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MEDICAL EXPERT SYSTEM FOR INDIAN RURAL HEALTH CARE SYSTEM USING FUZZY KNOWLEDGE BASE

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ABSTRACT: Fuzzy Knowledge base system is very effective idea for the rural health care system where the experienced doctors are not available. The opinion and knowledge of the experienced doctors can be compiled and implemented through the fuzzy inference system. Fuzzy inference system is very efficient system to predict on existing knowledge. This study suggests the world wide experience of the expert doctors can be compiling and incorporated in this system. In Indian scenario any expert system must be cost efficient and maintainable in less cost.

KEYWORDS: Fuzzy Inference System, Fuzzy Rule, Fuzzy Knowledge, Fuzzification, Defuzzification.

INTRODUCTION: This is the era of Artificial Intelligence and we can see the application AI in every sphere of human life. In this research paper we will discuss about the use of expert system in medical field. In the area of medical many decision support systems were developed as Aaphelp, Mycin, Internist I, Pip, Isabel, Emycin, Casnet/Glaucoma, Dxplain, Quick Medical Reference, Refiner Series System and PMA[**1**][**2**]. All these systems are helping physicians in their decisions for finding and treatment of different kind of diseases. The analysis of ailment involves several levels of ambiguity and vagueness [**3**]. Some uncertain situations exist in science and fuzzy logic is capable to deal with it. It can be say that fuzzy logic is an approach of qualitative data computation [**4**][**5**][**6**]. This paper is organized as follows; in section 2, research methodology is presented and section 3, describes the proposed model and its working process. Section 4 is conclusion and future work, which describe the significance of this research model and what can be done in future in this area of research.

METHODOLOGY: To analyse or perform any research related problem we have to go through some steps and procedure. To perform any kind of research problem some authentic and refined data are needed. Therefore we have to plan for the data collection methodology. To accomplish the proposed hypothesis now we have some simulation tools which works on some well-established scientific rules and principles. This study is completed through the given research approaches using the MATLAB simulator [**7**].

STEP-1 KNOWLEDGE ACQUISITION SYSTEM: The system or data gathering models are used in this process for the expert system. The knowledge engineer refine the acquired data from the allied are expert and make the rule base for the expert system to solve the proposed problems.

STEP-2 KNOWLEDGE BASE: This is the collection of rules to apply the fuzzy inference system.

STEP-3 INFERENCE ENGINE: This is a kind of control system which controls and implements the rule base. This system performs the reasoning process on existing data.

PROPOSED MODEL: This model is proposed to incorporate the expert knowledge in fuzzy knowledge base system with the help of rule base. In fuzzy logic data are always acquired in qualitative manner. In Table 1, some parameters are shown. With the help of these parameters some rule base are created on the basis of expert opinion or experienced people of the allied area. This data is shown only for the example purpose. The purpose of this study is only to show the working of the proposed model on some limited assumed data. Here eight symptoms are taken to predict three types of disease which is shown in Table 2. Input/output parameters are represented in qualitative manner (Low, Medium and High).

TABLE 1. INPUT PARAMETER

S. No.	INPUT PARAMETER	DESCRIPTION
1	P1	FEVER WITH WATERY NOSE
2	P2	VOMITING WHILE EATING
3	P3	FEVER PERSIST MORE THAN ONE WEEK
4	P4	LOOSE MOTION FREQUENCY
5	P5	GIDDINESS
6	P6	TONGUE DRYING
7	P7	WEAKNESS
8	P8	OBFUSCATION

TABLE 2. OUTPUT PARAMETER

S. No.	OUTPUT PARAMETER	DESCRIPTION
1	D1	VIRAL
2	D2	TYPHOID
3	D3	DIARRHEA

Figure 1, shows the relation of disease parameters with FIS where the compiled knowledge base exist and aggregate the existing knowledge with different aggregation techniques and finally produce the result in crisp manner. Figure 2, shows the triangular membership function to convert the qualitative data in quantitative form or vice versa. In given figure we can see that low triangle is represented by L and its value ranges from 0 to 0.4 and membership function lies between 0 to 1. Medium triangle domain value ranges from 0.1 to 0.9 whereas high triangle domain value ranges from 0.6 to 1. In low triangle we can see in the

Figure 2, when membership function degree is 1(highest), the value of the input/output variable will be 0 similarly this 1 membership degree in medium triangle domain gives 0.5 crisp value. In high triangle domain 1 membership degree gives exact 1 crisp value.

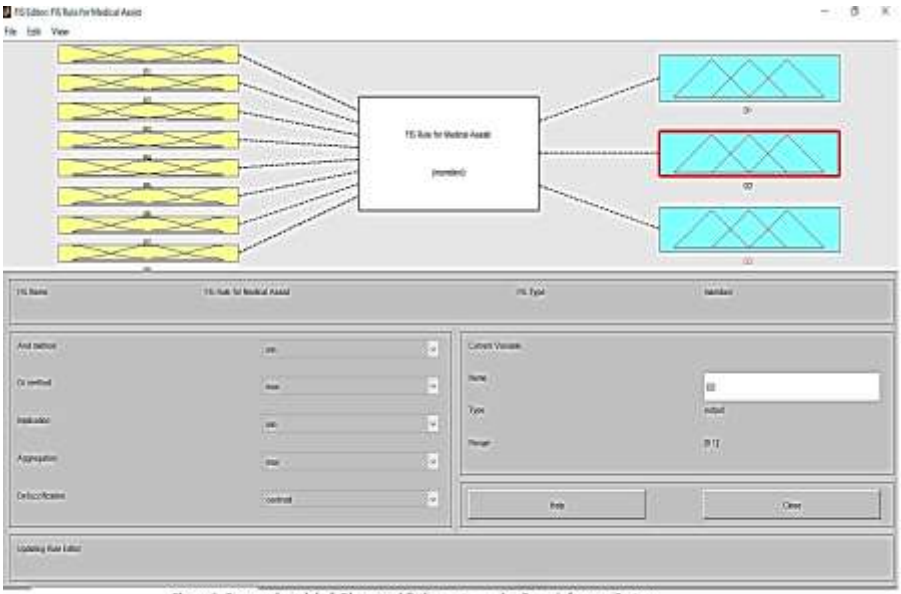

Figure 1. Proposed model of Disease prediction system using Fuzzy Inference System

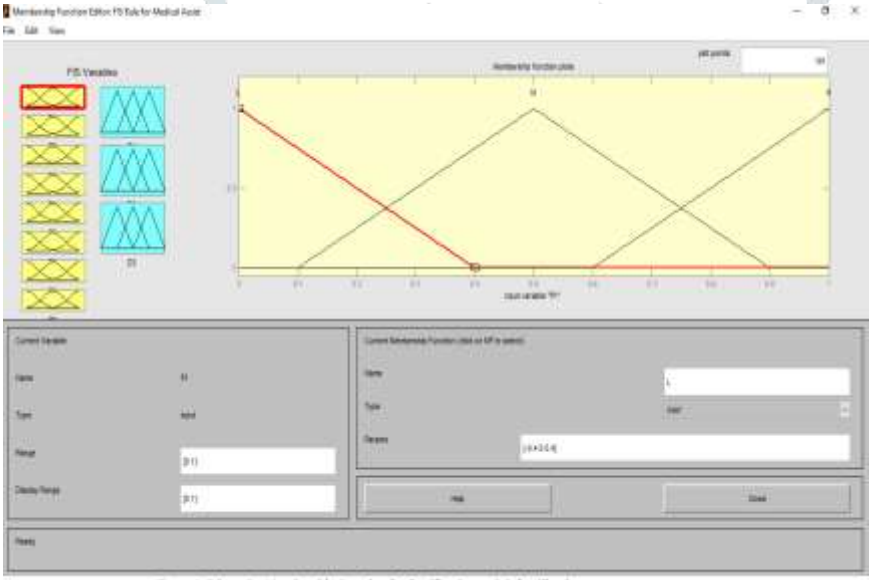

Figure 2. Triangular Membership Function for fuzzification and defuzzification process

The acquired data from the experts are represented in Table 3 in the form of rule base. Further this rule base/knowledge base is applied in the fuzzy logic supporting software system. In the given Figure 3, fuzzy rules are written in fuzzy rule base editor using the MATLAB simulator. In this editor Mamdani method is

applied for the aggregation and evaluation of the rule base result. Fuzzy rules and new parameter can be updated through this editor and saved.

TABLE 3. RULE BASE OF PATIENT CASE STUDY											
PATIENT INPUT PARAMETERS									DISEASE PREDICTION		
S.N.	P1	P2	P3	P4	P5	P6	P7	P8	D1	D2	D3
1	H	M	M	L	L	L	H	L	H	L	L
2	M	L	M	L	H	L	H	L	L	M	L
3	H	H	H	L	M	M	M	L	L	H	L
4	L	H	L	H	H	H	H	M	L	L	H
5	M	L	M	L	M	M	M	L	L	M	L
6	L	L	L	L	L	L	L	L	L	L	L
7	H	L	L	L	L	L	L	L	H	L	L
8	L	H	L	H	L	M	M	L	L	M	H
9	L	M	H	L	M	M	M	M	M	H	L
10	L	M	L	L	M	M	L	L	L	M	L

Figure 3. Fuzzy Rule base Editor of the Proposed Model

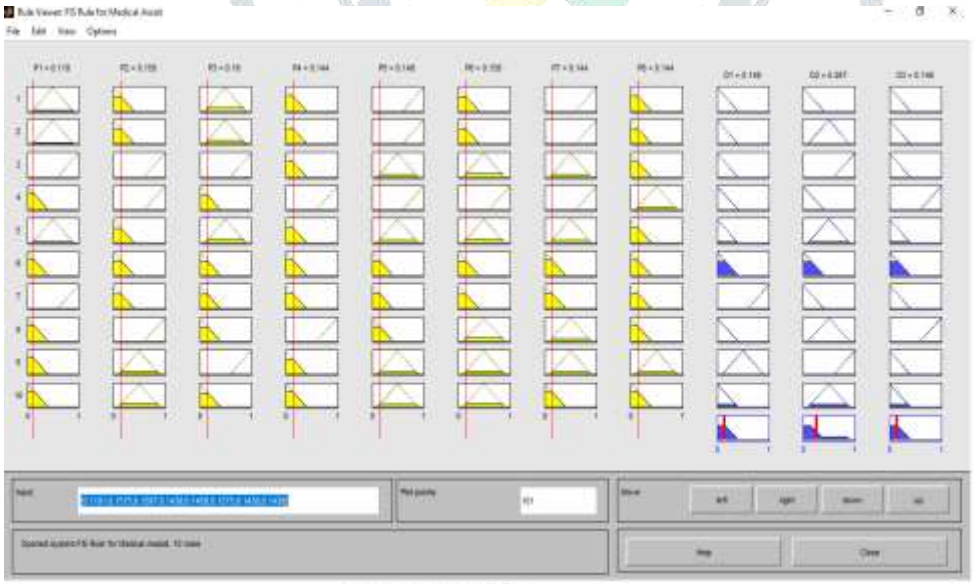

Figure 4. Fuzzy Rule Viewer

Figure 4, shows the rule viewer, in this figure we can see that vertical line shown in each input parameter. We can move this vertical line left and right around the given block in the rule viewer. By moving the vertical line we can generate the new value for the given input parameter and we can observe the result. Some observations are recorded, and with the help of this result we can predict the particular diseases possibility on the basis of input parameters qualitative/quantitative value.

CONCLUSION AND FUTURE RESEARCH: The proposed expert system may be very useful and cost efficient in Indian rural health care system where the expert and experienced doctors are available very less in number. This health care expert system may be very useful for the new/less experienced doctors and medical staff. In this proposed model there are no needs of programming language for the further new knowledge updating in the expert system. The created rule base in the demonstrated model is only based on some assumptions. There should be actual data for the working model. The accuracy of this system is depend upon the identification of input parameter and acquired data from the expert; therefore we should be more cautious in data gathering process. In future this research model can be enhanced with the new disease parameter identification and further the reinforcement learning can be implemented, where the model can correct itself in case of wrong decision.

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