

The Design of Fuzzy Expert System Implementation for Analyzing Transmissible Disease of Human

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ABSTRACT

The problem faced in the medical world is that decision makers to determine the disease still use manual method by doctor, even though doctor as human has a natural weakness, namely fatigue and limited physical consequences, it can be misdiagnosed, slow, sometimes uncertain, as well as transmissible disease of humans. To solve this problem, the writer conducted research for decision makers to determine transmissible disease of human using the forward chaining method in determining the initial prediction of a disease after the patient enters the symptoms. Then from the prediction of the initial disease, the software used backward chaining method in asking for other symptoms that the patient had not entered. This software was created by using the Fuzzy Set method in processing data on a knowledge-based system. Fuzzy method recognized the truth partially, this is very useful so that the system made has intelligence like human.

Key words : Transmissible disease, Symptomps , Fuzzy Expert system

INTROUCTION

Background

In the world of medical, we encounter something that is semi-relative thoughtlike a doctor who analyzes a disease, where a doctor cannot say the symptoms cause an absolute disease. Transmissible disease is a disease caused by biological agent (such as virus, bacteria or parasite), not due to physical factor (such as burns) or chemical factor (such as poisoning). A doctor here acts as an expert in providing information to patients regarding the disease based on complaints of symptoms expressed by the patient.

Problem Formulation

Based on the background described above, it can be concluded that the problem formulation is:

How to design and implement fuzzy expert system for analyzing transmissible disease of human in Pringsewu district"

Research purpose

The purpose of this research was to design and create expert system application using Fuzzy Expert System method in analyzing transmissible disease of human where this application is expected can help doctor in :

Identifying transmissible disease of patient based on the symptomps given by patient.. Confirming symptomps beside the symptomps input by patient after identifying patient disease formerly.
Determining accuracy of a disease.

Problem Limitation

Based on above description then it can be seen the limitations of the problem, namely :

Less precise in determining kind of transmissible disease System used is still manual

Research Benefit

The benefits of this research are :

Giving contribution to medical persommel as reference for determining possibility of transmissible disease suffered by patient and its solution.

For public, it can be used as guide for performing action that must be done if know how big the possibility of transmissible disease suffering.

Literature review

Fuzzy Expert System

Expert system is one part of artificial intelligence in which there are data derived from an expert. James P. Ignizio said that an expert system is a computer program that is made based on a particular field, whose expertise level of the program to deal with problems is comparable to the ability of an expert in the field. In other words, expert systems have knowledge as well as an expert. Expert system inside work based on rule based stored in the database. The general form of rule based used in expert systems is if A then B or if A then B, where A is called the premise and B is called a conclusion.

Fuzzy information system

Fuzzy Information System is a set of data that contains objects, where each object has an attribute [4]. The attribute between an object and another object is determined by a score between 0 and 1. Usually Fuzzy Information System is formed in a table. Fuzzy Information System table can be seen in Table 1.

Table 1. Fuzzy Information System

	A ₁	B ₂	C ₃	D ₄	E ₅	F ₆	G ₇	H ₈
U ₁	0	0	0.5	0	1	0	0	0
U ₂	1	0.8	0	1	0	0	0.6	0
U ₃	0	0	0.3	1	0	0	0.2	1
U ₄	0	0.9	0	0.4	0	1	0	1

From table 1 it can be seen if u1 until u4 is object and a1 until a8 is object attribute. From the table we can have the fuzzy form from each object as follows

$$u_1 = \{0.5/a_3, 1/a_5\}$$

$$u_2 = \{1/a_1, 0.8/a_2, 1/a_4, 0.6/a_8\}$$

$$u_3 = \{0.3/a_3, 1/a_4, 0.2/a_7, 1/a_8\}$$

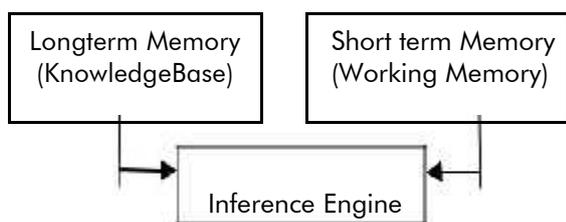
$$u_4 = \{0.9/a_2, 0.4/a_4, 1/a_6, 1/a_8\}$$

Object of this research is disease and each attribute is disease symptom. Each attribute has membership degree score between 0 and 1 to the object. If the score is 1 then the object certainly has that attribute. If the score 0 then the object does not have that attribute. If the score 0 until 1 it shows how big the opportunity of an object has certain score.

Forward chaining and backward chaining concept

There are three main parts in the architecture of the formation of an expert system, where the parts are: (1) Knowledge base is part of the expert system that contains domain knowledge. Generally in the form of a rule that has a structure if cause then effect. (2) Working memory is part of an expert system that contains information obtained from the user or the results of the inference from the system. Many expert system applications store information using databases, spreadsheets, or sensor devices. (3) Inference engine is a processor in an expert system that will match the information in the working memory with the domain knowledge located in the knowledge base.

The concept of this expert can be illustrated at Figure 1.



Forward Chaining Forward chaining

Forward Chaining Forward chaining is a problem solving method that is used to get the solution of a problem based on existing condition or a process that starts the search from the premise or data to the conclusion (datadriven). The way it works is that the inference engine turns on or select the rules where the premise part matches the information in the working memory section. Figure 2 is a chart of forward chaining

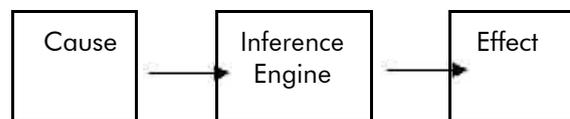


Figure 2. Forward Chaining

Sample of forward chaining usage where conclusion that is founded is G (Goal : G)

The samle of forward chaining usage where conclusion looked for is G(Goal :G) R1 = If A and C so E R2 = if D and C then H

$$R_3 = \text{If } B \text{ and } E \text{ then } F$$

$$R_4 = \text{If } B \text{ then } C$$

$$R_5 = \text{If } F \text{ then } G$$

The steps taken by the reasoning process with forward chaining are as follows: The computer takes the first rule (R1). There is A in the IF position because the score of A has not been in memory and there is no rule containing A conclusion, then the computer will question the answer from A to the user (assumed to be correct), after A is fulfilled then turn C to be checked for score, but there is no C score on memory. However, C is the conclusion of R4 rule. The system will switch to R4 rule. There is B in the IF position of rule R 4. Because it is not in memory and

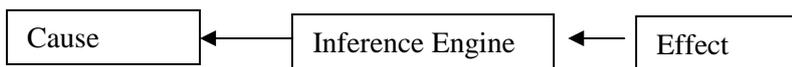
is not a conclusion of the rule, the computer will question the answer for B (assumed to be answered correctly). Thus the C conclusion is inputted to memory. By inputting C conclusion to memory, the requirements for E conclusion in R1 rule is fulfilled as well. E Conclusion is inputted to memory, then the computer will look for a rule with E in the IF position

Backward chaining

Backward Chaining Backward chaining is a method for finding a fact by recursively tracing existing subgoals. The working way of inference engine starts from a predetermined goal then goes backwards to prove the truth of the goal based on

and will get rule R3. In rule R3 the B and E scores are in memory with the correct score, then the F conclusion is fulfilled and will be inputted into memory. The computer then looks for another rule with F in the IF position and will get the R5 rule. G Conclusion on R5 rule is fulfilled, because F is true and the expert system will produce G conclusion.

what rules can form that goal. Backward chaining is the process of finding solution to conclusion then tracing the fact to find a solution that matches the facts given by the user (goal-driven). Figure 3 is a chart of backward chaining.



Gambar 3. Backward Chaining

In analyzing problem, if computer tries to fulfill the requirement from "JIKA" position in rule which conclusion is goal or premise from other rules.

Research method

Data Collection

Literature study that collects data related to the topic of this research, which is done by reading transmissible diseases, literature and collecting papers by visiting several hospitals and contacting parties related to the issues discussed. .

Data Analysis

The step of system analysis is research step on existing system with the purpose for designing new system or renew system. The activities were :

- a. Problem identification
- b. Project team organizing
- c. Information need defining
- d. System performance criteria defining

System Design And Implementation

Design

Application design as figure :

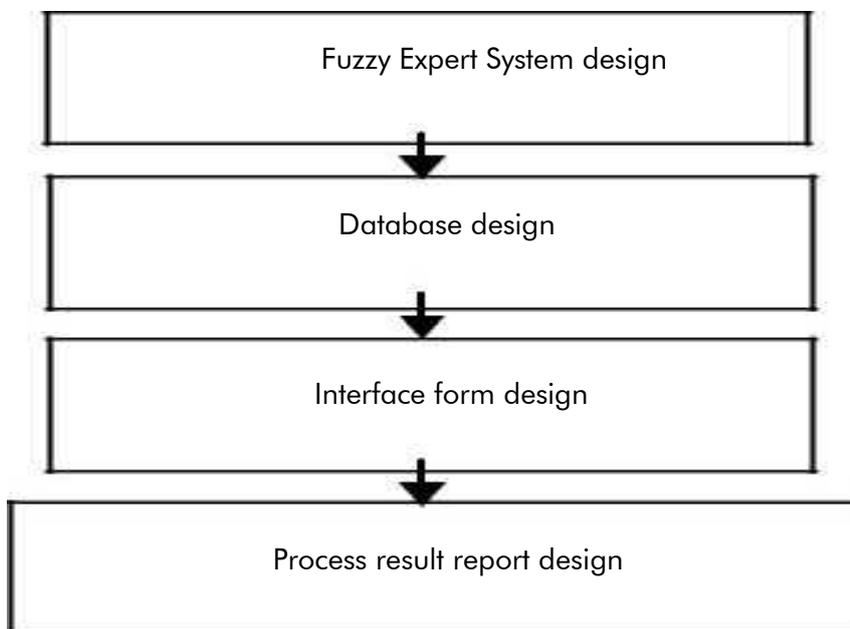


Figure 4. System planning diagram

At this step of fuzzy expert system planning, it more refers to the calculation of fuzzy score s at intervals 0 to 1. In this fuzzy expert system application, the inference engine greatly supports the success of an expert system. In the forward chaining and backward chaining method, the user can choose to use the

opinion of one expert or two experts. If the user chooses to use two experts, the user is required to give weight to each expert who represents the level of user confidence in each expert. In Figure 5 it can be seen the database design for the application created.

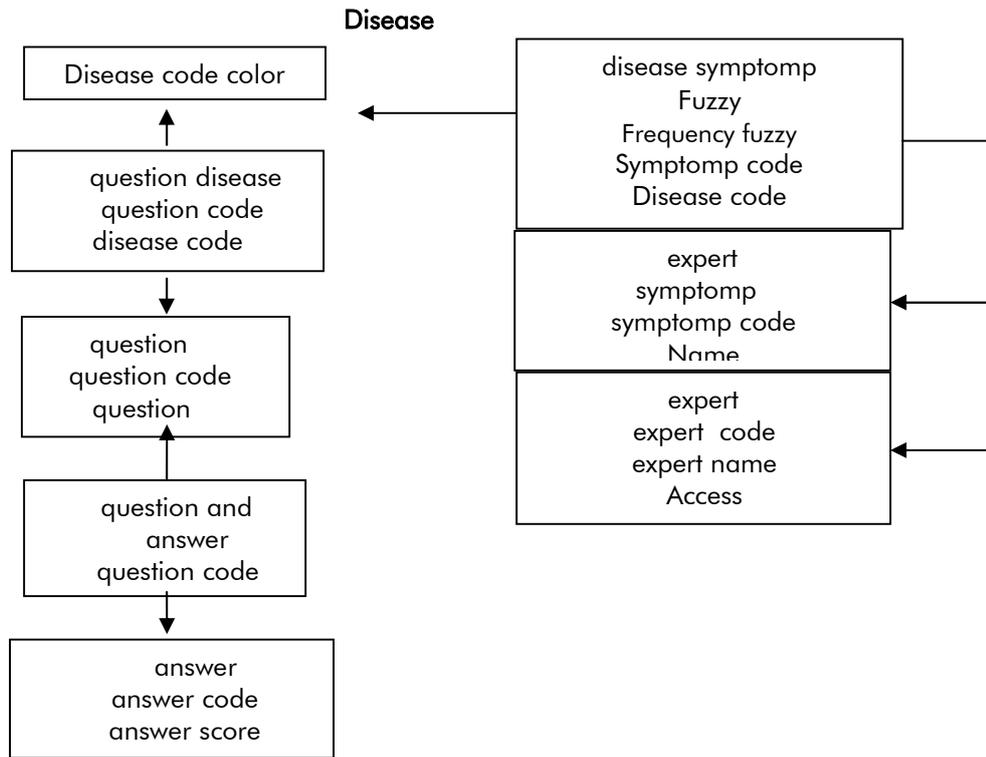


Figure 5. Physical Data of Application model

Implementation

System testing was done by comparing obtained result from program with the data in knowledge based and calculation result through formula with the process done by program.

Table 2. Knowledge-based of symptomp intensity based on expert-1

Disease	Symptomp							
	a ₁	a ₂	a ₃	a ₄	a ₅	a ₆	a ₇	a ₈
Influenza		0,2					0,8	
Allergic rhinitis				0,8			0,8	
DBD			1			0,8	1	
TBC	1	1	0,8	1				
Acute maxiliary sinusitis		1		1			1	1
Pneumonia		0,5	0,2	1	0,3		0,8	

Symptom							
a ₉	a ₁₀	a ₁₁	a ₁₂	a ₁₃	a ₁₄	a ₁₅	a ₁₆
				0,6	1	1	0,8
			0,8				
0,6							
0,6	1	0,6					
0,3							

a9	a10	a11	a12	a13	a14	a15	a16
				0,6	1	1	0,8
			0,8				
0,6							
0,6	1	0,6					
0,3							

Where a1, a2, ... a16 are symptomp that cause disease :

- a1 = coughing up blood
- a2 = chest pain and thightness
- a3 = weakness
- a4 = fever
- a5 = night sweat
- a6 = dizzy more than a month
- a7 = headache
- a8 = Pain in the forehead and eyebrows
- a9 = Reddish spots appear
- a10 = congestion and watery nasal
- a11 = sneezing
- a12 = watery eyes
- a13 = red eyes
- a14 = diarrchea of child
- a15 =tired
- a16 = pain in throat

Table 3. Knowledge-based of symptomp intensity based on expert-1

Disease	Sympto m						
	a2	a3	a4	a5	a6	a7	a8
Influenza	0,2					0,8	
Allergic rhinitis			0,8			0,8	
DBD		1			0,8	1	
TBC	1	0,8	1				
Acute maxiliary sinusitis	1		1			1	1
Pneumon ia	0,5	0,2	1	0,3		0,8	
		Sympto mps					

If a patient has symptoms with the following characteristics: Shortness of breath in the chest with a "very often" often (has a score = 1) and the intensity of the pain "very painful" (has a score = 1). - Pain in the body with "very often" frequency (has a score = 1) and the intensity of the pain "very sick" (has a score = 1). - The phlegm is mixed with blood with a frequency of "very often" (has a score = 1) and the intensity of the pain "is very painful" (has a score = 1).The patient wants to ask the expert1 for opinion. If

we look at Table 2 and Table 3 and the characteristics of these symptoms, the first possibility that the patient was suffering from tuberculosis. If with the application that had been made, the program gave the results of the Probability score = 0.6 for the name of TB disease. If the doctor wants to confirm other symptoms related to the disease, then a doctor will ask the patient about the symptoms of Cough suffered by the patient, after which the symptoms of Fever were more than a month (see

Table 2 and Table 3). From the symptoms suffered by the patient it can be concluded that the patient has tuberculosis.

Closing

Conclusion

The conclusion from this research are :
 The use of Table Information System is very suitable in the problem of transmissible disease analysis. Because by using the Table Information System the process of inputting data, changing data and deleting data can be easily done by an expert.-On the use of C constant , the more C is close to 1, the suitability score between knowledge-based symptom and the patient's input symptoms will be tighter. This means that the assessment of the application of the symptoms of the patient is more strict.-The use of suitability score and Fuzzy Conditional Probability help analyze infectious diseases that may be suffered by a patient.- The use of Rareness measures very well in finding common symptoms, and specific symptoms that are possessed by a disease, and in confirming symptoms beside those which are included for identifying possible diseases suffered by patients.

Suggestion

Implementation of fuzzy expert system design for analyzing transmissible disease of human on Pringsewu district is needed to be evaluated continuously so that it can be renewed and formed better application.

Main menu login to application

User must enter name/identity in username and password to be able to enter and to operate program.



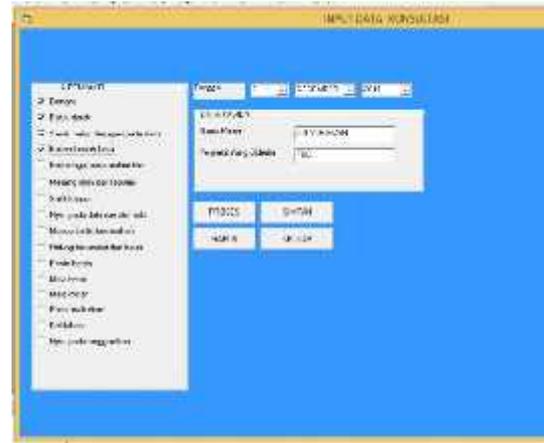
Patient data second menu

In this menu user is requested to input patient identity data to be known the number and patient data.



Last menu : Consultation data input

It can be used by user to input symptoms felt and to identify disease suffered.



Conclusion

Based on development and discussion result it can be concluded :

From this research it was generated a software that can diagnose transmissible disease type based on inputted symptom and can give information about diagnosed disease. Software generated can diagnose type of transmissible disease of human by using Visual basic 6.0 programming language that can act like an expert.

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