, 2019.

[8] Lewlyn L. R. Rodrigues, Dasharathraj K Shetty, Nithesh Naik , Chetana Balakrishna Maddodi and et al., “Machine learning in coronary heart disease prediction: Structural equation modelling approach ”, Rodrigues et al., Cogent Engineering (2020), 7: 1723198.

[9] Mohd Ashraf, M. A. Rizvi and Himanshu Sharma, "Improved Heart Disease Prediction Using Deep Neural Network", Asian Journal of Computer Science and Technology , ISSN: 2249-0701 Vol.8 No.2, 2019, pp. 49-54 © The Research Publication.

[10] Sumit Sharma, Mahesh Parmar , "Heart Diseases Prediction using Deep Learning Neural Network Model ", International Journal of Innovative Technology and Exploring Engineering (IJITEE) ISSN: 2278-3075, Volume-9 Issue-3, January 2020.

[11] Asma Baccouche, Begonya Garcia-Zapirain , Cristian Castillo Olea and Adel Elmaghraby, "Ensemble Deep Learning Models for Heart Disease Classification: A Case Study from Mexico", Information 2020, 11, 207;

[12] N. Sowri Raja Pillai , K.Kamurunnissa Bee, J.Kiruthika , "Prediction of heart disease using RNN algorithm", International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056 Volume: 06 Issue: 03 | Mar 2019 www.irjet.net p-ISSN: 2395-0072.

[13] M.Ganesan and Dr.N.Sivakumar, "IoT based heart disease prediction and diagnosis model for healthcare using machine learning models ", Proceedings of International Conference on Systems computation automation and networking 2019, IEEE- 978-17281-1524

[14] Yang, Li, et al. "Study of cardiovascular disease prediction model based on random forest in eastern China." Scientific reports 10.1 (2020): 1-8.

[15] He, Qingyun, Angelika Maag, and Amr Elchouemi. "Heart disease monitoring and predicting by using machine learning based on IoT technology." 2020 5th International Conference on Innovative Technologies in Intelligent Systems and Industrial Applications (CITISIA). IEEE, 2020.