ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Special Issue 8, November 2016

A Comparative Study on Heart Disease Prediction Methods of ANFIS and GAFL

Y.Harimadhava Reddy[1], Dr.K.Vijaya Bhaskar Reddy[2], D. Gireesh Kumar[3]

Assistant Professor, Dept. of EEE, Universal College of Engineering &Technology, Perecherla, Guntur, A.P, India

Professor, Dept. of EEE, B V Raju Institute of Engineering &Technology, Narsapur, TS, India

Assistant Professor, Dept. of EEE, B V Raju Institute of Engineering & Technology, Narsapur, TS, India

ABSTRACT : The vascular system, is an organ system that circulate blood and transport nutrients (such as amino acids and electrolytes), oxygen, carbondioxide, hormones, and blood cells to and from the cells in the body to provide sustenance and help in fighting diseases, stabilize temperature and pH, and maintain homeostasis.The Healthcare is generally clinical diagnosis done by doctor's expertise and experience. Computer Aided Decision Support System plays a crucial role in medical field. With the growing research on heart disease predicting system, it has become important to categories the research outcomes and provides readers with an overview of the existing heart disease prediction techniques in each category. Neural Networks are one of many data mining analytical tools that can be utilized to make predictions for medical data. From the study it is observed that Hybrid Intelligent Algorithm improves the accuracy of the heart disease prediction system. Various heart diseases are caused due to reduction in supply of blood and oxygen. Therefore main objective of our paper is to predict more accurately the percentage of possibility of cardiovascular disease in minimum number of attributes (like blood pressure, cholesterol, type of chest pain, blood sugar, etc). Many data mining techniques are used to analyse this rich collection of data from different perspectives and deriving useful information. This paper intends to discuss and compare, diagnosis and prediction system for heart disease based on soft computing technique that is ANFIS and GAFL model called Genetic Algorithm Fuzzy Logic model for effective heart disease prediction. It is easy to build the model thereby providing an easy option to be used in hospitals and medical centers for the aid of the physicians.

KEYWORDS: Heart Prediction, Fuzzy Logic, Neural Network, ANFSI & GAFL.

I. INTRODUCTION

The heart pumps oxygenated blood to the body and deoxygenated blood to the lungs. In the human heart there is one atrium and one ventricle for each circulation, and with both a systemic and a pulmonary circulation there are four chambers in total: left atrium,left ventricle, right atrium and right ventricle. The right atrium is the upper chamber of the right side of the heart. The blood that is returned to the right atrium is deoxygenated (poor in oxygen) and passed into the right ventricle to be pumped through the pulmonary artery to the lungs for re-oxygenation and removal of carbon dioxide. The left atrium receives newly oxygenated blood from the lungs as well as the pulmonary vein which is passed into the strong left ventricle to be pumped through the aorta to the different organs of the body.Medical mining involves computerized tools and techniques that help in providing the benefits to health systems.

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Special Issue 8, November 2016

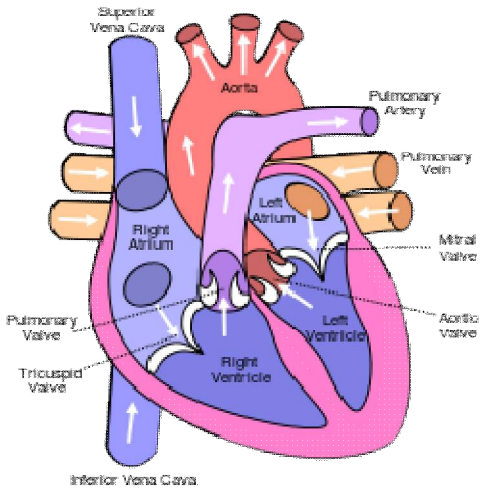

Fig:The Human Heart.

Especially artificial intelligence techniques are most commonly used for disease diagnosis1–3. The neural network classifier helps in diagnosing the diseases by developing a model using feed forward neural network, multi-layer perceptron neural network, and back propagation neural network. Genetic algorithms help in medical mining using their stochastic searching technique, the fitness function along with a set of genetic operators. The fuzzy logic is a tool for providing solution to the problems that deal with fuzzy input data4 . The proposed work takes into account the Genetic Algorithm (GA) for feature selection, and fuzzy logic for classification. The dataset chosen is the heart disease dataset that contains records of patients with and without heart disease. The objective of this work is to design a model that can help in predicting whether an incoming patient has heart disease or not. GA is one of the most effective feature selection methods5 . It is a stochastic searching technique that helps in producing optimal solution for optimization problem. In India casualties are also caused due to cardiovascular diseases and its diagnosis is very difficult process. Normally, thesediseases can be analysed using intuition of the medical specialist and it would be highly beneficial if the techniquesused for analysis shall be improved with the medical information system. At reduced cost, if a decision support orcomputer based information system is developed then it will be helpful for accurate diagnosis.Soft Computing is one multidisciplinary system as the fusion of the fields of Fuzzy logic, Neuro-computing,Evolutionary and Probabilistic Computing. It is the combination of methodologies designed to model and enablesolutions to real world problems, which are not modelled or two difficult to model mathematically.

II. LITERATURE SURVEY

GA helps in solving many real time problems using the process of evolution of species. The input to the algorithm is called as chromosome that contains the parameters that have unique characteristics. Each chromosome consists of a collection of genes. A gene expresses the characteristic of the input. A collection of such chromosomes form a population.Classification techniques are capable of processing a large amount of data. Classification is one of the most widely used methods of Data Mining in Healthcare organization. The common classification techniques used in healthcare are Bayesian Networks, Support Vector Machines, Nearest neighbor method, Decision trees, Fuzzy logic, Fuzzy based Neural Networks, Artificial Neural Network, Genetic AlgorithmsWork done in heart disease prediction using data mining techniques and fuzzy logic are discussed below:

Mai Shouman, Tim Turner and Rob Stocker[1], proposed various single and hybrid data mining techniques in heartdisease prediction. Using single data mining technique for heart disease has been thoroughly investigated showingthe considerable levels of accuracy. Recent investigation shows that hybridizing more than one technique, willobtain enhanced result in diagnosis. Here author applies various data mining techniques like naive bayes, decision tree on various heart disease datasets and measures the accuracy of it [8]. After applying hybrid data miningtechniques on different heart disease datasets shows the different accuracies [11] and [16].After comparing bothtechniques in diagnosis on heart disease datasets, hybrid datasets showing the better accuracy than single datamining

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Special Issue 8, November 2016

techniques.Nikita, Madan lalYadav[4] have proposed the system which uses Fuzzy rule based approach for prediction ofpatient disease. This methodology is functional to drive predictive analysis on single as well as on large dataset [13].As it is the intelligent soft computing approach, it can represent the probabilistic relation based on patient symptomanalysis. As work is rule based, the easy estimation of the interrelated variables can be identified to understand theapproach followed by the fuzzy analysis. The paper referred for this is by PrachiJambhulkar, VaidehiBaporikar [7].

Fig: Paradigm for Heart Disease Prediction.

This research article work presents a realtime WSN system for prediction and monitoring of any upcoming cardiovascular diseases. The system has acapability of monitoring of any upcoming of any upcoming cardiovascular diseases [6]. The system has a capabilityof monitoring multiple patients at a time and delivers remote diagnosis and prescription to the patients it alsoprovides fast and effective warning to doctors, relatives and hospitals. From this paper we get an idea of using wireless sensor network, we can enhance and expand the model with combination of WSN system and data mining techniques for getting accuracy and more real time data sets in prediction of various cardiac diseases. Aqueel Ahmed Shaikh Abdul Hannan [5], presents the research paper to find out the various cardiovascular disease through data mining, genetic algorithm, support vector machine (SVM), rough set theory, association rules andneural networks.

III. NEURAL NETWORKS

A Neural Network (NN) consists of many Processing Elements (PEs), loosely called “neurons” and weighted interconnections among the PEs. Each PE performs a very simple computation, such as calculating a weighted sum of its input connections, and computes an output signal that is sent to other PEs. The training (mining) phase of a NN consists of adjusting the weights (realvalued numbers) of the interconnections, in order to produce the desired output [5]. The Artificial Neural Network (ANN) is a technique that is commonly applied to solve data mining applications. Neural Network is a set of processing units when assembled in a closely interconnected network, offers rich structure exhibiting some features of the biological neural network. The structure of neural network provides an opportunity to the user to implement parallel concept at each layer level. Another significant characteristic of ANN is fault tolerance. ANNs are well suited in situations where information is noisy and uncertain. ANN are an information processing methodology that differs drastically from conventional methodologies in that it employ training by examples to solve problem rather than a fixed algorithm [3,4]. They can be divided into two types based on the training method: Supervised training and Unsupervised training. Neural networks are known to produce highly accurate results in practical applications. Neural networks have been successfully applied to a variety of real world classification tasks in industry, business and science [8]. Also they have been applied to various areas of medicine, such as diagnostic aides, medicine, biochemical analysis, image analysis, and drug development. They are used in the analysis of medical images from a variety of imaging modalities. Applications in this area include tumor detection in ultra-sonograms, detection and classification of micro calcifications in mammograms, classification of chest x-rays, and tissue and vessel classification in Magnetic Resonance Images. Artificial neural networks provide a powerful tool to help doctors analyze, model, and make sense of complex clinical data across a broad range of medical applications [9-21]. As the volume of stored data increases, data mining techniques assume an important role in finding patterns and extracting knowledge to provide better patient care and effective diagnostic capabilities. Neural networks can be used to extract

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Special Issue 8, November 2016

rules from a disease classification. From the rules system so discovered, we can predict if someone will have a particular stage of a particular diseaseThe advantages of Neural Networks for classification are:
• Neural Networks are more robust because of the weights
• The Neural Networks improves its performance by learning. This may continue even after the training set has been applied.
• The use of Neural Networks can be parallelized as specified above for better performance.
• There is a low error rate and thus a high degree of accuracy once the appropriate training has been performed.
• Neural Networks are more robust in noisy environment

IV. FUZZY LOGIC SYSTEMS

In recent years, computational intelligence has been used to solve many complex problems by developing intelligent systems. And fuzzy logic has proved to be a powerful tool for decision-making systems, such as expert systems and pattern classification systems. Fuzzy set theory has already been used in some medical expert systems. Fuzzy set theory and fuzzy logic are a highly suitable and applicable basis for developing knowledge-based systems in medicine for tasks such as the interpretation of sets of medical findings, syndrome differentiation in eastern medicine, diagnosis of diseases in Western medicine, mixed diagnosis of integrated western and eastern medicine, the optimal selection of medical treatments integrating western and eastern medicine, and for real-time monitoring of patient data. This was verified by trials with the following systems which were developed by our group in Vietnam: a fuzzy expert system for syndromes differentiation in oriental traditional medicine, an expert system for lung diseases using fuzzy logic, case based reasoning for medical diagnosis using fuzzy set theory, a diagnostic system combining disease diagnosis of western medicine with syndrome differentiation of oriental traditional medicine, a fuzzy system for classification of western and eastern medications and finally, a fuzzy system for diagnosis and treatment of integrated western and eastern medicine. All the above mentioned systems were developed and tested at the hospitals.
Application of fuzzy logic in developing rule based system for diagnosis of lung diseases: DoctorMoon6 .DoctorMoon has been programmed in Borland Delphi 4.0 and run on Microsoft Windows 9x. It's easy to install and has a friendly interface. a. Verifying the Knowledge base The more correct the rules are, the better the diagnosis will be. After acquisition, DoctorMoon had undergone much testing and the knowledge base had been corrected several times. Diagnostic tests were conducted to determine which rules were incorrect by comparing the conclusion of DoctorMoon to the conclusion of doctors. A group of lung disease experts will keep making changes until the conclusions from the diagnostic system were acceptable. Those changes can be made at every part of a rule: the , the or the . On the other hand, as the correctness of the knowledge base depends upon doctors' judgment, it's necessary to test doctors' diagnostic ability. So far, DoctorMoon has not been able to carry out that task. b. Validating the Rule base. A very important aspect of the knowledge base is the issue of truth maintenance and conflict resolution. This means that conflicts and coincidence between any pair of rules must be eliminated and besides, rules must be related logically: e.g., a rule with the consisting of 3 symptoms must affirm the infection with higher grade than a rule with the consisting of 2 diagnostic symptoms. Conflict resolution was performed by a software module in the program. The module identifies all conflicts and illogical relationships between rules so that necessary changes can be made. Normally, this module is activated whenever a new rule is created.

V. COMPARATIVE STUDY AND DEVELOPMENT ANFSI & GAFL

The primary task of our work is to perform classification using fuzzy logic. In 1965 Lotfi A. Zadeh proposed a fuzzy set theory that is more applicable to artificial intelligence, especially, for the problems that have uncertain input values18. Fuzzy logic is a form of uncertain or many – valued logic. This logic provides approximate solutions rather than accurate as it handles the concept of partial truth where the truth value can be in the range between completely true and completely false. Fuzzy membership functions are devised based on the problem to be solved and the fuzzy set chosen for the same. Membership function represents the fuzzy set and also provides a measure of the degree of similarity of an entity to a fuzzy set. Most common shapes for design of membership functions are triangular, trapezoidal, linear, Gaussian, bell-shaped etc. In the proposed work the Gaussian membership function is chosen as it is comprehensible and appropriate to the problem. A membership function for a fuzzy set A on the universe of discourse X is defined as $\mu A: X \rightarrow [0, 1]$, where each element of X is mapped to a value between 0 and 1. This value, called membership value or degree of membership, quantifies the grade of membership of the element in X to the fuzzy set A.

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Special Issue 8, November 2016

Membership functions allow us to graphically represent a fuzzy set. The x axis represents the universe of discourse, whereas the y axis represents the degrees of membership in the [0, 1] interval. The Figure 1 depicts the Gaussian membership function used in the work. A fuzzy inference system helps in mapping the inputs to the corresponding output using predefined fuzzy rules available in the knowledge base. The fuzzy rule generation is a vital task that helps in mapping the input to its corresponding output. Rules can be framed using any method that provides an antecedent and consequent.

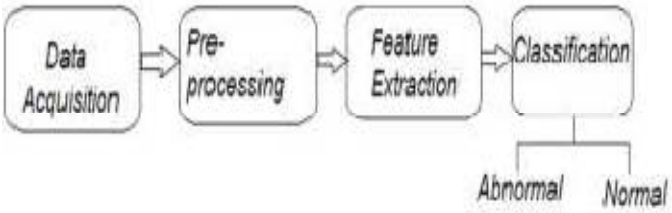

Fig:Block Diagram for ANFSI Method.

Diagnosing heart disease is considered as a nonlinear problem that shows the complex causal relationship between the variables. However, there is a new computational paradigm called an artificialneural network, which is suitable for problems of extreme complexity not addressable with our conventional technologies, either by the conventional computer programming or statistical method. Several studies have shown that an artificial neural network can be successfully applied in diagnosing heart diseases [3][4]. Therefore, the purpose of this study is to evaluate the application of neural network in predicting the presence of heart disease. In the neural network, the hidden neuron can influence the error on the nodes to which their output is connected. It can greatly degrade the generalization capability of the neural network which leads to the significant deviation in prediction result to the problem. To overcome this, an approach is proposed which is able to find minimum number of hidden nodes. The Neural Network Training Problem consists in determining the synaptic weights of a neural network to get the desired output for a set of input vectors. As the Genetic Algorithm is able to find global optimize solution to the problem it can be used for the initialization of neural network weights. Thus, the proposed method with Genetic-Neural approach can be used to design system for the heart disease prediction.

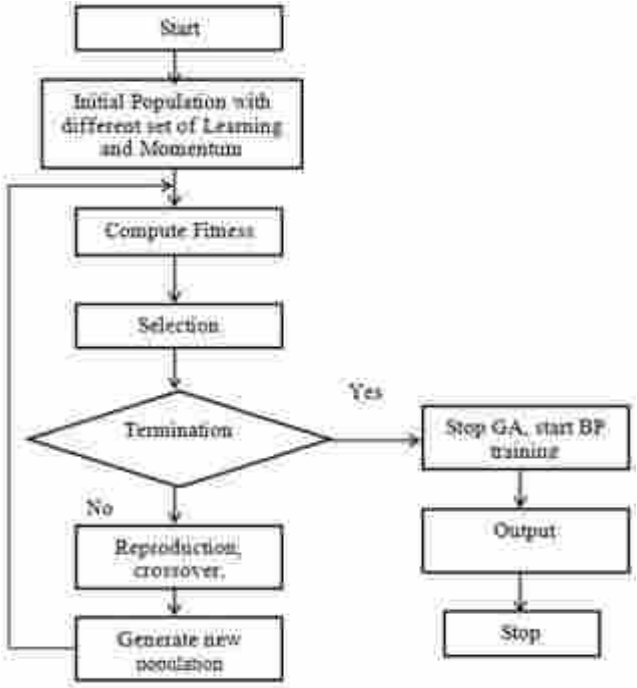

Fig:Flow Chart for GAFL Method.

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Special Issue 8, November 2016

This hybrid system uses backpropagation algorithm for learning and training the neural network. The Multi-Layer Neural Network is optimize by calculating the number of nodes in hidden layer to minimize the over fitting; which causes the overestimation of complexity of the target problem that leads to significant deviation in prediction. As the initialization of the Neural Network weights is a blind process which makes it difficult to find out globally optimized initial weights and the network output would run towards local optima hence the overall tendency of the network to find out a global solution is greatly affected. So the problem of local optimum solution is solved by optimizing the initial weights of neural network. For this a genetic algorithm is used which is specialized for global searching. Thus the system uses the backpropagation algorithm to train the network by using the weights optimized by Genetic Algorithm. Error is calculated using equation (1) to measure the differences between desired output and actual output that has been produced in feed forward phase. Error then propagated backward through the network from output layer to input layer as represented below. The weights are modified to reduce the error as the error is propagated. The neural network uses the genetic algorithm fitness function to initializes the weights that makes it possible to have global optimal convergence. Neural network architecture is constructed by identifying the input and output layer neuron along with number of hidden layers and hidden nodes identification.

VI. RESULTS & CONCLUSION

The experimental results of the heart attack disease system for prediction using Genetic-Neural Approach are explained in this section. The system was developed using MATLAB R2012a. Global Optimization Toolbox and the Neural Network Toolbox were used for implementing the algorithm. The data for risk factors related to heart diseases are collected from 50 people who are provided by American Heart Association. After studying various data mining and soft computing techniques, we can conclude that ANFIS is better predictionmethod for heart disease. So there is scope in designing a prediction system whose accuracy is more than presentsystem using less number of attributes compared to others.In this proposed system we will be using ANFIS as a soft computing technique for diagnosis. We are aiming to designing an intelligent system using soft computing method. As soft computing technique proves to be better ingiving human like decisions.

REFERENCES

1.Mai Shouman, Tim Turner, and Rob Stocker “Using Data Mining Technique in Heart Disease Diagnosis and Treatment”, 2012 Japan-Egypt Conference on Electronics, Communications and Computers 978-1- 4673-0484-9/12@ 2012 IEEE.pp.173-177.
2. Dhanashree S. Medhekar, Mayur P. Bote, Shruti D. Deshmukh “Heart Disease Prediction System using Naïve Bayes”, International Journal of Enhanced Research In Science Technology & Engineering, ISSN NO: 2319-7423 VOL. 2 ISSUE 3, MARCH- 2013.p.p. 1-5
3.VikasChaurasia and Saurabh Pal “Data Mining Approach to Detect Heart Diseases”, International Journal of Advanced Computer Science and Information Technology (IJACSIT) Vol. 2, No. 4, 2013, Page: 56-66, ISSN: 2296-1739.
4.Nikita, Madam lal Yadav “A Fuzzification Approach for Prediction of Heart Disease”, International Journal of Engineering Trends and Technology (IJETT)- Volume 4 Issue 5 May2013. ISSN: 2231-5381.
5.Aqueel Ahmed, Shaikh Abdul Hannnan “Data Mining Techniques to Find Out Heart Diseases: An overview”, International Journal of Innovative Technology and Exploring Engineering (IJITEE) ISSN:2278-3075, Volume-1, Issue-4, September 2012,pp.18-23.
6.Deepali Chandna “Diagnosis of Heart Disease Using data Mining Algorithm”,International Journal of Computer Science and Information Technologies (IJCSIT), Vol. 5(2), 2014 pp. 1678-1680.
7.Prachi Jambhulkar, VaidehiBaporikar “Review on Prediction of Heart Disease Using Data Mining Technique with Wireless Sensor Network”, International Journal of Computer Science and Applications, Vol. 8, No. 1, Jan-Mar 2015, ISSN: 0974-1011.
8. Levashenko V, Zaitseva E. Fuzzy decision trees in medical decision making support system. Proceedings of the Federated Conference on Computer Science and Information Systems; IEEE; 2012. p. 213–9.
9. Elashiri MA, Hefny HA, AbdElwhab AH. Construct fuzzy decision trees based on roughness measures. Lecture Notes of the Institute for Computer Sciences, Social Informatics and Telecommunications Engineering. 2012;
108:199–207. 10. Abu-halaweh NM, Harrison RW. An improved fuzzy decision tree induction tool.IEEE; 2010.
11. Jaganathan P, Kuppuchamy R. A threshold fuzzy entropy based feature selection for medical database classification. ComputBiol Med. 2013; 43(12):2222–9.
12. Cheng Y, Miao D, Feng Q. Positive approximation and converse approximation in interval-valued fuzzy rough sets. Information Sciences: an International Journal. 2011; 181(11):2086–110.
13. Fan C-Y, Chang P-C, Lin J-J, Hsieh JC. A hybrid model combining case-based reasoning and fuzzy decision tree for medical data classification.Applied Soft Computing. 2011; 11(1):632–44.
14. Holland JH. Adaptation in natural and artificial systems. Ann Arbor MI: The University of Michigan Press; 1975.
15. Sivanandam SN, Deepa SN. Introduction to genetic algorithms. Heidelberg: Springer-Verlag Berlin; 2008.
16. Fan Weiguo, Fox EA, Pathak P, Wu H. The effects of fitness functions on genetic programming-based ranking discovery for web search. J Am Soc Inform Sci Tech. 2004; 55(7):628–36.
17. Hong T. MCMC algorithm, integrated four-dimensional seismic reservoir characterization and uncertainty analysis in a bayesian framework. ProQuest LLC; 2008.p. 31.
18. Zadeh LA. Fuzzy sets. Inform Contr. 1965; 8:338–53.
19. Maarit. Fuzzy logic fundamentals, Chapter 3, Scribd. 2011. p. 70.