*2021 5th International Conference on Information Systems and Computer Networks (ISCON)*
*GLA University, Mathura, India. Oct 22-23, 2021*

# Cardiac Arrest Detection using Genetic machine Learning Algorithm

Dibakar Sinha
*Department of Computer Science & Engineering,*
*Shri Vaishnav Vidyapeeth Vishwavidyalaya,*
Indore (MP) India,
dibakar.sinha_phd18@gla.ac.in

Ashish Sharma
*Department of Computer Engineering & Applications,*
*GLA University,*
Mathura (UP) India,
Ashishs.sharma@gla.ac.in

2021 5th International Conference on Information Systems and Computer Networks (ISCON) | 978-1-6654-0341-2/21/$31.00 ©2021 IEEE | DOI: 10.1109/ISCON52037.2021.9702429

***Abstract*-Cardiac arrest is the world's mainreason for fatality. A boring job is the diagnosis of heart failure. For disease prediction, an intelligent system for disease detection is prime necessity. Todecide whether a sufferer is healthy or has illness, data mining methods are also used. In intelligent medical system for estimation and detection of different illness with good correctness, data mining methods have been commonly used. These methods were particularly useful in developing structures of health support because they were able to uncover occulted patterns and associations in patient records. One of the most necessaryuse of likewisemachines is the detection of cardiacillness since it is one of the world's mainreason of death. Almost all programmed that forecast cardiac disorders use clinical data with parameters and inputs from complex laboratory experiments. Neither system forecasts cardiovascular disorders that rely on concernedissues like age, diabetes,high-cholesterol, family background, consuming cigarettes, alcohol, physical inactivity,obesity, etc. Patients of cardiac arrest have various visible risk characteristics in common and can very easily be used for detection. Method focused on risk factors of this type will not only support medical practitioners, but also alert patients of the possible occurrence of heart disease when they go to the hospital or receive expensive medical exams.**

**This paper also supplies a predictive strategy for cardiac arrest using important health symptoms. The methodhasmultiple most useful methods for data processing, neural networks and naïve bays. Our proposed model claims that hybrid systems should be used for classification of heart disease (prediction). The hybrid method used for the initialization of neural network weights uses the whole optimization advantage of the genetic algorithm. Learning is faster, more reliable and right than context spread.**

**Our experimental findings in the data collection for coronary diseases prove that the hybrid method reports 95% accuracy and improves current techniques.**

**This technique can be used by medical practitioners to expect the heart arrest successfully long before it does occur and to save many patient lives,**

***Keyword: Machine Learning, classification, medical imaging, cardiac attack, ann.***

## I. INTRODUCTION

Heart disease is a cardiovascular disorder. Motion of blood through the veins may start or stop because the "coronary arteries narrow down, cause chest pain, heart attacks"[1]. Highly trained and competent doctors are required to diagnose heart disease [2]. Cardiac arrest is the major reason for fatality: more people die of Heart disease every year than any reason. Nearly half a billion people (about the population of New York) died in 2008 as a result of cardiovascular disease, accounting for 30% of all world deaths. Of these deaths, many were reported to be due to cardiac arrest and 6.2 million to stroke [1]. Current research into medicine has found risk factors that may lead to heart disease progression, but it takes further research to leverage this information to slow the prevalence of cardiac illness. The key risk factors for cardiac disease include diabetes, asthma and elevated blood cholesterol.Risk factors in the lifestyle include eating habits, inactivity, smoking, drinking, obesity and the main risk factors for cardiac disease and heart cancer [2,3]. Studies have shown that reducing these risk factors can help reduce heart disease. Data mining, an integration of various disciplines, is used to derive knowledge from vast volumes of data. Data mining is useful in extracting awareness of healthcare in clinical decision-making and in generating large-scale hypotheses [3]. Classification is an all-embracing challenge for many applications and unfamiliar samples. The researchers concentrate on the development of effective algorithms of classification for large data sets [1]. The rating scheme lets doctors examine a condition, whether heart disease is likely to occur. Langseth and Nielsen suggested secret naïve bays in 2005[4]. In secret naive bayes, hidden parents are generated for each attribute mixing the influences of all other characteristics [5].

HRV (Heart Rate Variability) has been used widely to test autonomous heart control under different circumstances. HRV is used to detect cardiac autonomy[1] as a therapeutic method. The HRV analysis is based on the RR interval analysis. RR intervals are the sequence of intervals between cardiovascular beats. Several features were used for HRV analysis. For eg, a basic time domain study for HRV such as the average, standard deviation, and a mean root square of the RR interval (RRI) is commonly used to measure the overall cardiovascular variability[2]. The HRV frequency domain function provides cardiac autonomous control markers[3]. There are also some nonlinear traits. The nonlinear relationship of different cardiac regulatory systems contributes to clinically useful principles of heterogeneity and regularity. Nonlinear research involves the calculation of complexity and the analysis of fractal scaling. There is a link between recumbent posture and HRV in patients with CAD, according to a previous study (Coronary Artery Disease). In previous research, HRV was observed as an increase in parasympathic activity and a decrease in the right lateral posture of sympathetic modulation[4],[5].

The aim of our paper is to suggest and then analyse quantitative steps for HRV and IMT along with an effective prediction approach to improve the efficacy of cardiovascular medical evaluation and care. We first studied the linear properties of HRV's time and frequency domain functions. PrimaCare maps, fractal scaling metrics and complexity calculations were used as non-linear functions. We have also calculated IMT with high-resolution ultrasounds and a newly developed algorithm for image processing[7]. Finally, we used classification approaches to estimate cardiovascular diseases in patients.

We checked the decision tree induction, support vector machine,associative classifiers , Bayesian classifiers and to make sure these process' corrrectness for detecting heart arrest.Experiments have demonstrated that the diagnostic findings could be improved with suitable classification methods.

## II. Related Works

M.A. M.A. Jabbar et.al suggested "intelligent cardiac detection process "[7]. Writers sought to improve heart attack accuracy. They also used techniques of discernment pre-processing and genetic algorithms applied on naïve bays. Predictions of cardiac arrest using associative classification and GA are formulated in [1]. In order to classify the risk of heart failure, the scientists developed a decision support system. Gini index and Z statistical tests are applied to the filtering of associative classification algorithm rules by numbers of rules. FSS and ANN classification is proposed in [3].

M.A was proposed to forecast heart disease using GA and nearest neighbor. As a function preference metric, Jabbar et.al is used in [9].GA. For building classifier, top ranking features are picked. Their process was good than other methods

A research was performed by Seyedamin et al in 2017. Research investigate and compare various parameter according to the value of precision. In this analysis different machine learning methods are used on small data sets and the results are compared. Heart disease dataset is applied on SVM that contributes to a classification. To increase the accuracy of bagging, boosting and piling techniques. Applying SVM , MLP is 84.15 percent more effective than other techniques[14].

In 2015, Nguyen Cong Long et al. conducts research on diagnosis of disease using a firefly algorithm. The classificator is educated with rough set theory. The findings are contrasted with other methods of grouping, likeSVM and Naïve Bayes. The suggestedprocess supervises convergence speed, time processing and precision add on to 87.2%. The drawback of this analysis is that where there is a many charecterestics[15], a rough set attribute cannot be handled.

A 2012 research by TasadduqImama,Jesmin Nahar , Kevin S. Tickle compared multiple classification schemes for cardiac disease extraction. SVM has promise when it comes to perfecting absolute accuracy as an output metric. The paper also addresses automatic choice of features and inspired methods of choice of features such as MFS and CFS. Both approaches have encouraging accuracy results[16].

In 2013, Jesmin Nahar et al. used the rule mining definition association to extrapolate primary cardiac arrest causes. Laws extraction experiment is performed using the law mining process on heart disease dataset (Predictive Aprior,Aprior,Tertius,). Predictive Aprior chooses a high-precision rule[17].

2014 H. Hannah Inbarani et al. is undertaking studies. In this investigation new methods of controlled function choice for disease prediction focused on the hybridisation of Fast Reduction of Particle Swarm Optimization (PSO) and PSO-based (PSO-QR).

A research paper entitled "Evaluation for human genome prediction: application for high-dimensional feature selection" has been released in 2015. The results of five separate feature-selection strategies are evaluated on the basis of the (G-BLUP) and (Bayes C) efficiency effects. This research predicts elevated cholesterol (HDL) lipoprotein and body mass index (BMI). The findings of the analysis indicate that supervised function selection of the SNP (G-BLUP) allowed for a scalable and computational alternative to BayesC. The drawback of this study is that predictive success involves too much assessment while supervised selections are used otherwise the results cannot be achieved[19].

DiviaTomar and Sonali Agarwal published a research paper that reduces the value of various methods of data mining, such as sorting, clustering, correlation, regression, and so on in the health study. They often show their benefits and weaknesses by introducing these strategies. They also highlighted obstacles and additional issues related to data mining on medical record. This article is suggested for the study of the available techniques of data mining[22].

## III. Datasets

UCI is an open source dealing with a range of illenss and includes a wide source of datasets, domain hypotheses and data generators that researchers use. The trouble with cardiovascular risk factors, which is that there are multiple risk factors such as age, tobacco use, blood cholesterol, exercise, blood pressure, stress etc.; it is a difficulty to consider and recognise each one in accordance with their significance. A cardiac defect is most often found as a patient approaches the advanced levels of the illness[21]. The major issues were then evaluated from multiple sources[22]-[23]. The dataset consisted of 12 significant risk factors such as age,sex, blood pressure background, alcohol ,Smoking habit, exercise, asthma, blood cholesterol, unhealthy food habit, fattyness. The machine indicated whether or not the patient is at issues of cardiac arrest. Data were gathered for 50 individuals from the American Heart Association[23] surveys. Most patients with cardiac illness have many correlations in issues[24].

## IV. Data Preprocessing:

1. Change missing values: We have used the philtre to change the missing values. This philtre substitutes lost values for the mode and mean of the training results.

2. Discretization: Number values is discretized by a 10bin Discretization Filter.

3. Inter-quartile range philtre (IQR): the IQR is a heterogeneity index. Data are divided into quartiles. Q1: In the first half of the ordered rank of data set middle value, Q2: median in the set of data. Q3: in the second half of the data collection, the "middle value is. Q3 - Q1 IQR= Q3.

| Category | Features | Data Type |
|---|---|---|
| 1 | Age | Integer |
| 2 | Gender | Categorical |
| 3 | Pain in Chest type | Categorical |
| 4 | BP | Integer |
| 5 | ECG outcome | Categorical |
| 6 | Cholesterol in serum | Integer |
| 7 | blood sugar in fasting | Categorical |
| 8 | Angina due to Angina | Categorical |
| 9 | HRmaximum | Integer |
| 10 | ST depression | Real |
| 11 | Thalassemia | Categorical |
| 12 | Exercise ST segment of slope | Categorical |
| 13 | Cardiac arrest | Categorical |
| 14 | Result due to fluoroscopy | Categorical |

## V. Methodology

This segment addresses the technological dimensions of our strategy. Below is our suggested algorithm. Algorithm: prediction of heart disease using secret naïve bays Input: data set for heart disease Output: Classification of whether a person is healthy or heart disease.

Step 1: cardiac record set is loaded

Step 2: Apply discretization of the philtre and the interquartile distribution (IQR)

Stage 3: Split the data into training and test collection

Phase 4: Data set for heart disease HNB is qualified

Stage 5: HNB is given the test data set for testing

Phase 6: Calculate the HNB algorithm precision for secret naïve bays (HNB)

Input: a database package

Output: Naive secret bayes classifier S

Phase 1: for each c class C value

Phase 2: Measure Database D probabilities P(C)

Stage 3: For Ai and Aj attributes

Step 4: Compute P(ai|aj,c) in D Step 5: Compute the MI=IP (Ai; Aj|C) and D weights of Wij.

### A. *Neuro-Fuzzy*

For building of a fluid-based neural network, the stochastic back propagation algorithm is used. The algorithm steps are as follows: First, start with the weights of connection ranging with irregular value. Then calclulateoutput value, input and error rate for every unit. Third, to manage ambiguity for every node, the amount of certainty (c) is determined for each node. Dependent on the calculation of certainty, the decision is taken. The certainty degree is determined according to the following parameters. If 0.8 < c 1, then b) If 0.6 < c 0.8 then high certitude (c) occurs If c 0.4 < c 0.6, then average certitude (d) If 0.1 < c 0.4, so there is less certainty (e) If c 0.1 so there exists even less certainty, then the network built consists of three layers, a layer of data, a hidden layer and an output layer. Figure 2 shows a trained neural network composed of 9 input nodes, 3 hidden nodes and 1 output node. If a thrombus or blood clot is more than 75 percent of the surface of an artery's lumen, the predicted outcome may be a predictor of cell death or cardiovascular disease, i.e. R is produced with regard to the input data set

## VI. Results

Each model was assessed on the basis of the following two measures (accuracy, sensitivity). As Table 1 reveals, the Bayesian model (BN) obtained 0.82 with a sensitivity of 0.87.

With a sensitivity of 0.88, the SVM achieved classification accuracy of 0.825. Sensitivity of 0.8717 and accuracy of 0.825 is obtained by the decision trees (C4.5). Nevertheless, the neural network model (MLP) was the best of the four models tested. MLP reached a scoring precision of 0.897 with a sensitivity of 0. 9017. Why does the MLP (neural network) function best? We know the syndrome is symptom mix. In reality, syndrome is a term diagnosed by mapping the symptoms to the minds of TCM experts. Thus, human brain syndrome is observed, and a neural network is considered the human brain's strongest model.

TABLE I. Performance measuring statistical parameter

| Parameter | Values |
|---|---|
| Sensitivity | 86% |
| Accuracy | 85% |
| Precision | 88% |
| Specificity | 81% |
| F-Score | 84% |

## VII. FUTURE WORK AND CONCLUSION

We also overviewed the issue of shortening various data mining algorithms. We based on forecastingmix of multiple target characteristics using various algorithms. In this article, we introduced automatic and efficient predictive approaches for heart attacks using techniques for data mining. Firstly, for the efficient diagnosis of heart attacks, we have provided an efficient method for drawing important patterns from cardiovascular data storage units Based on the measured significant weighting value, regular patterns with a value greater than the predefined threshold have been selected to be useful in predicting heart attack. Three mining priorities are specified on the basis of data analysis. All these models may respond to complex questions in heart attack prediction. This can be strengthened and extended further. Fifteen characteristics are mentioned in medical literature to predict heart attack. Other characteristics on outcomes such as financial status, depression, noise and previous medical records must be added apart from this list. Other methods for data processing, clustering ,time seriesand correlation principles can again be used to evaluate the nature of the patient. Time series simulation can be used in predictions for the creation of the false alarm rate. It may also be used to analyze the patient's illness in comparison to clinical treatment.

## REFERENCES


[1] Ed-daoudy, Abderrahmane, and Khalil Maalmi. "A new Internet of Things architecture for real-time prediction of various diseases using machine learning on big data environment." *Journal of Big Data* 6.1 (2019): 1-25.

[2] Verma, Prabal, and Sandeep K. Sood. "A comprehensive framework for student stress monitoring in fog-cloud IoT environment: m-health perspective." *Medical & biological engineering & computing* 57.1 (2019): 231-244.

[3] Ram, Sigdel Shree, Bernady Apduhan, and Norio Shiratori. "A machine learning framework for edge computing to improve prediction accuracy in mobile health monitoring." *International Conference on Computational Science and Its Applications*. Springer, Cham, 2019.

[4] Rastogi, Rohit, et al. "Investigating Correlation of Tension-Type Headache and Diabetes: IoT Perspective in Health care." *Internet of Things for Healthcare Technologies*. Springer, Singapore, 2021. 71-91.

[5] Idris, Nashreen Md, et al. "Feature selection and risk prediction for patients with coronary artery disease using data mining." *Medical & Biological Engineering & Computing* 58.12 (2020): 3123-3140.

[6] Idris, Nashreen Md, et al. "Feature selection and risk prediction for patients with coronary artery disease using data mining." *Medical & Biological Engineering & Computing* 58.12 (2020): 3123-3140.

[7] Sunagar, Pramod, et al. "Smart Healthcare: Using IoT and Machine Learning-Based Analytics." *Artificial Intelligence for Information Management: A Healthcare Perspective*. Springer, Singapore, 2021. 307-329.

[8] Edara, Deepak Chowdary, et al. "Sentiment analysis and text categorization of cancer medical records with LSTM." *Journal of Ambient Intelligence and Humanized Computing* (2019): 1-17.

[9] Paul, P. K. "Biosensor and Healthcare Vis-à-Vis Cloud Computing and IoT: Towards Sophisticated Healthcare Development—An Overview." *Modern Techniques in Biosensors* (2021): 253-273.

[10] Bentes, Paulo César Lucena, and Jurandir Nadal. "A telediagnosis assistance system for multiple-lead electrocardiography." *Physical and Engineering Sciences in Medicine* (2021): 1-13.

[11] Ma, Zhao, et al. "Association between gestational exposure and risk of congenital heart disease: A systematic review and meta-analysis." *Environmental research* (2021): 111014.

[12] Indrakumari, R., T. Poongodi, and Soumya Ranjan Jena. "Heart disease prediction using exploratory data analysis." *Procedia Computer Science* 173 (2020): 130-139.

[13] Shah, Devansh, Samir Patel, and Santosh Kumar Bharti. "Heart disease prediction using machine learning techniques." *SN Computer Science* 1.6 (2020): 1-6.

[14] Shah, Devansh, Samir Patel, and Santosh Kumar Bharti. "Heart disease prediction using machine learning techniques." *SN Computer Science* 1.6 (2020): 1-6.

[15] Aziz, Sameen, et al. "EARLY Heart Disease Prediction with Minimal Attributes using Machine Learning." *Pakistan Journal of Engineering and Technology* 3.2 (2020): 178-182.

[16] World Congress of Cardiology Scientific Sessions 2016 Volume 11, Issue 2, Supplement, Pages e1-e203, June 2016

[17] World Health Organization. The world health report 2000: health systems: improving performance. World Health Organization, 2000. ARCHANA, BADE, AHER DIPALI, and SMITA KULKARNI PROF. "International Journal on Recent and Innovation Trends in Computing and Communication." 2277-4804.

[18] Silwattananusarn, Tipawan, and KulthidaTuamsuk. "Data mining and its applications for knowledge management: A literature review from 2007 to 2012." arXiv preprint arXiv:1210.2872 (2012)

[19] Leventhal, Barry. "An introduction to data mining and other techniques for advanced analytics." Journal of Direct, Data and Digital Marketing Practice 12, no. 2 (2010): 137-153.

[20] Abdelaziz, Ahmed, et al. "A machine learning model for predicting of chronic kidney disease based internet of things and cloud computing in smart cities." *Security in smart cities: models, applications, and challenges*. Springer, Cham, 2019. 93-114.

[21] Pławiak, Paweł, and U. Rajendra Acharya. "Novel deep genetic ensemble of classifiers for arrhythmia detection using ECG signals." *Neural Computing and Applications* 32.15 (2020): 11137-11161.

[22] Mahdi, Muhammed Abaid, and Samaher Al_Janabi. "A novel software to improve healthcare base on predictive analytics and mobile services for cloud data centers." *International conference on big data and networks technologies*. Springer, Cham, 2019.

[23] Rastogi, Rohit, et al. "Intelligent heart disease prediction on physical and mental parameters: a ML based IoT and big data application and analysis." *Machine Learning with Health Care Perspective*. Springer, Cham, 2020. 199-236.

[24] Rastogi, Rohit, et al. "Intelligent heart disease prediction on physical and mental parameters: a ML based IoT and big data application and analysis." *Machine Learning with Health Care Perspective*. Springer, Cham, 2020. 199-236.

[25] Wang, Jian, et al. "A review of deep learning on medical image analysis." *Mobile Networks and Applications* (2020): 1-30.

[26] Shukla, Saurabh, et al. "Improving latency in internet-of-things and cloud computing for real-time data transmission: a systematic literature review (SLR)." *Cluster Computing* (2021): 1-24.

[27] Jackins, V., et al. "AI-based smart prediction of clinical disease using random forest classifier and Naive Bayes." *The Journal of Supercomputing* 77.5 (2021): 5198-5219.

[28] Jimenez, Jaime Ibarra, Hamid Jahankhani, and Stefan Kendzierskyj. "Health care in the cyberspace: Medical cyber-physical system and digital twin challenges." *Digital twin technologies and smart cities*. Springer, Cham, 2020. 79-92.

[29] Bhattacharyya, Debnath, and N. Thirupathi Rao, eds. *Machine Intelligence and Soft Computing: Proceedings of ICMISC 2020*. Vol. 1280. Springer Nature, 2021.

[30] Yazdani, Armin, et al. "A novel approach for heart disease prediction using strength scores with significant predictors." *BMC Medical Informatics and Decision Making* 21.1 (2021): 1-16.