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Artificial Intelligence-Enabled Heart Disease Prediction Using Genetic Evolutionary Heart Disease Optimization from Internet-of-Things Sensors

M. Annamalai[1], X. Mary Jesintha[2]

Abstract

Today, heart disease is one of the most important causes of death in the world. Therefore, the prediction and early diagnosis are important in supporting treatment time in a medical field. It reduces death and incurs less medical expenses. Cardiovascular disease (CVD), despite significant advances in the diagnosis and treatment, is still a major cause of morbidity and mortality worldwide. The heart rate, blood pressure, and temperature of the patient have carried during the testing phase through the Internet-of-Things setup. Artificial intelligence techniques such as depth learning and machine learning can improve medical knowledge due to unlocking the clinically relevant information and increasing the complexity of data. CVD brings a heavy burden on the whole of the patient and society. Therefore, to provide effective treatment options, there is a need to improve the diagnosis and treatment of cardiovascular disease. Regarding the above issues, the Genetic Evolutionary Heart Disease Optimization algorithm is proposed in this work; it uses the new communication and information technology to create universal health-care services and apply it to cardiovascular diseases and it also offers the potential to doctors in the heart and clinical practice.

Keywords: Cardio vascular disease, Genetic evolutionary heart disease optimization, Heart disease

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Introduction

A patient monitoring system is a process that can monitor multiple patients in remote locations because the surgeon is continuously monitoring several parameters simultaneously. Development and talent of the technology in different fields, one of them is embedded in the communication with the system, have led to a sudden change in lives. Regardless of the location, through communication medical services must be provided to improve the quality and access to health care possibilities. Advances in information and communication technology, as long as it happens to be the media to continuously monitor, enable the wireless sensor's technical health-related parameters. The doctor monitors the patient's current and previous state of health, can analyze and offer valuable real-time information. There are some efforts to develop a system for remote monitoring of patients.

An increase in health-care costs and services has extended the pressure of funds to the sustainability of the health-care system. To achieve sustainable development and to provide medical services, it needs to be more efficient. If the demand for services is well known, to optimize the process of placing the health service, it can improve the working efficiency. However, in the random demand for services, this is the reason for the non-efficient medical service process. The best design deterministic system, with very high available resources ≥90%, can achieve a best utilization rate. However, in a system with unique randomness, resource utilization is increased and the quality of service is reduced.

Surgical Patients Risk Prediction

Risk prediction in surgical patients includes two specific areas where patients are likely to require hospitalization (e.g., methods used to determine the risk of stroke in patients with atrial fibrillation), more generally. Risk stratification of adverse drug events in hospitalized patients is possible to group the target and is aimed at reducing the drug-related morbidity in the form of personalized medicine. It will support efficient clinicians more and hospital pharmacists will give priority to patients in the medical services. Risk prediction in a clinical environment leads to poor treatment and does not take into account the outcome for the patient.

Long waiting for elective surgery in the hospital, medical service planning, management, and delivery has promoted the country's research agenda. Since the operating room will affect the hospital's performance, the surgical schedule has to be analyzed in several methods. Under the operating room, in a complex and dynamic hospital environment, uncertain demand to optimize resources is assigned to deal with a surgical scheduling problem.

Health Surgery Patients

Surgical treatment, in many cases, offers important health effects and diagnostic information required. The delay in cancellation of

[1]Research Scholar, Department of Computer Science, Bharathiar University, Coimbatore, Tamil Nadu, India.

[2]Department of Computer Science, Periyar University, Salem, Coimbatore, Tamil Nadu, India.

Corresponding Author: Annamalai M, Research Scholar, Department of Computer Science, Bharathiar University, Coimbatore, Tamil Nadu, India.

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surgery is rare; the absolute number of cancellations during the perioperative period, creating a main source of waste, is high. These compensations represent the unused medical resources, and the value is as high as a dollar for every second. In addition, the negative impact of the previous cancellation of the patient's surgery leads to embarrassment. Factors can be greatly used to reduce the length of hospitalization from the electronic medical record system. Artificial intelligence (AI) is used in the medical field to help resource planning, and it satisfies patients in hospitalization by creating a disease prediction based on these factors.

Previous Research Work

The innovative system architecture has been proposed to improve the patient's hygiene and surgical process monitoring.[1] The integrated system, a video see-through headset, shows the complete set of information on the patient's health status (anesthesiologist with other members to wear involved a surgical team nurse and procedures) real time. Specifically, operators can get the patient's vital signs from the operating room or equipment and access electronic medical records in real time.[2]

Heart disease is the main cause of death in many countries. There are many ways to focus on the exact surgical methods for the treatment of this disease. The 5-year survival rate of heart disease patients, in general, is predicted by the small sample and the data size of the traditional regression model. Irreversible electroporation is used as a high voltage and a short electrical pulse is cut to break the tissue.[3-5] The success of treatment depends on the overall exposure to a direct lethal electric field. However, this contact is difficult to predict in advance, and it is to determine the best treatment parameters; it must be a challenge for clinicians. For clinicians, one method that can be relied upon is stopping the pulse during the electroporation which is to monitor the tissue's resistance between the changes under the cells in the tissue.[6,7]

It uses the prediction algorithm model partially observable Markov decision process of heart disease.[8] In an emergency, the doctor will transport the patient through the difficult situation of fog calculation warning in the rescue location of the doctor. Data obtained by the physician through the fog of computing yogism are a new field of medical computing; it has gained a lot of attraction than the traditional methods.[9-11] Heart disease and death are the most common causes globally; therefore, early detection of heart disease and ongoing monitoring can reduce the death rate. For such things, health monitoring on the internet and the rapid growth of data from different sources use wearable sensor devices, streaming systems, and others to produce large amounts of data[12] continuously.

In modern society, heart disease is the cause of concern and a short life span. Large-scale populations, to enable them to obtain accurate results quickly, will depend on the medical system. A large amount of data is generated and collected daily by the medical institution. With the rampant increase in the rate of heart attacks in puberty, the company detects the symptoms of a heart attack at an early stage and it must place a system that can prevent it. These are unrealistic to normal people as in many cases, expensive tests like an electrocardiogram are conducted. At the same time, predicting the probability of heart disease requires a convenient and reliable system.[13]

Heart disease is one of the most harmful and causes of death; it has a serious long-term disability. The disease will destroy the people so quickly that patient dataset details are useful to give required treatment as soon as possible. Therefore, patient's time is valuable based on the datasets emergency process can be done easily, and patients' lives can be saved.

A prediction model is trusted by patient's it gives priority-wise tasks depending on the patient's status. The rest of the LOS of each day can calculate the Spearman rank correlation between (training in the complete heart disease prediction dataset) each patient and each model's predicted probability.[14,15] It offers incentives to improve the flow of patients by increasing demand for services and economic pressure. The approach to providing an analytical tool to improve its collection efficiency enables clinicians and hospital administrators.

Materials and Methods

Cardiac auscultation is the first basic analysis tool used to assess the functional state of the heart. If the heart sound view from phonocardiogram indicates abnormal heart sounds, an electrocardiogram test is the order. Heart auscultation has a listening and viewing image, which provides higher accuracy of the initial diagnostic benefits. As expected, however, the diagnosis may not seem accurate due to noise or misunderstanding. AI machines are used to provide a potential diagnostic use of some features of the sound signals of the heart; diagnostic accuracy has been greatly improved. Such a process is expected to reduce mortality and health care costs.

Figure 1 described above shows the architecture diagram for heart disease prediction using the Genetic Evolutionary Hear Disease Optimization (GEHDO) algorithm. This method consists of an Internet-of-Things (IOT) input dataset and its feature extraction and prediction model to perform an evaluation.

Dataset Collection

The heart disease prediction dataset collection is the sum of 72 features that have been extracted from the IOT sensors and medical records. These features, demographic information like intensive care unit (ICU) information, surgical information, drug information, and the experimental parameters have been selected by experienced doctors and nurses.

Data Pre-processing

In the real world, consistent data cannot be used for direct data mining. Data cleaning, data integration, data conversion, and data compression are the many ways for pre-processing data. To improve the quality of data mining, the technology ensures reduction in data mining, and it takes the actual mining time.

Missing Data

In most of the methods, ICU viewing distance of prediction did not mention the treatment of missing values. Treatment of missing values describes most of the missing data directly excluded from patients.

Normal Distribution Transformation

Most of the numerical ICU data presented in this method have the inclination distribution that affects the model's final performance. Therefore, the normal distribution of the technology to fix it again is introduced in this method. In other words, the normal

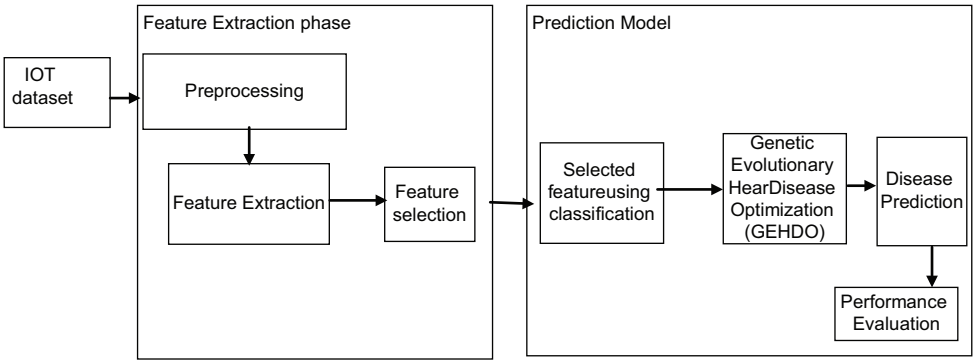

Figure 1: Proposed diagram for heart disease prediction

distribution transforms the coefficients which are done using all the features >0.5.

Normalization

Considering different dimensions between the numerical functions (equal age, white blood cell and neutrophils, etc.) and the scope of the ICU data that vary greatly, it is necessary to standardize the original data ICU. The Z-score method is used in this method to regularize ICU data. In this way, obtained data of the ICU follow the standard normal distribution.

Feature Extraction

Feature extraction will discover new dimensions such as age, gender, cholesterol, and treetops and these is a combination of the original size. It has been used in the compression process for the information theory in unsupervised learning and mutual information and supervised learning. Data mining is divided into two broad types which are predictive data mining and descriptive data mining. Predictive models can be deployed in one or more of the data model. The former structure is used to collect features such as age, gender, cholesterol, and treetops and the latter is used to generate the characteristics of the abstract and the label data.

Feature Selection

Function and retail remaining functions from the original feature set such as age, gender, cholesterol, and treetops select a subset of the best features discarded. Following certain criteria, this technique is used to select the optimal feature subset from the original input. If it reduces the high size of fewer dimension sizes, these problems can be resolved easily with high accuracy. Feature subset selection techniques such as packaging methods and embedding methods are divided into filtration methods. The filter method does not use any of the learning algorithms. This is useful for data analysis excluding salient features such as age, gender, cholesterol, and treetops which have some opportunities; this is fast and inexpensive. The wrapping method may be a subset of the evaluation function by the classifier or clustering algorithms because it takes advantage of the improved accuracy of selecting the functions related to the learning algorithm.

Feature Classification

Cardiovascular disease is the most important issue in the world of health care. Prevention and treatment management of the cardiovascular disease requires a universal record of data. Medical records are the most important data that must be classified by one of the technologies to be processed conveniently and quickly.

Genetic Evolutionary Heart Disease Optimization (GEHDO)

GEHDO is the proposed algorithm. It uses the new communication and information technology to create universal health-care services and apply it to cardiovascular patients; it also offers the potential to doctors in the heart and clinical practice.

Algorithm Steps

Step 1: Start the procedure.
Step 2: Then, the IOT dataset is inserted for pre-processing in the feature extraction phase.
Step 3: Next, after pre-processing, in the feature extraction phase, feature selection improves accuracy, if the dimension is reduced from the higher dimension to the lower dimension.
Step 4: The prediction model for the selected feature classification is done to maintain patient records and use classification. Therefore, the treatment process can be done easily and fast.
Step 5: After that the proposed algorithm creates universal health-care services and it also provides physicians potential in cardiac and clinical practice.
Step 6: Heart disease can be predicted using AI; it is possible to design medical assistant systems.
Step 7: Finally, the proposed algorithm and AI help precisely diagnose the disease by increasing the precision, robustness, and performance of disease diagnosing in the medical community.
Step 8: Thus, the result is succeeded.
Step 9: Stop the procedure.

Disease Prediction

The use of AI technology for cardiovascular disease will help design a medical support system. More and more attention is given to the promotion of new technology and the diagnosis of disease which are beyond the style of internal processing. Efforts of most of the doctor's and experts' are available for the early prediction of disease who use a label. In medicine, diagnosis of heart disease is important and this requires extremely important responsibilities. However, it is possible to improve the prediction

of heart disease by extracting the prediction data, medical data, including the patient's details to analyze and there are several tools.

Performance Evaluation

The most important factor and the index for heart disease patients are the patient information. The accurate information helps in improving the robustness and the medical community's diagnostic performance.

Results and Discussion

Heart disease and cardiovascular illness remain the primary causes of death many developed countries and middle-income countries. Many predispositions, such as the genetic susceptibility of such personal and professional life habits, are earmarked as the reasons. Early diagnosis of heart disease, medical efficiency, and accuracy plays an important role in preventing death. These refer to the feature extraction datasets such as age, gender, cholesterol, and treetops. As required by the medical field, large heart disease prediction datasets from various datasets such as age, gender, cholesterol, and treetops are useful in heart disease prediction. Artificial learning is one of the most rapidly developing methods and it allows the analysis of large amounts of data from various fields and is an important tool in the medical field. These can be done by reducing the error between the actual results and predicted which replaces the conventional prediction modeling methods using a computer to understand the complex non-linear interaction between various factors.

Table 1 describes feature development and high-precision calculations modeling technology, will be used in the prediction model. The best classification method has the highest accuracy, and high sensitivity is achieved by the proposed algorithm GEHDO. It gives superior performance compared to the existing methods. The proposed algorithm GEHDO achieves superior performance compared to existing algorithms of hybrid random forest (HRF) and genetic algorithm (GA).

Figure 2 describes feature development and high-precision calculations modeling technology, which will be used in the prediction model. The best classification method has the highest accuracy, and high sensitivity is achieved by the proposed algorithm of GEHDO. It gives superior performance compared to the existing methods. The proposed algorithm of GEHDO achieves 88% of result compared to existing algorithms of HRF 84% of result and GA with 76% of the result.

Table 2 describes that accuracy is defined as the ratio of the corrected prediction of positive class of an instance and classification error is defined as the percentage of available exact whereabouts unknown instance. To determine the feature of heart disease, performance indicators will help understand the various combinations of good feature selection. The proposed algorithm of GEHDO achieves superior performance compared to existing algorithms of HRF and GA.

Table 1: Sensitivity

No. of data	*GEHDO in %*	*HRF in %*	*GA in %*
10	70	68	60
20	75	70	64
30	84	80	72
40	88	84	76

Table 2: Precision

No. of data	*GEHDO in %*	*HRF in %*	*GA in %*
10	80	74	64
20	84	76	74
30	86	80	76
40	88	82	80

Figure 3 describes that accuracy is defined as the ratio of the corrected prediction of positive class of an instance and classification error is defined as the percentage of available exact whereabouts unknown instance. To determine the feature of heart disease, performance indicators will help understand the various combinations of good feature selection. The proposed algorithm of GEHDO achieves 88% of result compared to existing algorithms of HRF 82% of result and GA with 80% of the result.

Table 3 describes accuracy. It may give strong results than previous heart disease prediction datasets and algorithms used to improve the performance of heart disease. It can also improve the precision performance of the prediction of heart disease. Several methods are performed. All of the features are used due to the function selection limits used by the proposed algorithm. It does not require any of the limitations of feature selection. The proposed algorithm of GEHDO achieves superior performance compared to existing algorithms of HRF and GA.

Figure 4 describes accuracy. It may give strong results than previous methods heart disease prediction datasets and algorithms used to improve the performance of heart disease. It can also improve the precision performance of the prediction of heart disease. Several methods are performed. All of the features

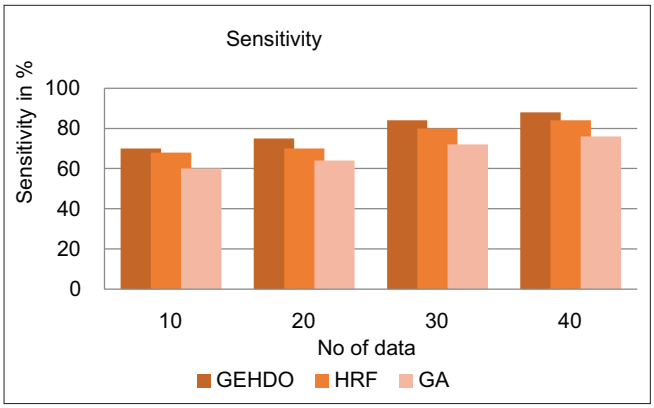

Figure 2: Sensitivity

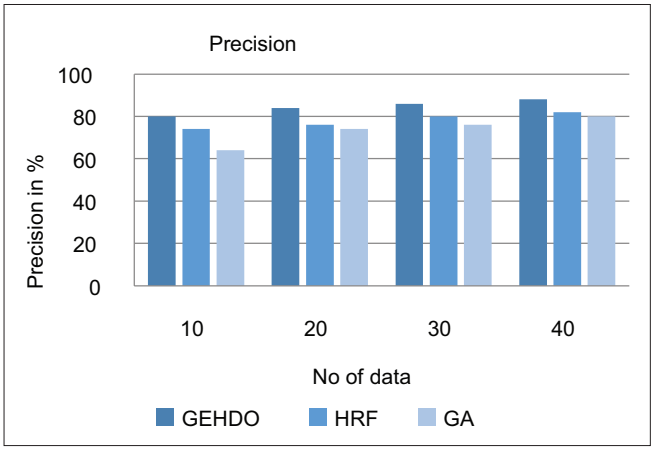

Figure 3: Precision

Table 3: Accuracy of artificial intelligence

No. of data	*GEHDO in %*	*HRF in %*	*GA in %*
10	72	70	65
20	75	72	70
30	80	74	72
40	84	79	74

Table 4: Time complexity

No. of data	*GEHDO in ms*	*HRF in ms*	*GA in ms*
10	16	40	46
20	20	38	42
30	22	32	40
40	25	30	34

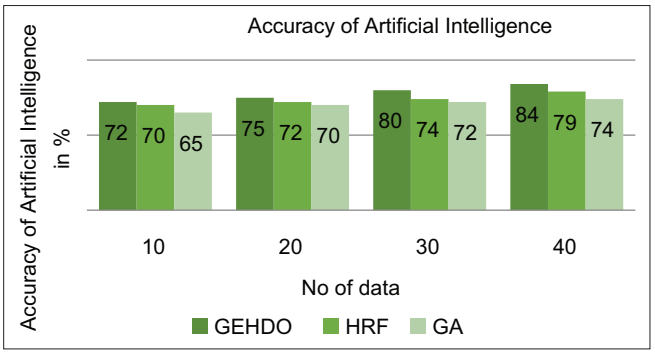

Figure 4: Accuracy of artificial intelligence

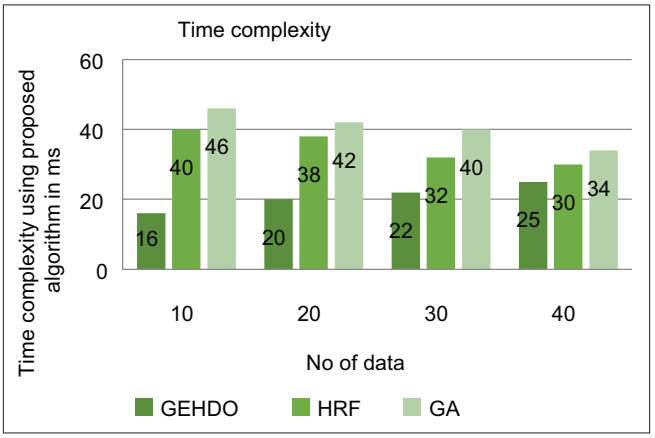

Figure 5: Time complexity

are used due to the function selection limits used by the proposed algorithm. It does not require any of the limitations of feature selection. The proposed algorithm of GEHDO achieves 84% of result compared with existing algorithms of HRF 79% of result and GA with 74% of the result.

Table 4 describes the time complexity using the proposed algorithm; it gives superior performance compared to existing algorithms. The proposed algorithm of GEHDO achieves superior performance compared to existing algorithms of HRF and GA.

Figure 5 describes the time complexity using the proposed algorithm; it gives superior performance compared to existing algorithms. The proposed algorithm of GEHDO achieves 25 ms of result compared to existing algorithms of HRF 30 ms of result and GA with 34 ms of the result.

Conclusion

The processing of the raw medical data from IOT sensor is used to detect long-term abnormalities in the early stages of people's lives to save them from heart disease. AI is used to process the raw data and provide a new approach to heart disease detection. To provide prediction results to the user, employing AI, a prediction system algorithm is very essential in heart disease. In the latest development technologies, AI in heart disease prediction using the proposed algorithm, it gives reliable output based on the input provided by the user. Management is required to prevent and treat universal and comprehensive system cardiovascular diseases for recording data. Medical records are the most important data classified as one of the technologies to be processed conveniently and quickly. The goal of the current methods to improve the health policy is to provide a classification system for treating cardiovascular disease as against the prevention of cardiovascular disease. These features run the test of heart diseases that are used as inputs to these input samples. Test results of the proposed algorithm GEHDO show that it has a superior performance compared to conventional algorithms.

Appendix

An appendix, if needed, should appear before the acknowledgments.

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