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A Review on Automated Heart Disease Diagonsis

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***Abstract*-In this paper, we design a heart disease diagnosis system based on fuzzy Petri net. Now a day's heart disease prediction is very relevant due to the increase of heart patients. Fuzzy Petri net is an alternative version of discrete event system (DES) and can have application in different fields. This system contains twelve input fields and one output field. Here the input fields are chest pain, blood pressure, cholesterol, blood sugar, ECG, heart rate, exercise, old peak, thallium scan, age, weight and height. The output was obtained on the basis of fuzzy reasoning tools. The present study is an alternative for the existing systems.**

Keywords-Fuzzy petri net, fuzzy rule-based system, fuzzy system

I. INTRODUCTION

On the analysis result of WHO (World Health Organization), the reason for death in the UK, USA, Canada and Australia is the heart disease. The centre of the cardiovascular system is the heart. The heart pumps blood to all of the body's cells through the body's blood vessels. The oxygen can be carried by the blood in which the cells need. When the heart and blood vessels aren't working the way they should, then cardiovascular disease can occur. In the present paper, we design a system for the diagnosis of heart disease using fuzzy petrinet. Our present study can have 12 input field and one output field. The results were obtained on the basis of fuzzy reasoning tool. But here the results cannot be defuzzified. The healthiness and sleekness of a person can be obtained from this study.

II. RELATED WORKS

A. A Fuzzy Expert System For Heart Disease Diagnosis

Ali.Adeli, Mehdi.Neshat has used a fuzzy expert system for the diagnosis of heart disease. They used several input like chest pain, pressure, cholesterol, resting blood sugar, resting maximum heart rate, sex, electrocardiography (ECG), exercise, old peak, thallium scan and age. The status of the patients is either healthy or sick and that has been used as output. Output is based on four types of sickness. It includes Sick s1, Sick s2, Sick s3 and Sick s4. In this study, they use low density lipoprotein (LDL) cholesterol. They use systolic blood pressure. Fields can be divided in to some sections and each section can have a value. For each instance in the dataset, sex has two section (1=male and 0=female), chest pain type has 4 section (typical angina, atypical angina, non-angina pain and asymptomatic), resting blood sugar has 2 section (0=false and 1=true) and it is true when FBS>120, ECG has 3 section (0=normal, 1=having ST-T wave abnormality (T wave inversions and/or ST elevation or depression of > 0.05 mV) and 2=Hypertrophy (showing probable or definite left ventricular hypertrophy by Estes' criteria)), exercise has 2 section (0=false and 1=true), thallium scan has 3 section (3=normal, 6=fixed defect and 7=revisable defect). This fuzzy expert system uses these sections exactly and for dividing of the other fields we use expert's idea.

The most important application of fuzzy system (fuzzy logic) is in uncertain issues. The fuzzy logic tool is used when a problem has dynamic behaviour. Fuzzy Expert System for Heart Disease Diagnosis designed with membership functions, input variables, output variables and rule base. The fuzzy expert system can be divided into two steps. They design the membership functions (MF) of all variables and these functions determine the membership of objects to fuzzy sets. In the first step, they will describe the input variables with their membership functions. In the second step, they introduce the output variable with its membership functions. In the last section, they will show the rules of the system. Compared to other existing systems, it improves results and is more efficient. This system has been verified by an expert doctor and is designed in such a way that the patient can use it himself. Experimental results showed that this system is better than the non-expert system and is about 94 % efficient.

B. Design Of A Fuzzy-Based Decision Support System For Coronary Heart Disease Diagnosis

Adel Lahsasna, Raja Noor Ainon, Roziati Zainuddin, Awang Bulgiba used a fuzzy rule-based system for Coronary heart disease (CHD) diagnosis. In this paper, a fuzzy rule-based system (FRBS) is designed as a decision support system for Coronary heart disease (CHD) diagnosis. This system considers both the decision accuracy of the rules and transparency at the same time. In order to achieve the above properties, we apply a genetic algorithm.

In this study, CHD diagnosis can be designed on the basis of transparent and a relatively accurate fuzzy rule-based system. The concept of transparency is extended to include the traditional measures such as the number of rules and fuzzy sets, to include the degree of certainty and the support of each rule. The development of the fuzzy rule-

based system can have four main steps. First step is the pre-processing step aiming at reducing the complexity of the dataset; a feature selection method is applied to select the most discriminative subset of features. The generation of all the possible fuzzy rules will be done in the second step. In the third step, to obtain a subset of a small number of rules with the highest classification ability a multi objective genetic algorithm is used. A set of fuzzy rule is the result of the third step. The accuracy capabilities of the produced fuzzy rule are enhanced in the fourth step. Finally, the results achieved by the FRBS are evaluated and compared with other methods.

The results show that the generated system is humanly understandable. Along with this, the produced FRBS is able to identify the uncertainty cases so that the physician can give a special consideration to deal with those patients and can provide better management of efforts and tasks.

C. *Analysis Of Heart Disease Dataset Using Neural Network Technique*

K. Usha Rani has used a classification approach based on neural network. For the classification of heart disease dataset they have used single and multilayer neural network mode. They use both the back propagation algorithm and parallelism technique for training the network at the same time at each neuron in all hidden and output layers to speed up the learning process. In information technology, a neural network is a system of programs and data structures that approximates the operation of the human brain. A large number of processors, which are operating in parallel, are included in the neural network in which each of its own small sphere of knowledge and access to data in its local memory. Initially, a neural network is trained or fed large amounts of data and rules about data relationships. The network will get the response to an external stimulus or can initiate activity on its own through a program.

Neural networks use several principles, including fuzzy logic genetic algorithms, gradient-based training and Bayesian methods for making determinations. Sometimes neural networks are described in terms of knowledge layers, with more complex networks having deeper layers. Learned relationships about data can feed forward to higher layers of knowledge in the feed forward systems. Neural networks can also learn temporal concepts and have been widely used in signal processing and time series analysis.

Back propagation neural network is a multilayer feed forward neural network with an input layer, an output layer and more than one hidden layers. From the external nodes, the input layer will receive signal and transmit those signals to other layers without performing any computations at that layer. Through a weighted connection link, the output layer will receive signals from the input layer and produce the output of the network. Along with this, the hidden layer will also receive signal from the input layer through a weighted connection link, perform computation and transmit these results to the output layer as signals. Using Generalized Delta Rule, a new neural network is trained. This neural network based technique has given satisfactory result.

D. *A Diagnostic Fuzzy Rule Based System For Congenital Heart Disease*

Ersin Kaya, Bulent Oran and Ahmet Arslahn have used a fuzzy rule for the diagnosis of congential heart disease which defines structural and functional disease of heart. Congenital heart disease (CHD) can cause a different number of problems affecting the heart. One of the common types of birth defect is the CHD. Congenital heart disease can cause more deaths in the first year of life than any other birth defects. About eight weeks after conception, the heart is completely developed which is one of the earliest organ to develop. If the heart or blood vessels near the heart do not develop properly before birth, then congenital heart defects will occur. Some new born babies are affected with mild types of congenital heart defects, but most of them need surgery in order to survive. In certain cases, if the defect may be mild at birth, then it can diagnose later in life.

Ongoing Research shows that at least 35 congenital heart or cardiovascular defects have been identified. By its location and severity each defect is defined. There will be an obstruction on the flow of blood in the heart or blood vessels which are nearest, or cause an abnormal flow of blood through the heart when it was affected by most congenital cardiovascular defects. When the newborn has only one ventricle or when the pulmonary artery and the aorta shared the same ventricle, or one side of the heart is not completely formed then it will be the rare case of congenital cardiovascular defects. Here, they used the weighted vote method and single winner method. For the congenital heart disease diagnosis, the result has shown that the weighted vote method can give more accuracy than single winner method.

E. *Prediction of Risk Score for Heart Disease in India Using Machine Intelligence*

K.Rajeswari, V.vaithiyanatham, P.Amirtharaj have used a system for Medical Data Mining in which machine intelligence is used. Medical Data Mining finds various data's from the collection of Medical data. This system uses necessary information from heart disease data set. In most of the developed countries, a high percentage of death rate is due to Coronary Heart Disease (CHD).India is one of these developing country that faces a high risk due to CHD. Due to this, a Decision Support System (DSS) is developed and this system effectively identifies the risk for predicting the Heart disease of a Patient. Thus patients can take precautionary steps such as balanced Diet and medication which increase the life time of patient. After considering Indian conditions from literature and based on the Expert knowledge from Doctors, prediction features are selected. For the comparison Framingham Risk score which has five attributes is used. This proposed system has nineteen features. To reduce the number of features using Genetic algorithms, a discussion is made. For the implementation of Machine Intelligence algorithms, this system includes a theoretical study.

For supporting various complex tasks, a health care domain with multi-purpose type is used and which combine more than one AI technique. By means of an automated

medical diagnosis system, medical care could be enhanced and costs could be reduced. The important role of data mining technique is to provide better patient care and effective diagnosing by pattern recognition and knowledge extraction that increases the stored data volume. Here they proposed a Clinical Decision Support System (CDSS) for the prediction of heart disease risk score. This system is mainly designed for Indian Population. Coronary Heart Disease can be handled effectively if more research is done in this field. As this paper mainly focused on the present risk analysis, future work may be directed for life time risk analysis.

III. CONCLUSION

In the present study we have explicitly discussed the symptoms of heart disease in fuzzy environment. So the fuzzy rule based system is appropriately matched to the diagnosis. Thus we analyze the heart disease symptoms through fuzzy rule based system and infer the healthiness, sickness through fuzzy approximate rule. This system can also be used for other medical disease diagnosis, where the imprecision is more. Fuzzy Petri nets can be used for fuzzy performance evaluation, diagnostic systems, financial planners, decision support system, and navigation system. The doctors while examine the patients of various symptoms related to the suspicion of the disease more or less imprecise and vague in nature. So the fuzzy rule based system is appropriately matched to the diagnosis. This system can also be used for other medical disease diagnosis, where the imprecision is more. It can also be processed through automata theory.

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