

Medical Diagnostic Systems For Heart Diseases

Jimmy Singla, Dalwinder Singh

School of Computer Sci. & Engg.

Lovely Professional University, Phagwara, Punjab, India

Abstract

Heart diseases are the major problem in the world now a days. Majority if the people are suffering from heart disease. Even number of deaths is also increasing due to heart diseases. So, it is very important to diagnose heart diseases and treat them in early stages. This problem is more in undeveloped areas, where number of doctors is very less and people do not have much awareness. They often come to know about the heart diseases in the last stages and difficulty arise to treat them in last stages. So, with the help of artificial intelligence, researchers tried to solve this serious problem. They had applied different algorithms for detection of heart diseases. In simple language, it can be said that they had developed medical diagnostic systems for diagnosis of heart diseases. Numerous researchers have done a lot work in this direction and they are able to get good results. Similarly, work had been done to diagnose other diseases as well, but here in this paper the focus is only on diagnosis of heart diseases. In this paper, the contribution made by different authors for diagnosis of heart diseases is stated. Some medical diagnostic systems developed by different researchers for diagnosis of heart diseases are described here in this study. Most of the authors have used the concepts of machine learning, deep learning and soft computing for diagnosis of heart diseases. Researchers have diagnosed heart diseases using simple rule-based approach, fuzzy logic, neuro fuzzy algorithms, artificial neural network, supervised machine learning algorithms, unsupervised machine learning algorithms, Deep learning techniques like CNN etc. Different tools and programming languages such as MatLab, python etc. are used to implement these systems and performance of these systems are calculated in terms of different performance parameters such as accuracy, recall, sensitivity, specificity, precision etc.

Keywords: -disease, heart, diagnosis, medical diagnostic system

Introduction

There are several conditions which affect the functioning of heart. There are several diseases which are related to heart infections. These are heart rhythm, coronary artery problem etc. There is another name for heart diseases that is known as cardiovascular disease. Cardiovascular disease generally refers to conditions that involve narrowed or blocked blood vessels that can lead to a heart attack, chest pain (angina) or stroke. Other heart conditions, such as those that affect your heart's muscle, valves or rhythm, also are considered forms of heart disease. So, heart diseases are the major problems for the society. In some areas, people are not able to have right diagnosis. So intelligent systems are there to help these people to provide them right diagnosis. These systems will act like experts and will diagnose the patient having heart disease. Further there are concepts of machine learning, deep learning and soft computing to detect the disease. These are the AI algorithms which help in prediction of disease. Each algorithm works and performs in a different way.

Literature Review

Anchana Khemphila and Veera Boonjing (2011)[1]proposed an expert system for diagnosis of heart diseases. The proposed system uses concept of multilayer perception with learning algorithms of back propagation. Feature selection is also incorporated in the proposed work. Initially the system is developed for 13 features and performance analysis is done using 13 features and further 13 features are reduced to 8 features and again performance analysis is done. Same is done during training phase as well as validation phase. The difference in accuracy during training phase on 13 and 8 features is 1.1% and during validation the difference on the same attributes is 0.82%.

Amir Mohammad Amiri and Giuliano Armano (2013)[2] designed an intelligent system for diagnosis of heart defects. It is an automatic methodology used for segmentation of heart sounds using classification and regression techniques. The dataset of 116 heart sounds taken from the medical experts is considered in this research work. The performance analysis of this research work is done and various parameters such as accuracy, specificity, sensitivity are calculated. The values for these parameters are 99.14%, 100% and 98.28% respectively.

Ebenezer O. Olaniy et al (2015)[3]developed an intelligent system for diagnosis of heart diseases. The dataset considered in this research work is taken from UCI repository. The proposed work also helps to avoid the misdiagnosis of the patient. The concept of multilayer neural network is used in this research work. The system is tested and 85% recognition is achieved.

Purushottam et al (2015)[4]developed an expert system for prediction of risk level of the patient based on the different parameters. This system is useful in areas where skilful doctors are not available. The proposed work is also helpful in designing the rules for the prediction. The rules are prioritized based on the requirements of the user. The performance of this system is evaluated in terms of accuracy.

C.Sowmiya and Dr. P. Sumitra (2017)[5] used nine classification techniques for prediction of heart diseases. These nine classification techniques are decision tree, naïve Bayesian neural network, KNN, SVM, ANN etc. One more algorithm is proposed in this work that is apriori algorithm and SVM for the diagnosis of heart diseases. The parameters used in this research are age, blood pressure, sex, fasting blood sugar, type of chest pain. Based on these parameters, it would predict the risk of heart diseases. The classification techniques are more accurate as compared to the other techniques.

Tanmay Kasbe and Ravi Singh Pippal (2017) [7] developed a medical diagnostic system for heart diseases using fuzzy logic. The proposed system consists of 13 input parameters and 1 output parameter. Centroid method is used for defuzzification. The whole research work is implemented in MatLab. The dataset for the proposed work is taken from V.A. Medical Center Long Beach and Cleveland clinic foundation.

Alberto Palacios Pawlovsky (2018)[9]developed an intelligent system for diagnosis of heart diseases using an ensemble based on distances for KNN method. Two configurations are used for the implementation of this work. The diagnostic accuracy of 85% is achieved from this research work.

A comparison of some studies based on the disease and technique is also elaborated in following table I.

Table I. Comparison of existing medical diagnostic systems

S No.	Author(s)	Year	Disease	Technique	Remarks
1	Anchana Khemphila and Veera Boonjing[1]	2011	Heart disease	ANN	Accuracy is calculated by considering 13 and 8 features in this research work and difference in accuracy in both the cases is 1.1% during training and 0.82% during validation.
2	Amir Mohammad Amiri and Giuliano Armano[2]	2013	Heart disease	Classification and Regression	99.14% accuracy is obtained from this research work.
3	Ebenezer O. Olaniy et al[3]	2015	Heart disease	Neural network	85% recognition is obtained from the proposed work.
4	Purushottam et al[4]	2015	Heart disease	Automated medical diagnostic system	The performance of the proposed system is evaluated in terms of accuracy and good results have been obtained.
5	C.Sowmiya and Dr. P. Sumitra[5]	2017	Heart disease	Apriori algorithm and SVM	The proposed work has more

					diagnostic accuracy as compared to other medical diagnostic systems.
6	Nikhil Gawande and Alka Barhatte[6]	2017	Heart disease	CNN	The proposed work used concepts of deep learning.
7	Tanmay Kasbe and Ravi Singh Pippal[7]	2017	Heart disease	Fuzzy expert system	The proposed work is having 13 input parameters and 1 output parameter and it is implemented in MatLab.
8	Sarath Babu et al[8]	2017	Heart disease	K-means algorithms and decision tree	The proposed work is beneficial for medical industries in diagnosis of heart diseases.
9	Alberto Palacios Pawlovsky[9]	2018	Heart disease	Ensemble based kNN	85% diagnostic accuracy is achieved from this research work
10	Anjan Nikhil Repaka et al[10]	2019	Heart disease	Navies Bayes	The proposed work is effective in prediction of risk factors relating to heart diseases.

Conclusion

From the different studies considered in this paper, it is concluded that the authors have proposed medical diagnostic systems for heart diseases and calculated the performance in terms of different parameters such as accuracy, sensitivity, specificity etc. In some studies, performance is not calculated for certain medical diagnostic systems. Many artificial intelligence techniques such as machine learning, deep learning and soft computing have been applied for diagnosis of heart diseases. Maximum accuracy from the studies considered in this work is obtained by using classification and regression techniques [2] and the value for the diagnostic accuracy by using classification and regression technique is 99.14%.

References

- [1] Khemphila, Anchana, and Veera Boonjing. "Heart disease classification using neural network and feature selection." *2011 21st International Conference on Systems Engineering*. IEEE, 2011.
- [2] Amiri, Amir Mohammad, and Giuliano Armano. "Early diagnosis of heart disease using classification and regression trees." *The 2013 International Joint Conference on Neural Networks (IJCNN)*. IEEE, 2013.
- [3] Olaniyi, Ebenezer O., et al. "Neural network diagnosis of heart disease." *2015 International Conference on Advances in Biomedical Engineering (ICABME)*. IEEE, 2015.
- [4] Saxena, Kanak, and Richa Sharma. "Efficient heart disease prediction system using decision tree." *International Conference on Computing, Communication & Automation*. IEEE, 2015.
- [5] Sowmiya, C., and P. Sumitra. "Analytical study of heart disease diagnosis using classification techniques." *2017 IEEE International Conference on Intelligent Techniques in Control, Optimization and Signal Processing (INCOS)*. IEEE, 2017.
- [6] Gawande, Nikhil, and Alka Barhatte. "Heart diseases classification using convolutional neural network." *2017 2nd International Conference on Communication and Electronics Systems (ICCES)*. IEEE, 2017.
- [7] Kasbe, Tanmay, and Ravi Singh Pippal. "Design of heart disease diagnosis system using fuzzy logic." *2017 International Conference on Energy, Communication, Data Analytics and Soft Computing (ICECDS)*. IEEE, 2017.
- [8] Babu, Sarath, et al. "Heart disease diagnosis using data mining technique." *2017 International conference of Electronics, Communication and Aerospace Technology (ICECA)*. Vol. 1. IEEE, 2017.
- [9] Pawlovsky, Alberto Palacios. "An ensemble based on distances for a kNN method for heart disease diagnosis." *2018 International Conference on Electronics, Information, and Communication (ICEIC)*. IEEE, 2018.
- [10] Repaka, Anjan Nikhil, Sai Deepak Ravikanti, and Ramya G. Franklin. "Design And Implementing Heart Disease Prediction Using Naives Bayesian." *2019 3rd International Conference on Trends in Electronics and Informatics (ICOEI)*. IEEE, 2019.