International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 07 Issue: 05 | May - 2023 SJIF 2023: 8.176 ISSN: 2582-3930

Heart Disease Detection using Hybrid Machine Learning and IoT (Software based)

Tanmay Salunke, Pavankumar Jagade, Shreyash Pawar, Pavan Rathod, Prof.Neha Ghawate

Dept. of Information Technology, Parvatibai Genba Moze College of Engineering, Pune Maharashtra, India

tanmaysalunke981@gmail.com, pavanjagade90@gmail.com, shreepawarofficial2534@gmail.com, pavan.it.eng@gmail.com, nehaghawate1611@gmail.com

Abstract: *Heart disease is a prevalent ailment that may be deadly in the elderly and those who do not live a healthy lifestyle. It may avoid it to some degree with frequent check-ups and diagnosis, in addition to keeping a good eating routine. Hospitals generate a lot of patient data, such as x-rays, lung tests, heart pain tests, chest pain tests, personal health records (PHRs), and so on. The decision tree classifier is developed based on the symptoms, which are specifically the properties required for prediction. We will be able to identify specific features that are the best and will lead to a better forecast of the datasets using the decision tree technique. The data collected by hospitals is not being utilised efficiently. Other functions are not permitted, and some of these tools are used to harvest data from the heart disease detection database. In this research, several optimization methods (Fuzzy Logic, Random Forests, and Q-Learning) machine learning algorithms, and health care data are utilised to determine whether or not patients have cardiac illnesses based on the information in their records. Attempt to utilise the data as a model for determining whether the patient has cardiac disease.*

Introduction

A healthcare system should deliver improved healthcare facilities to individuals all over the world in an accessible and patient-friendly manner. The health system is changing recently, from an outmoded strategy to a new patient entered one. Doctors perform the key role in the traditional fashion. They must pay visits to the patients in order to provide proper diagnosis and recommendations. The two main concerns with this strategy are that first, the required physicians should be present at the patient's location for 24 hours, and second, the patient should be hospitalised for a lengthy amount of time in the hospital, with connected biomedical devices wired to the bedside. I found a patient-friendly solution to these two problems. Patients are aware of the skills and knowledge required to take a more active part in illness diagnosis and prevention in this area. A safe and easily available patient monitoring system is a crucial feature of this second strategy (PMS). Health is the most challenging issue for people all over the globe. According to the World Health Organization's composition, the best possible quality of health is a vital right for every person (WHO). One may protect his lifelong earnings by maintaining his fitness. Healthy individuals may also lessen the workload of public safety charities, governmental or non-governmental organisations, and networks, easing the stress on already overburdened hospitals, clinics, and medical practitioners. A modern, easily accessible healthcare system is essential for a healthy human being. The patient monitoring system has recently made significant gains as a result of enhanced technology. With different sensor data, we

compute patients' parameters (ECG, temperature, heart rate, pulse, blood pressure, and so on) in our system. According to the most recent report, the mortality rate from heart disease is skyrocketing. To reduce mortality, an intelligent cardiac disease prediction system is also required. Heart disease may be caused by a variety of factors, including altering behaviours, increasing stress, and so on. As a result, predicting heart disease is a highly important aspect of life. Different data mining approaches have been employed to forecast cardiac disease, as we have seen in the literature. The experiment parameters include blood pressure, heart rate, body temperature, pulse rate, ECG, and so on. Medical data is generated in vast quantities every day, making it difficult to extract useful information from it. The heart is the most important component of human existence, thus if it functions correctly, human health is good.

Literature Survey

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.

Researchers have designed an intelligent system to classify healthy and heart disease people.

In Li Yang et. al. [3] Various approaches were employed to construct a forecasting 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 Youness Khourdifi et. al. [4] researchers improved the heart disease classifier by filtering redundant features using the Fast Correlation-Based Feature Selection (FCBF). Then, they performed a classification based on different classification algorithms.

In Shadman Nashif et. al. [5] researchers designed a disease prediction system based on cloud. A real-time monitoring system sensing health parameters like blood pressure, temperature, heartbeat and humidity was developed using Arduino microcontroller. The proposed system can detect heart disease using ML techniques as recorded data transmitted to a central server is updated at every 10 seconds.

In P. Suresh et al. [6] implemented optimized prediction model using genetic algorithm and studied various prediction models and important feature selection algorithms. Its performance is better than other traditional prediction models. The various prediction models were retested with heart disease data sets and validated with real-time data sets. The K –Cross validation

methodology is applied to produce balanced training and testing data set.

In Fahd Saleh Alotaibi [7] researchers used Rapid miner tool and various ML approaches to improve the previous accuracy score and to predict the heart disease. UCI heart disease dataset was tested. The proposed work improved the previous accuracy score.

In Lewlyn L. R. Rodrigues [8] proposed the Structural Equation Modeling using Partial Least Square method for the analysis of data. They studied the association of body mass index, age, systolic blood pressure, diastolic blood pressure, cigarettes smoked per day, alcohol consumed per week on hypertension and coronary heart disease to use machine learning. They discovered that except for age, SBP and BMI, the rest of the features had a significant positive association with CHD (coronary heart disease) and hypertension. These results contributed for researchers and medical practitioners in ML which make an effort to look for these variables relationships.

In Mohd Ashraf et. al. [9] researchers proposed Deep Neural Network technique to create an automated system for heart attack prediction. ML techniques were tested on multiple datasets for certain accuracy. Proposed method introduced automated preprocessing approach in data and removed the anomalies from system.

In Kathleen H. et. al. [10] proposed a DNN training classification model and a DNN diagnosis model for heart disease. Applying classifier as enhanced DNN, they achieved 83.67% accuracy.

Proposed System Design

To remove all such drawback current Body sensor network has been implementing which provides a fully automated and wireless patient body monitoring. Basically proposed system has divided into two different phases, training and testing. In this research, an effective disease prediction using deep learning techniques is proposed. To achieve the classification accuracy, dataset plays an important role in entire execution. Generated the data from two different environments; first collected the dataset from Kaggle called heart disease prediction, while the second dataset generated from IOT environment. Various sensors have been established and connected with microcontroller. Each sensor collects data from user's runtime body events, and stores it into cloud database.

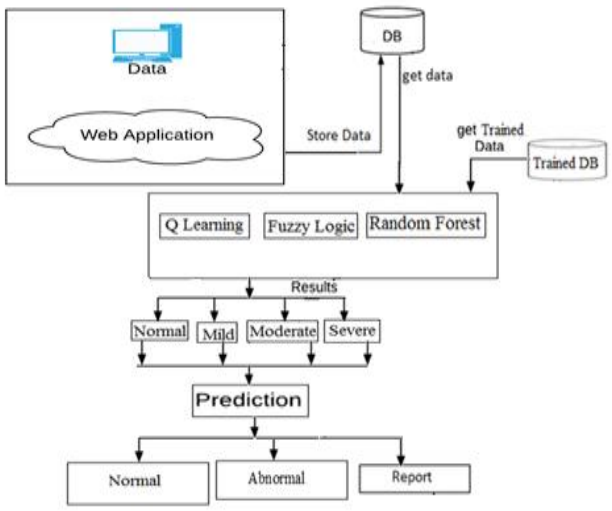

Figure 1: Proposed System Design

The proposed system is collaboration of various modules such IoT modules, database modules and GUI modules. In below section we described each module in detail

1) Training:

- Collect data.
- Apply data mining approaches.
- Data is been saved into the database called as background knowledge, which is used at the time of testing.

2) Testing:

- System work with synthetic as well as real time input patients data over the internet and predict the disease possibility based on trained module.
- Using a link-oriented architecture, all collected data is stored in a global database.
- In testing, all testing and training data are read simultaneously.
- Apply the classification of the machine and foresee the future application of the decision-making method.
- Finally, provide the consistency of the study with the system's real (positive) and false (negative)

Algorithm Design

Q- Learning Algorithm

Input: inp[1…..n] all input parameters which is generated by sensors, Threshold group TMin[1…n] and TMax[1…n] for all sensor, Desired Threshold Th.

Output: Trigger executed for output device as lable.

Step 1 : Read all records from database (R into DB)

Step 2: Parts [] ← Split(R)

Step 3:

$$\text{CVal} = \sum_{k=0}^{n} \textbf{Parts[k]}$$

Step 4: check (Cval with Respective threshold of TMin [1…n] and TMax [1…n]**)**

Step 5: if (Cval > Threshold)

Read all measure of for penalty TP and reward FN

Else continue. Tot++

Step 6: calculate penalty score = (TP *100 / Tot)

Step 7: if (score >= Th)

Generate event

End for

Fuzzy Logic Algorithm

Input: User input file data record which contains all body parameters sensor values, Patient id Pid, Timestamp T.

Output: Classified label

Step 1: Read R {All attributes} from current parameters.

Step 2: Map with train features with each sample.

Step 3: calculate average weight of train DB with same evidences

$$\boldsymbol{AvgTScore} = \sum_{\boldsymbol{k=0}}^{\boldsymbol{n}} (\boldsymbol{Sc})$$

Step 4: evaluate AvgTScore > threshold

Step 5: Return AvgTScore

Random Forest

Input: Selected feature of all test instances D[i….n], Training database policies {T[1]……T[n]}

Output: No. of probable classified trees with weight and label.

Step 1: Read (D into D[i])

V ←Extract features (D)

Step 2: N ←CountFeatures(D)

Step 3: for each(c into TrainDB)

Step 4: Nc[i] ←ExtFeatures(c)

Step 5: select relevant features of w= {Nc[i], N}

Step 6: Statement (w>t)

Step 9: Return Tree Insatnce { Nc[i], N, w, label}

Results and Discussions

The implementation process was completed in a Java open-source setting. The device operates on the Java 3-tier analytics platform with a distributed INTEL 3.0 GHz i5 CPU and 4 GB RAM. Whether an email is spam or not has been determined uses the Email Spam dataset. We have performed experiment analysis on ensemble machine implementation to verify the outcomes**.**

Figure 2: Accuracy of system analysis

Figure 2 shows the suggested system's classification accuracy and a comparison to several state-of-the-art systems. The figure above shows the detection accuracy of heart disease detection using different machine learning classifications.

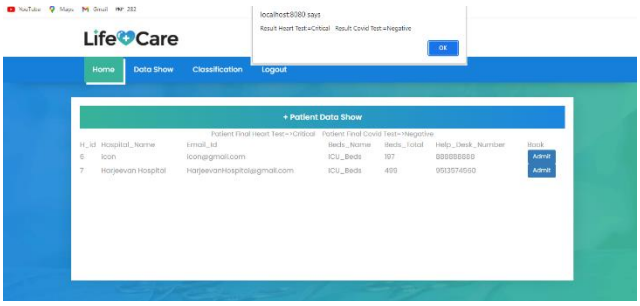

Figure 3: Patients Result

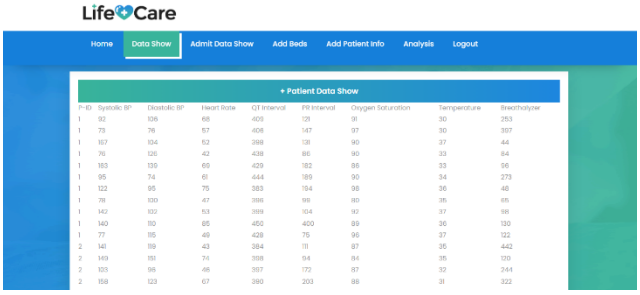

Figure 4: Admit Patient Data Set

Conclusion

The Internet of Things Architecture is a well-functioning technology because it gives the regular person with a common platform that they can purchase in a variety of different areas. In the aforementioned domain, the study field known as healthcare is an essential and unavoidable component of our daily life. The Internet of Things (IoT) provides a better platform for aggregating sensory data in the medical area and integrating it into smart devices. Super brilliance gives the finest supervision for the underprivileged. This is the most fundamental level of intellectual thinking in android devices, which may also be referred to as smart gadgets. In the traditional method, most examinations are invasive, causing patients pain and causing discontent or carelessness with their health. It's really difficult for them to manage with such situations. As a result, the purpose of this research is to supply them with a forum where each necessary patient may receive their vitals using a proposed non-invasive way. In this instance,

patients will use internet technology to contact the doctor 24 hours a day, seven days a week, and will be alerted. The suggested system can regulate cholesterol, blood pressure, stress indicators, and a variety of other measures that are critical to my heart health, including vascular age and cardiac index.

References

[1] 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.

[2] 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 .

[3] 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

[4] Youness Khourdifi and Mohamed Bahajm," Heart Disease Prediction and Classification Using Machine Learning Algorithms Optimized by Particle Swarm Optimization and Ant Colony Optimization", International Journal of Intelligent Engineering and Systems, Vol.12, No.1, 2019 DOI: 10.22266/ijies2019.0228.24.

[5] Shadman Nashif, Md. Rakib Raihan, Md. Rasedul Islam and Mohammad Hasan Imam," Heart Disease Detection by Using Machine Learning Algorithms and a Real-Time Cardiovascular Health Monitoring System", DOI: 10.4236/wjet.2018.64057 Nov. 22, 2018 World Journal of Engineering and Technology.

[6] P. Suresh and M.D. Ananda Raj," Study and Analysis of Prediction Model for Heart Disease: An Optimization Approach using Genetic Algorithm,", International Journal of Pure and Applied Mathematics Volume 119 No. 16 2018, 5323-5336, ISSN: 1314-3395 (on-line version).

[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] Kathleen H. Miaoa, Julia H. Miaoa, "Coronary Heart Disease Diagnosis using Deep Neural Networks", (IJACSA) International Journal of Advanced Computer Science and Applications, Vol. 9, No. 10, 2018