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EXPERT SYSTEM FOR DIAGNOSING LUNG DIASES USED CERTAINTY FACTOR

Yessica Siagian[1*], Janner Pelanjani Simamora[2]
[1]Information System, Sekolah Tinggi Manajemen Informatika dan Komputer Royal, Indonesia
[2]D3 Kebidanan, Poltekkes Kemenkes Tarutung, Indonesia

***Corresponding author*:**
yessica.cyg123@gmail.com
jannerosaze@gmail.com

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ABSTRACT

An expert system is a computer program that mimics thought processes and expert knowledge in resolving a particular problem. Implementation of the expert system can be applied in health, one of them to conduct lung disease diagnosis. According to WHO the case of TBC sufferers in Indonesia in 2017 ranks the largest third in the world. The high incidence of pulmonary disease is caused by several factors, among which the medical personnel who are experts in the field of disease, lack public awareness of lung health if experiencing certain symptoms of the disease often delay to conduct a medical examination. Also, air pollution such as smoke from smokers, industrial smoke mills, and the smoke of motor vehicles, when inhalation may cause impaired pulmonary health conditions. Therefore, researchers intend to build an expert system application that can help resolve the problem using the Certainty Factor method. This method provides space on the expert in giving his or her confidence value to the knowledge it reveals. This expert system is used as an initial diagnosis to determine the type of lung disease and as a tool for doctors to make decisions quickly and accurately.

INTRODUCTION

An expert system is a computer-based system that adopts human facts, reasoning, and knowledge so that it can solve problems such as experts[1]. The expert system is one of the science branches of Artificial intelligence which constructed based on knowledge base and rules and using research discussing the system of diagnostic experts [2][3]. The disease has been done much on previous research. One of them is a diagnostic expert system Diseases of the respiratory tract and lung can. Identifying diseases by documenting. Information or knowledge from experts with Search conclusions using the Certainty Factor Method [3].

Lung disease is one of the most common diseases in Indonesia. According to WHO the case of TBC sufferers in Indonesia in 2017 ranks the largest third in the world. The high incidence of pulmonary disease is caused by several factors, among which the medical personnel who are experts in the field of disease, lack public

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awareness of lung health if experiencing certain symptoms of the disease often delay to conduct a medical examination. The higher level of air pollution also triggers a variety of lung diseases. Smoke industrial plants and various other fumes, if many are inhalation by humans can interfere with lung function and cause the emergence of the disease Tuberculosis. A smoking habit can trigger the onset of lung cancer.

Lung disease is one of the diseases that have many symptoms and types that are different so that the handling requires the accuracy, expertise, and experience of the doctors. Symptoms such as cough, shortness of breath, or pain in the chest area indicate a disturbance to the lungs. By detecting it faster, this will help to prevent the disease from getting longer and worse. Therefore, the author intends to build an expert system application program that can help solve the problem using a method of assurance factor. This method provides space on the expert in giving his or her confidence value to the knowledge it reveals. This expert system is used as an initial diagnosis to determine the type of lung disease and as a tool for doctors to make decisions quickly and accurately.

METHOD

The certainty factor method is used when to Face an issue that answers are uncertain. This uncertainty could constitute a Probability. The measure of certainty of a fact or rule is determined using the Certainty factor. Several theories have been found to resolve uncertainty, among them using certainty factors [4].

Certainty Factor is a method to prove whether a fact is definite or uncertain in the form of a metric usually used in an expert system [5]. This method is perfect for expert systems that diagnose something that is not certain. The certainty factor is the value of the parameter given to demonstrate the magnitude of trust and distrust. By showing the weight value approach of the probability of the result of the problem. Thus acquired value of the trust or the truth of the rule or rule as a result of the approach of the probability weight value, where the value is between 0 and 1[6].

Certainty Factor (CF) was valued to make parameter clinical and given to the MYCIN as the level of trust [4]. Then the following formula is used the certainty factor:

$$CF(H,E) = MB(H,E) - MD(H,E) \qquad (1)$$

The expert systems are divided about the method and facts and rules to make the decision [4]. Expert systems are several important components namely: premise which is connected the AND or OR. certainty factor can be used to connect the estimate and different to the expert by several methods. In here, the formula will be accounted by certainty factor or CF in the bellow it :

$$CF(H) \begin{cases} CF(R1) + CF(R2) - [CF(R1) * CF(R2)] \text{ ; Value of CF(R1) and CF(R2)} > 0 \\ CF(R1) + CF(R2) + [CF(R1) * CF(R2)] \text{; Value of CF(R1) and CF(R2)} < 0 \\ \dfrac{CF(R1)+CF(R2)}{1-(\min[|CF(R1)|,|CF(R2)|])} \text{ ; Value of CF(R1) and CF(R2) contrary of sign} \end{cases} \qquad (2)$$

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The implementation of the expert system to a diagnosis about limited of lung disease will be formulated:

$$CF(R1,R2) = CF(R1) + CF(R2) - [CF(R1) \text{ x } CF(R2)] \qquad (3)$$

RESULT AND DISCUSSION

The knowledge base is very important for the expert system, the representation of the knowledge, or intelligently by a human. The system will be solved the problem and formulation of this program. Knowledgebases consist of two basic elements they are fact and save the rule into database form.

a. Fact is decided from knowledge by a human expert especially for lung disease from dr. Nini Deritana Sp.P, source a lot of books of health, the internet, and other literature that is related to this disease.
b. Rules as information a computer program needs can behave intelligently, it is related to the new fact and we have known the fact.

Inference Engine is a function of the process to guide the condition in the knowledge base. The inference engine can be saved in the process to show the manipulation of the system, model, and fact in the knowledge base and to get the solution and conclusion. The system of inference engine can be drawn in Image 1:

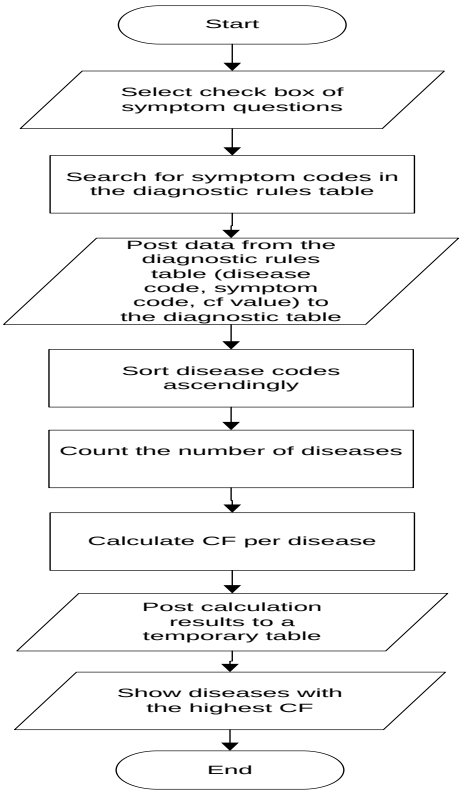

Image 1. Inference mechanism

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For know that, we will be described the way of interference engine :

1. In the inference engine by using the expert system, the system will be read to the user of symptoms and what they felt.
2. The symptoms are chosen, so the system will be done to get information about the disease in the knowledge base then looked for the rules with certainty.
3. After the rules, the system will be defined as several factors about the certainty factor (CF) based on the fact.
4. The system will be accounted for the combination of the value of certainty factor if the symptoms found one or more the disease. But if we found the only one about symptoms so the could not the combination of account. The result of accounted for to make a combination of the certainty value. If the value can be found the bigger or near of 1, so the bigger can be remarked with certainty the disease to diagnosis by the user.
5. After the interference engine will be shown the result for the diagnosis of the solution by using the certainty factor (CF).

In general, the diagram is showed the context and drawn to make the design with global, the diagram can be presented or related between system and to impacted the system operation.

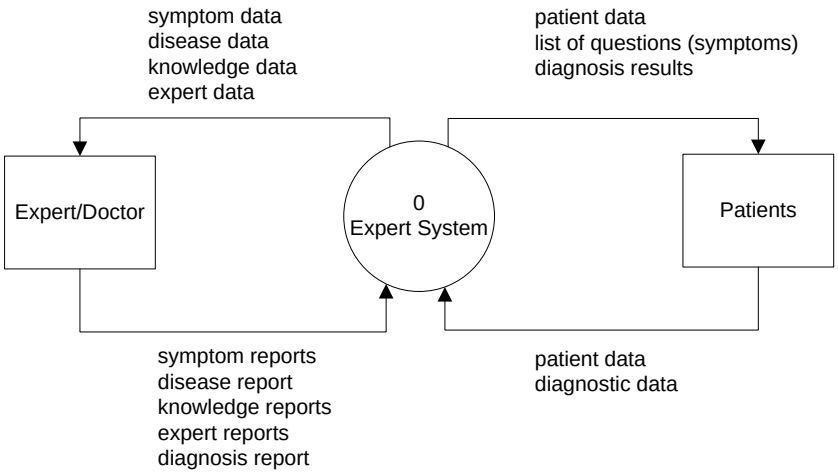

Image 2. Context Diagram

The context diagram used the expert system to diagnose lung disease and one process to get two terminators, which all process can be related to the expert system for diagnosis of lung disease. To Showed the data and information to use in this process of application development so to build the design about the database by using the tools Entity Relational Diagram (ERD). Complete of tables are used by the expert system for diagnosis the lung disease in the bellow it:

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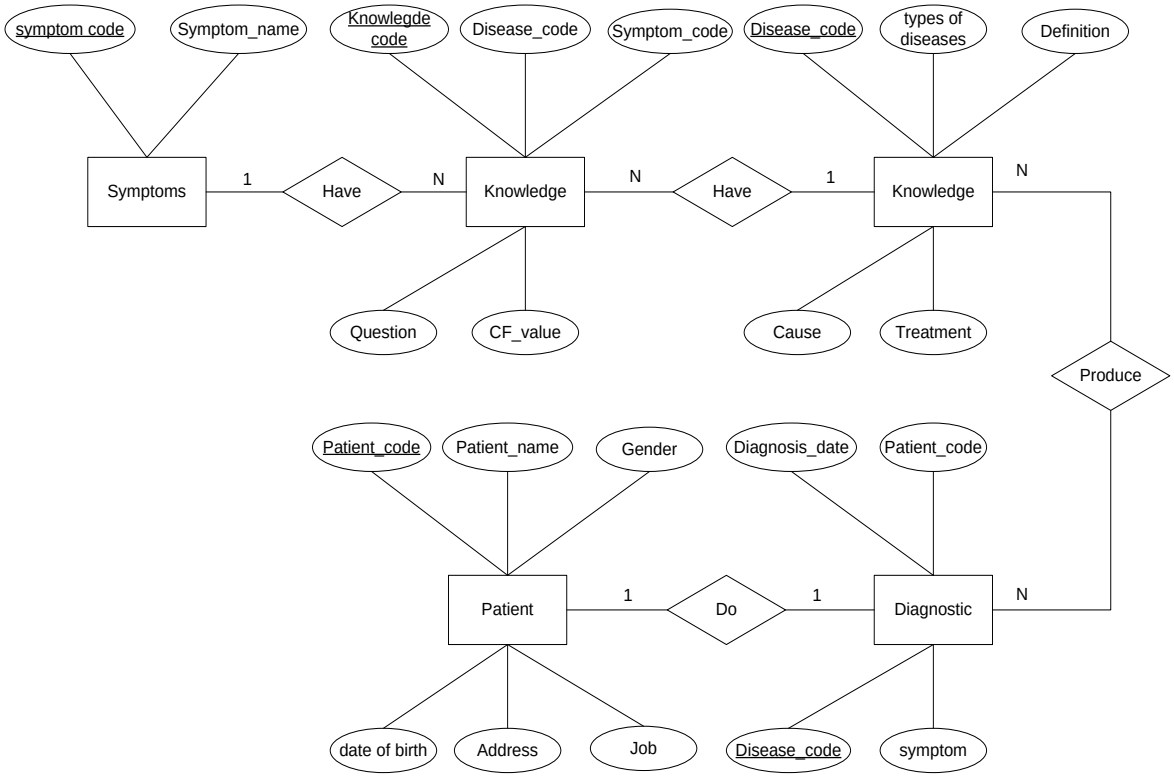

Image 3. Entity Relationship Diagram

An expert system is to diagnose lung disease and designed to use by a human, doctor, hospital, in here to the user is divided into two users with different about the orientation. The user of this expert are :

a. Expert/doctor
   Expert as a user with full access to the system and it was very important for the system, especially to managed the knowledge about lung disease. The menus were: front page, page of lung disease, page of data for disease, page of data for diagnosis, page of knowledge, page of expert data.
b. Patients
   As a visitor who can be accessed for diagnosis of lung disease. In this part can be done the self diagnose is the user to diagnose by himself with answered the questions about the symptoms to the growth trouble. These steps are divided into 3 parts: step 1: input data of patients, step 2: input for diagnosis or questioner is given to the system and patients will be answered the symptoms who they felt, and step 3: result for diagnosis.

For known the testing from the output by this expert system, firstly we can be done the process input to the data of patients then made the process of diagnosis, and gave the questioner about the symptoms for the lung disease what they felt by the patient. Answer the questions that will be assigned to the user so drawn the result for diagnosis and known the kinds of lung disease, factor value of certainty, definition, cause, and cure of

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this disease. We are shown the page and scene of diagnosis especially for the lung disease by using the question to the user.

Table 1. Diagnosis for Diseases

No	Question of Syptoms	Answer
1	whether to cough phlegm ?	☑
2	whether to cough dry ?	☐
3	whether to cough for more than 3 weeks ?	☐
4	whether muoid phlegm ?	☐
5	whether phlegm spurulen ?	☑
6	whether phlegm mukopurulen ?	☐
7	does phlegm mukopurulen the amount of sputum a lot ?	☑
8	whether the sputum smells fishy and anchovy-colored ?	☐

In Table 1 chose 3 points of symptoms then approach to diagnosis in the checkbox as the list of the questioner. Input 3 points of symptoms with codes 1, 5, and 7. Next, the system should be looked for the symptoms code in the table, then symptoms code is looked for the data of disease with code CF in the table of knowledge.

Before we do the account, the code of symptoms put into the smaller number to the bigger number as the function of the session with the account by certainty factor per-disease. the account of data and result with code CF (Code of disease and CF) after that can be moved to the table of result moment then the system should have appeared about the disease with the bigger code CF. The data saved in the table of result moment, it meant that to different the diagnosis which one we took it.

The table is shown that the diagnosis moment in Table 2, appeared some disease with the symptoms from the questioner checkbox with code CF the total per code based on the number code of disease.

Table 2. Result CF Total Per Id Disease in the Result of moment

No	Symptoms_code	CF_value
1	P1	0,85
2	P2	0,3825
3	P3	0,7975
4	P4	0,892
5	P5	0,25
6	P6	0,66
7	P7	0,595
8	P8	0,235
9	P9	0
10	P10	0

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Table 2. Result CF Total Per Id Disease in the Result of moment

No	Symptoms_code	CF_value
11	P11	0
12	P12	0
13	P13	0
14	P14	0
15	P15	0

The CF as the bigger of the disease with a code of P4. It was showed Bronkiektasis. Because most of the disease was not suitable for the input of symptoms. The rule CF has different from diagnosis the bigger or the smaller with code CF. There are many diseases which come upper and under this classification, or between the input symptoms code and code of disease. The bigger rule of CF is obtained from the expert system for diagnosis.

Table 3. Result for diagnosis of Diseases

No	Selected Symptoms	Diagnosis Date
1	whether to cough phlegm ?	22 March 2020
5	whether phlegm spurulen ?	22 March 2020
7	does phlegm mukopurulen the amount of sputum a lot ?	22 March 2020

You have a disease : **Bronkiektasis – CF 0.892**

From the inference engine cycles in this chapter so we have done the test in rule-1. From the data about 62, we can see that the symptoms of lung disease and the patients got feel only 3, they have done the cure of symptoms with id in the number: 1, 5, and 7. And then the system will be searched the code of systems and used the data with code CF in the table of knowledge. All the data sent to the diagnosing table and calculation.

CONCLUSION

The application of an expert system can be able to diagnose lung disease as an impact of patients and gave a contribution to them. The detection should be answered and very fast about the lung disease but also help the doctor and less of the level of the mistake. The method is used by Certainty Factor (CF) in the expert system and to answer the problem about the knowledge which the incompleted and uncertainty. This system can be made up of dynamic and the knowledge will be changed as the process of the diagnosis.

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