International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395 -0056
Volume: 03 Issue: 06 | June-2016 www.irjet.net p-ISSN: 2395-0072

Artificially Intelligent Primary Medical Aid for Patients Residing in Remote areas using Fuzzy Logic

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Abstract - *This work introduces a system that will analyze and evaluate the disease of the patient residing at remote sites where the provision of a qualified medical doctor is not available. This system is based on Fuzzy Logic, adopting Mamdani model as the fuzzy inference mechanism, list of medical diseases and a list of medicines that may be required for primary health maintenance as metrics for evaluating the disease and providing primary medical aid. It is based on relevant inferences from field experts and exploration of the available literature from the books, research papers, and the web. This is user-friendly, GUI-based system that enables even early developers to analyze the disease and its primary medical aid. The advantage of the system is that it provides 24X7 primary medical aids at remote locations with the pre-defined medical metrics. The computer database (rule-base) consists of disease-symptom relationships, disease probabilities, and depending on the appropriate organization, other medical information relevant to diagnoses and search of the particular diseases involved.*

Key Words: Medical, OPD, Remote, Fuzzy Logic, Fuzzy inference model, Mamdani Model, De-fuzzification.

1. INTRODUCTION

Fuzzy logic was advanced in 1965 by Dr. Lotfi Zadeh a professor at the University of California, Berkley. One kind of uncertainty is fuzziness that is no sharp transition from complete membership to nonmembership. In human reasoning much of the logic is not based on two values, it is not even multi-valued but fuzzy truth. In conventional logic everything is considered true or false, black or white but nothing in between.

The Fuzzy logic idea is similar to the human being's feeling and inference process unlike classical control approach, which is a point-to-point control, fuzzy logic control is a range-to-point or range-to-range control. The output of a fuzzy controller is borrowed from fuzzifications of both inputs and outputs using the identify membership functions. A crisp input will be transformed to the different members of the identity membership functions established on its value. From this point of view, the output of a fuzzy logic controller is established on its memberships, which can be tested as a range of inputs.

The idea of fuzzy logic was advanced by Dr. Lotfi Zadeh of the University of California at Berkeley in 1965. This development was not well recognized until Dr. E. H. Mastrategymdani who is a professor at London University, applied the fuzzy logic in a practical application to control an automatic steam engine in, which is approximately ten years after the fuzzy theory was created. Then, in 1976, Blue Circle Cement and SIRA in Denmark established an industrial application to control cement kilns. That system began to operation in 1982. More and fuzzier implementations have been reported since the 1980s, along with those utilizations in industrial manufacturing, automobile production, banks, hospitals, libraries and academic education. The main aim is to construct a control system that will provide good transient and steady state reply of the system. Fuzzy logic develops into a standard technology and is also applied in data and sensor signal analysis. Fuzzy logic has verified to be a powerful tool for decision-making systems, such as expert systems and pattern classification systems. Dr. Zadeh was working on the difficulty of computer understanding of natural language.

Formation of the fuzzy knowledge base in MATLAB can be done using a tool Fuzzy Logic Toolbox [2]. The Toolbox is a suite of software applications that make up the environment Matlab. It allows you to create fuzzy inference system and fuzzy classification in the environmental MATLAB, i.e., functionally driven to the formation of versatile classification for data systems. The base element in the Collection is the FIS-structure, i.e. the Fuzzy Inference System. FIS-structure contains the necessary functional blocks for implementation of fuzzy inference.

The Medical Diagnosis System takes input in the form of symptoms and gives output in the form of a particular disease. The fuzzy rules used in the system are based on expert knowledge. There are basically 5 inputs provided and 1 output given by the system.

2. PROPOSED METHODOLOGY

- The theoretical framework of a decision making (if-then) system for defining the proper design of object-oriented software.
- The basic concept of fuzzy logic.

Theoretical framework: Online primary medical aid symptoms evaluation implies pointing out of those symptoms that are relevant for the analysis of disease and then infer from the database/rule-base the possible disease. Hence, the framework is comprised of three metals:

- The dataset for the symptoms.
- Design principles.
- Relevant inference.

Fuzzy logic: The term Fuzzy logic is a method to calculate a solution based on "degree of truth" instead of classical "true or false" (1 or 0) Boolean logic upon which even today's computers are based. The concept was advanced by Dr. Lotfi Zadeh of the University of California at Berkeley in the 1960s. Dr. Zadeh was going through the concept of computer understanding natural language, which is not obviously translated into the discrete terms of 0 and 1 [3]. (To mention everything in binary terms is a philosophical question of great concern).

Fuzzy logic consist of 0 and 1 as horizons of truth (or "the state of matters"), it also contain the various states of truth in between, for example, the result of a identification between two things could be not "tall" or "short" instead it is ".38 of tallness." Fuzzy logic appears to be very near to the way the human brains work [4]. Human brain collects the data and forms a number of partial truths which it aggregate further into higher truths that in turn when certain thresholds are exceeded, cause certain further results. It may help to see fuzzy logic as the way reasoning really works and binary or Boolean logic is simply a special case of it.

Assigning weight: Weighting factors [5] are estimated values indicating the relative importance or impact of each item in a group as compared to the other items in the group. The purpose of assigning weighting factors is straightforward they help us establish work priorities. There are a number of different statistical packages available and each has different methods of adding weights to the data. The simplest way is to consider a standard fixed weight to your data set according to the specified criteria. Each individual response can then be compared to this standardized weight.

ASSIGNING: A

- Low=3
- Med=2
- High=1

Adding up all the values of "n" inputs of symptoms. We divide the sum by "n" to get the average value. Output weights from assigned inputs:

$$O[W] = \frac{Values\,[symptom1 + symptom2 + \cdots + symptom\ n]}{n}$$

Now comparing O[w] with A (set) we may virtually qualify the symptom as:

- HIGH
- MEDIUM
- LOW

The structure of a fuzzy rule can be divided into two parts: an if-part (also referred to as the antecedent part) and a then-part (also referred to as the consequent part)

IF<antecedent>THEN<consequent>

The antecedent describes a condition whereas consequent describes a conclusion. Fuzziness helps to evaluate the rules, but the final output of the fuzzy system has to be a crisp number. De-fuzzification is used to convert fuzzy inference results into a crisp output.

3. MEDICAL DIAGNOSIS SYSTEM

The principle of this system has two major components which are symptoms as input and the output as a disease. This system will interactively ask the patients about the symptoms then a decision will be inferred from the rule base with respect to these symptoms according to the fuzzy inference system and then the primary medical aid will be prescribed.

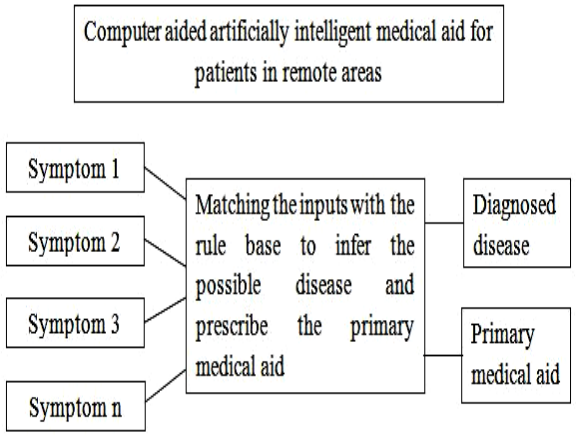

Fig -1: Graphical layout of the working of the system

3.1 Fuzzy Interface System

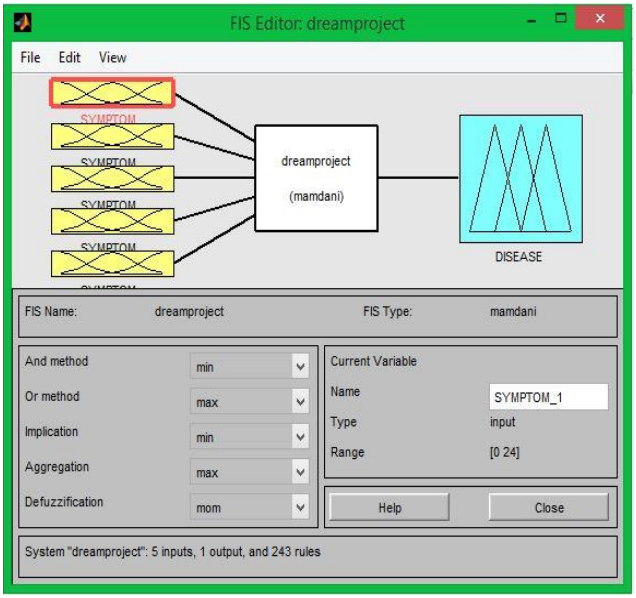

Fig -2: Fuzzy Inference System

To design a Fuzzy Diagnosis System, Fuzzy Inference System (FIS) Toolbox in MATLAB is a very powerful Graphical User Interface (GUI). The FIS Editor displays instruction about a fuzzy inference system. There's a simple diagram at the top that shows the names of each input variable on the left and those of each output variable on the right. However, the number of inputs may be limited by the available memory of your machine.

3.2 Membership Function Editor

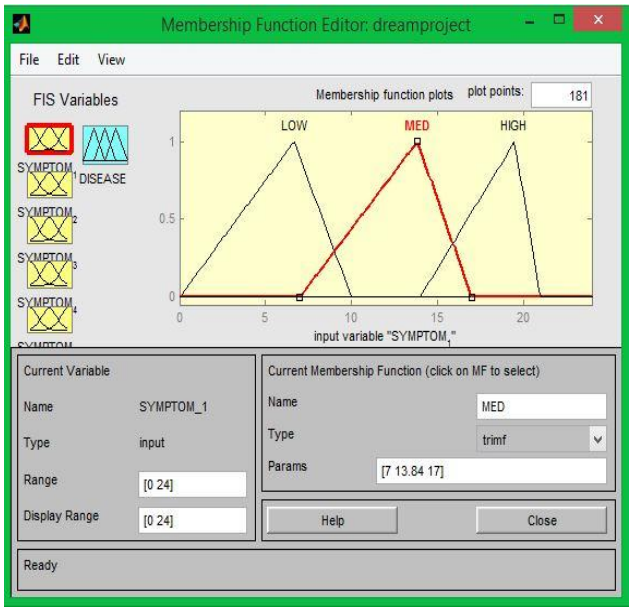

Fig -3: Membership Function Editor

Figure 3 is to define the shapes of all the membership functions associated with each variable. The sample membership functions shown in the boxes are just icons and do not depict the actual shapes of the membership functions. The Membership Function Editor is the tool that lets you display and edits all of the membership functions for the integrated fuzzy inference system, including both input and output variables.

3.3 Rule Editor

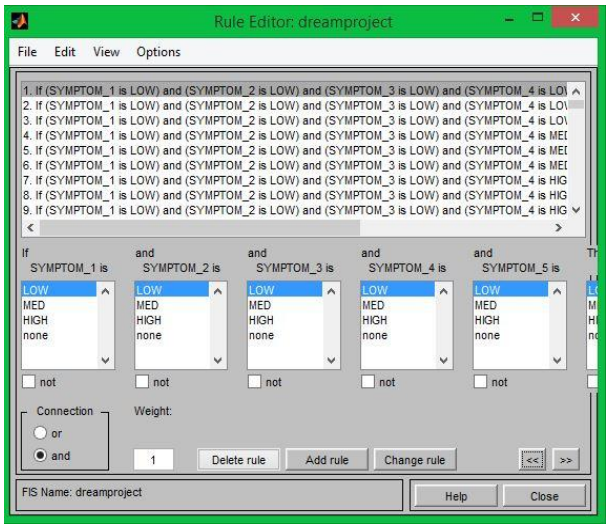

Fig -4: Rule editor

Rule Editor is for editing the list of rules that defines the behavior of the system. The Rule Editor consists of a large editable text field for displaying and editing rules. It also has some by now familiar landmarks similar to those in the FIS Editor and Membership Function Editor, including the menu bar and the status line.

3.4 Rule Viewer

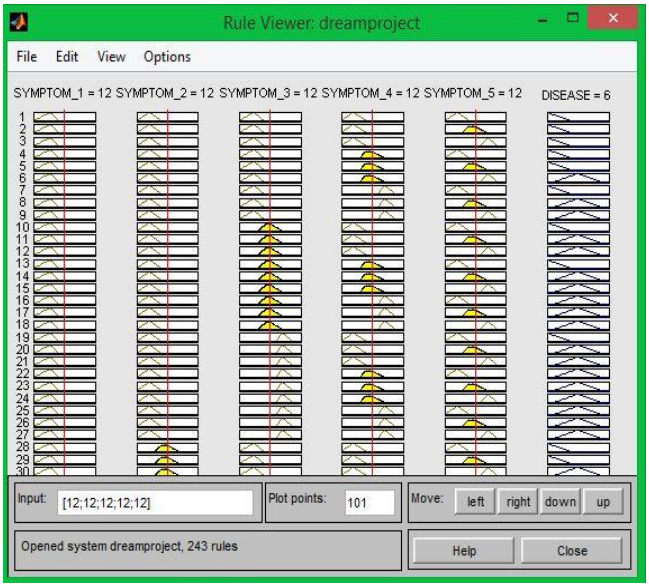

Fig -5: Rule Viewer

Rule Viewer to view the fuzzy inference diagram. Use this viewer as a diagnostic to see, for example, which rules are active, or how individual membership function shapes significance the results. The Rule Viewer displays the instructions of the whole fuzzy inference process. In addition, there are the now intimate items like the status line and the menu bar. In the lower right, there is a text field where you can enter a specific input value.

4. CONCLUSION

Fuzzy logic is a simple and effective technique that can be advantageously used for medical diagnosis of a wide range of diseases. This work presents a methodology to capture the experience of expert physicians and store it to represent disease profiles. Simple fuzzy inference techniques can be used to provide diagnosis decisions. Complete agreement with the diagnosis of human expert specialists has been obtained in many experiments with different input symptoms by various researchers. Fuzzy logic provides an alternative way to represent linguistic and subjective attributes of the real world in measuring. It is ready to be applied to control systems and other applications in order to improve the efficiency and simplicity of the design process.

5. FUTURE WORK

This work will become a strong foundation for the hard workers who will aim at defining negative features of any system so as to improve existing system and produce the best for future. There may be addition of video conference with medico experts in required cases, X-RAY scan, blood pressure monitor analogous to mercury Sphygmomanometer, temperature monitor analogous to mercury thermometer and if the threshold value of the disease reaches beyond toleration limit then the whole case file may be reported to the qualified doctor for expert advice through e-mail.

REFERENCES

[1] W. Rogers, B. Ryack and George Moeller "Computer-Aided Medical Diagnosis: Literature Review." International Journal of Biomedical Computing 10.4 (1979): pp. 267-289.
[2] G. Licata, Dipartimento Fieri, University Of Palermo, Viale Delle Scienze, Palermo, Italy; "Employing Fuzzy Logic in the Diagnosis of a Clinical Case"; Vol.2, No.3, pp. 211-224 (2010).
[3] Fuzzy logic. (n.d.). Retrieved January 27, 2015, from http://en.wikipedia.org/wiki/Fuzzy_logic'.
[4] Yen, John, and Reza Langari. Fuzzy logic: intelligence, control, and information. Prentice-Hall, Inc., 1998.
[5] Zhiliang, Lin. "Water Sensitive Urban Design cost balance model through life-cycle costing methods."
[6] Runkler, Thomas A. "Selection of appropriate defuzzification methods using application specific properties." Fuzzy Systems, IEEE vol no, Transactions on 5.1 (1997): page no, pp. 72-79.
[7] Saneifard, Rahim, and Rasoul Saneifard. "A method for defuzzification based on centroid point." Official J Turk Fuzzy Syst Assoc 2 (2011): pp. 36-44.
[8] Hung, Wen-Liang, and Jong-Wuu Wu. "Correlation of intuitionistic fuzzy sets by centroid method." Information Sciences 144.1 (2002): pp. 219-225.
[9] Patel M., Virparia P., and Patel D., "Web Based Fuzzy Expert System and its Applications-A Survey." International Journal of Applied Information Systems 1.7, 11-15 Volume 1– No.7, March 2012.
[10] Mayilvaganan M., Rajeswari K., "Health Care Analysis based on Fuzzy Logic Control System." Blood Pressure 180.110: 70 Volume 2 Issue 4, Jul-Aug 2014.
[11] Dagar P., Jatain A., and Gaur D., "Medical Diagnosis System using Fuzzy Logic Toolbox." ISBN: 978-1-4799-8890-7/15/$31.00 ©2015 IEEE.

[12] Mayilvaganan M., and Rajeswari K., "Risk Factor Analysis to Patient Based on Fuzzy Logic Control System." Blood Pressure 60: International Journal of Engineering Research and General Science Volume 2, Issue 5, August-September, 2014.

[13] Monish Kumar Choudhury, Neelanjana Baruah "A Fuzzy Logic-Based Expert System for Determination of Health Risk Level of Patient." Volume: 04 Issue: 05, May-2015 IEEE.

BIOGRAPHIES

Ravinkal Kaur, is pursuing M.TECH final year in department Computer Science Engineering at CT Institute of Technology and Research, Jalandhar. She has done her B.TECH in trade Information Technology from CT Group of Institute. Her topic of research is primary medical aid for patients residing in remote areas using fuzzy logic.