

Diagnose System for Heart Risk with Fuzzy Controller

^{#1}Neeru Pathania, Ritika^{*2} and Sanjeev^{*3}

^{#1}M.Tech Scholar, Department of ECE SSCET, Badhani, Punjab, India

^{*2}AP, Department of ECE SSCET, Badhani, Punjab, India

^{*2}AP, KCTE, Punjab, India

Abstract— The diagnose system for any disease are greatly required nowadays. The use of information technology in diagnosis and treatment of illnesses has highly increased. The recognition of heart disease from symptoms features or signs are a multi layered problem. The knowledge and experience of specialists and clinical data of patients assist the diagnosis procedure. The automated prediction about the heart disease of patient made treatment easy. The intelligent and effective heart attack prediction system using fuzzy inference system is designed in this paper. The main factors or symptoms of heart attack are discussed.

Keywords—Fuzzy, Heart predictions, FIS.

1. INTRODUCTION

Information technology plays an important role in the fields of bio medical area and is used widely for diagnosis and treatment of illnesses. The complexity and uncertainty in bio medical area requires an intelligent system that uses fuzzy logic, artificial neural network and genetic algorithm for diagnosis of disease. Health care systems face lots of difficulties due to the high amount of risk factors of heart diseases in peoples. Hence knowledge based intelligent systems played an important role and has a contribution towards the development of the healthcare system for cardiovascular disease. Today peoples are very aware over their health and wellness troubles. The majority of the countries face the problem of cardiovascular disease and it has the leading cause of death worldwide [1]. Health domain application is one of the research fields nowadays. Ideal example of expert health system application is the detection and diagnoses system for cardiovascular disease [2], where the information acquired from numerous sources and is evaluated based on computer based application. It is difficult and time consuming job to get knowledge from physician and include this knowledge to computer system program by hand into data base medical decision support system. This problem has been solved by using expert health systems.

In boost outcomes at a couple of healthcare companies and strategy internet sites, expert system has actually operated by making needed clinical knowledge quickly readily available to know-how users [3]. Taking care of clinical needs, such as making certain

specific medical diagnoses, evaluating in a quick manner for avoidable health problem, or avoiding undesirable drug occasions, are the most standard exploitation of Expert System [4].

Expert System could also be possibly lessened costs, progression performance, and reduce client stress. These systems are classified into two groups namely (1) Knowledge based and (2) non-knowledge based [5].

The knowledge based system consists of rules (if-then statements). Expert system that is implemented with the assistance of artificial intelligence has the ability to support in a new setting and to learn for instance [6, 7]. Given that the concept of computer-based Clinical Decision Support System aroused at first, significant research has actually been made in both academic and practical areas. Many obstacles are longer to impede the effective application of expert systems in scientific environments, among which portrayal and reasoning concerning clinical understanding predominantly under anxiety is the locations that require improved methodologies and strategies.

Cholesterol, blood pressure, chest pain and diabetes are main risk factors that affect on heart disease risk. Heart disease diagnosis is sometimes hard for experts due to large and uncertain risk factors. Hence, there exists no strict boundary between healthy and diseased, thus distinguish is uncertain and vague. Due to many factors to analyze for diagnose the heart disease of a patient makes the physician's job difficult. Therefore, experts require an accurate tool that considering these risk factors and show certain result in uncertain term. A large proportion of heart diseases are preventable; they continue to rise mainly because preventive measures are insufficient. Clinical problem solving or diagnostic reasoning is the skill that physicians use to understand a patient's complaints. They identify a short, prioritized list of possible diagnoses that could account for those complaints. This diagnosis then makes the choice of diagnostic tests and possible treatments. Clinical problem solving has not yet been efficiently replicated by computers, making it necessary that clinicians work to develop expertise in this very important skill set. Therefore, more efficient expert health systems for diagnosis of cardiovascular disease need to be developed.

Data mining is the process of analyzing data from different perceptions and summarizing it into useful information. Fuzzy logic provides a simple way to arrive at a definite conclusion based upon vague, ambiguous, imprecise, noisy, or missing input information.

2. RELATED WORK

The expert system for health monitoring or diagnosis of diseases is widely used. The variety of methods was used for this purpose. E. P. Ephzibah [8] designed a fuzzy based system for Coronary heart disease diagnosis. A multi-objective genetic algorithm is used to optimize both the accuracy and transparency of the model. Fuzzy rules are well designed that incorporates the degree of decision certainty. Novruz Allahverdi, Serhat Torun & Ismail Saritas [9] proposed a fuzzy based system to find or predict of coronary heart disease risk of patient. The performance accuracy of this fuzzy expert system is 79%. Manisha Barman, J Pal Choudhury [10] designed a fuzzy based system for the diagnosis of the heart disease with seven inputs. The status of heart risk of patients is assigned by a number between '0' to '1' and that number indicates whether the heart attack is mild or massive.

Ali Adele and Mehdi Neshat [11] introduced a system by using fuzzy expert system for the diagnosis of heart disease. They design the system based on the 13 input fields and one output field. The 13 inputs are chest pain, blood pressure, cholesterol, blood sugar, maximum heart rate, electrocardiography, exercise, old peak, thallium scan, sex and age. The results obtained from designed system are compared with the data in upon database and are observed results of designed system are correct in 94%.

M. Anbarasi, E. Anupriya, N.Ch.S.N.Iyengar [12] uses genetic algorithm for the prediction of heart disease. They reduce the thirteen attributes to six by using genetic algorithm. Three classifiers like Navie Bayes, Classification by clustering and decision tree are used to predict the diagnosis of patients. Classification via clustering performs poor compared to other two methods.

Dr. V. Shrandhanjali and E. P. Ephzibah [13] developed a Fuzzy Petri net application for Heart Disease Diagnosis. The rule based is associated with transition for certainty factors. Vanisree K, Jyothi Singaraju [14] has used a decision support system for the diagnosis of congenital heart disease. They have used back propagation neural network. The input layer receives signals from the external nodes and transmits these signals to other layers without performing any computation at that layer. It has been trained using a supervised delta learning rule. The dataset used in this study are the signs, symptoms and the results of physical evaluation of a patient. The proposed system has achieved an accuracy of 90%.

A.Q. Ansari, Neeraj Kumar Gupta [15] in 2011 proposed that Computational intelligence combines

fuzzy systems, neural network and evolutionary computing. In their paper, Neuro fuzzy integrated system for coronary heart disease is presented. In order to show the effectiveness of the proposed system, Simulation for automated diagnosis is performed by using the realistic causes of coronary heart disease. The results suggest that this kind of hybrid system is suitable for the identification of patients with high/low cardiac risk. R. Das, Ibrahim Turkoglu, Abdulkadir Sengur [16] have used a neural network based model for the diagnosis of heart disease. Initially the data have been partitioned for the purpose of the usage of the neural network and for the validation of data sets. Three types of neural networks have been used. The authors have made a comment that a multilayer feed forward neural network has shown the excellent performance among the three types of neural networks. K. Rajeswari, V. vaithyanatham,, P. amirtharaj [17] have proposed a Decision support system for reliable heart disease risk prediction of Indian patients using machine learning technique. They have used genetic algorithm to determine high impact pattern and their optimal value. They have used theoretical approaches to implement the machine learning algorithm.

3. RESULTS & DISCUSSION

We implemented the heart disease diagnosis system with FIS editor and we use Mamdani approach. The inputs attributes, output attributes, membership function and rules are embedded in FIS editor.

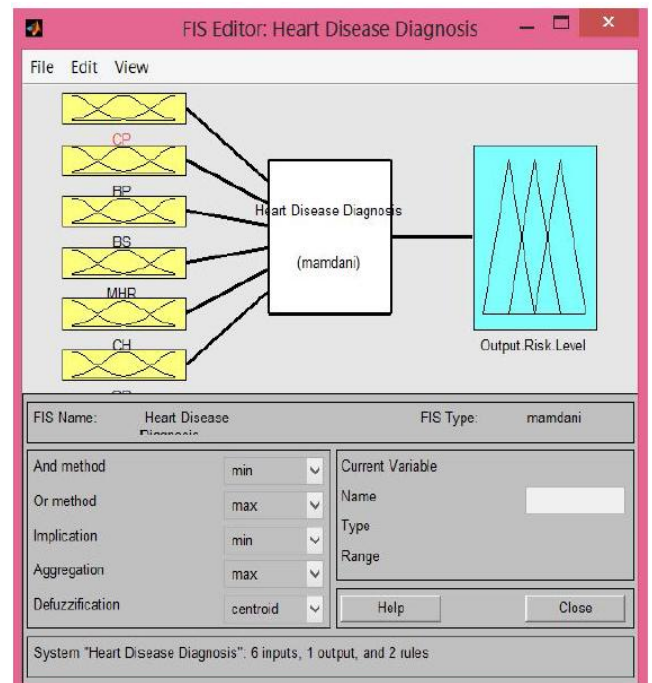


Figure 5.2 FIS Editor with Input & Output Variables

We have six input variables so we can add input variables by clicking edit, add variables, input. One can add number of input and output variables as per requirement. The name of variables, type of membership function and range is selected for each variable. In our case we use CP, BP, BS, MHR, CH and OP input variables representation of Chest Pain, Blood Pressure, Blood Sugar, Max. Heart Rate, Cholesterol and Old Peak respectively. The FIS now needs to have rules defined. To do this double click on the white box in between the input and output membership functions. This will bring up the Rule Editor; this is where the linguistic inference rules are entered. To enter a rule select the desired 'if' option and 'then' option and click 'add rule' at the bottom.

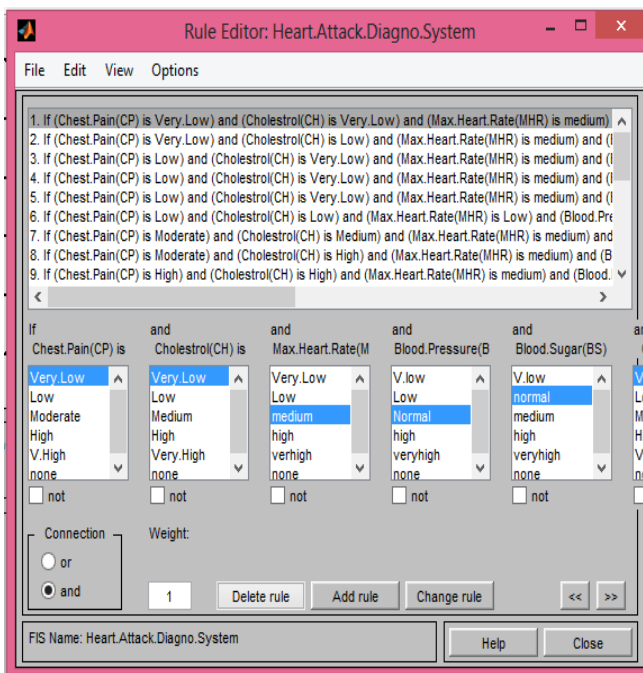


Figure 5.4 Rule Editor Window

Table 5.1: Diagnosis Model Testing

CP	CH	MHR	BP	BS	OP	Result	Remark
0	100	108	135	100	0	0.0721	Healthy
1	400	150	200	250	1	0.970	Terrible
0.5	300	150	160	150	0.6	0.5	Moderate
0.3	120	112	15	145	0.03	0.199	Low
0.7	335	138	175	150	0.5	0.669	Risk
0.82	352	148	180	200	0.75	0.795	High

4. CONCLUSION

Heart Disease Diagnosis with Fuzzy Expert System is implemented in FIS editor of MATLAB. The system is designed with the help of membership functions,

input variables, output variables and rule base. The fuzzy based heart disease diagnosis has 6 inputs attributes or variables and one output attribute/variables which are selected with the help of literature reviewed. The system check whether a person have any heart disease risk or not and is utilized for further necessary action. The use of fuzzy logic is one of the simpler and efficient techniques for the diagnosis of heart diseases analysis and hence improves results. The developed system is designed in way that patient can use it himself. Experimental results showed that the system did quite better and have about 90% efficiency.

REFERENCES

- [1] Mendis, S., Puska, P., Norrving, B. (2011). Global Atlas on cardiovascular disease prevention and control. ISBN 978-92-4-15637-3.
- [2] Gale Nutrition Encyclopaedia (2011). Heart disease http://www.answers.com/topic/ischaemic_heart_disease (Accessed 25 February 2011).
- [3] Merijohn G. K., Bader J. D., Frantsve-Hawley J.,(2008). Clinical decision support chair side tools for evidence-based dental practice. The Journal of Evidence-Based Dental Practice, 8 (3) 2008, pp.119–132.
- [4] Garg N.K., Adhikari, McDonald H. (2005). Effects of computerized clinical decision support systems on practitioner performance and patient outcomes. Journal of the American Medical Association. Pub Med, 293 (10). pp. 1223–1238.
- [5] Abbasi M.M., Kashiyarndi S. (2006). Clinical decision support systems: a discussion on different methodologies used in health care.
- [6] Warren J., Beliakov G., Zwaag B. (2000). Fuzzy logic in clinical practice decision support system. In: Proceedings of the 33rd Hawaii International Conference on System Sciences, Maui, Hawaii. 4–7 January 2000.
- [7] Anderson J., Clearing the way for physicians use of clinical information systems Communication of the ACM (1997), pp. 83–90.
- [8] E. P. Ephzibah “Design of a Fuzzy-based Decision Support System for Coronary Heart Disease Diagnosis” Journal of Medical Systems October 2012, Volume 36, Issue 5, pp 3293-3306.
- [9] Novruz Allahverdi & Serhat Torun & Ismail Saritas “Design of a Fuzzy Expert System for Determination of Coronary Heart Disease Risk” International Conference on Computer Systems and Technologies - CompSysTech’07.
- [10] Manisha Barman, J Pal Choudhury” A Fuzzy Rule Base System for the Diagnosis of Heart Disease” International Journal of Computer Applications (0975 – 8887) Volume 57– No.7, November 2012.
- [11] Ali Adele and Mehdi Neshat, “A fuzzy expert system for heart disease diagnosis”, International Multi-conference of engineers and computer scientists, 2010, Volume 1.
- [12] M. Anbarasi, E. Anupriya, N. Ch. S. N. Iyengar “Enhance Prediction of Heart Disease with Feature Subset Selection using Genetic Algorithm” International Journal of Engineering and Technology Vol.2 (10), 2010, 5370-5376.
- [13] E. P. Ephzibah and Dr. V Shrandhanjali “A Hybrid Genetic-Fuzzy Expert System for Effective Heart Disease Diagnosis”, International Journal of Latest Trends in Computing (E-ISSN: 2045- 5364) 165 Volume 2, Issue 1, March 2011.
- [14] Vanisree K, Jyothi Singaraju, “Decision Support System for Congenital Heart Disease Diagnosis based on Signs and Symptoms using Neural Networks”, International Journal of Computer Applications (0975 – 8887), volume 19– No.6, April 2011. Pp: 6-12.

- [15] A. Q. Ansari ,Neeraj Kumar Gupta “Automated Diagnosis of Coronary Heart Disease Using Neuro-Fuzzy Integrated System” IEEE Conference on Fuzzy Systems in 16-18 Jan 2011.
- [16] Resul Das, Ibrahim Turkoglu, Abdulkadir Sengur, “Effective diagnosis of heart disease through neural networks ensembles”, Expert systems with applications, vol. 36 number 4, may, 2009, pp: 7675–7680.
- [17] K. Rajeswari, V. vaithyanatham, P. Amirtharaj, ”Prediction of risk score for Heart Disease in india using Machine Intelligence”, International Conference on Information and network Technology 2011, IPCSIT Press, Singapore, vol no 4, pp: 18-22.