E-Diagnostic Early Detection of Pulmonary Tuberculosis Disease Using Certainty Factor Method

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Abstract
Currently, technological developments are very rapid, this development has brought significant changes to the role and function of computer technology. Pulmonary Tuberculosis Pelnylakit is an infectious disease caused by the infectious bacterium Mylcobactelrium Tubelculosis. The Mellati Community Health Center is one of the Mellati Community Health Centers which provides early detection services for pulmonary tuberculosis patients in the Pelrbaungan District. Pulmonary Tuberculosis disease at the Melati Community Health Center is limited to four with sixteen symptoms. The programming language that will be used is MySQL database and PHP. With this research, the aim is to create a system with accurate results for pulmonary tuberculosis. This expert system uses the certainty factor method and can be used to solve problems regarding pulmonary tuberculosis in patients well. The final result of the diagnosis is in the form of several questions that will be answered by the patient according to the condition they feel.

Keywords: Expert system, Pulmonary Tuberculosis, Certainty Factor

INTRODUCTION

At this time the development of technology is very rapid, this development has brought significant changes to the role and function of computer technology.

Pulmonary Tuberculosis is an infectious disease caused by the infectious bacteria Mycobacterium Tuberculosis. Most Tuberculosis germs attack the lungs, but can also infect other organs of the body which are commonly called Extra Pulmonary Tuberculosis (Nuraini, elt al. 2017). Pulmonary Tuberculosis is similar to a common cough, so that people often assume that coughing for months is a common cough [3].

Symptoms of Pulmonary Tuberculosis are: Continuous cough for two weeks, cough with liquid phlegm, cough with green phlegm, cough with blood phlegm, shortness of breath, chest pain, decreased appetite, decreased body weight, feeling unwell/malaise, night sweats without any physical activity, fever, prolonged fever, shivering, the appearance of lumps in parts that are not experiencing cell disorders such as the larynx, armpits, or groin area, lumps continue to grow in size and number, lumps feel soft when touched (Trio Alfianto, 2018).

Puskesmas Mellati is one of the Puskesmas Mellati that provides early detection services for Pulmonary Tuberculosis in Pelbaungan District. Puskesmas Mellati was established in 2001 and has served 1000 patients. Although it has had quite a long experience, Puskesmas Mellati still faces several technical or handling problems in providing services for technological advancements.

There are several technical or handling problems, namely: The problem of the relatively high cost of conducting Pulmonary Tuberculosis tests is an obstacle for communities with economic limitations, and the distance to the clinic is quite far, which is also an obstacle for communities living in rural or remote areas.

With the current technological era, a web-based application system can be designed which can implement the capabilities of a specialist in the health field which can be used to diagnose or detect early pulmonary tuberculosis using the Cell Factor method so that prevention can be carried out and the patient can receive serious treatment if pulmonary tuberculosis has been diagnosed.

Many previous studies have investigated Tuberculosis Pelnylakit, including those conducted by Naufal Rasylid et al (2022) in the Expert System for Diagnosing Pulmonary Pelnylakit Using Meltodel Celrtaintyl Factor and the results of the study showed a low level of virulence and were less specific and could not be applied in a region. Another study, Alelxius Ulan Bani & Fifto Nugroho (2020) in the Expert System for Diagnosing Brain Tuberculosis Pelnylakit Using Meltodel Celrtaintyl Factor and the results of the study produced a very high level of virulence and the location of the focus was not mentioned in this study. Based on the above problems, a study was conducted with the title "El-Diagnostic Early Detection of Pulmonary Tubelerculosis Disease Using the Celrtaintyl Factor Meltodel".

RESEARCH METHODS

Data collection is a technique or method carried out by researchers to be able to collect data related to the problems of the research being taken. The data collected by researchers is to support research related to the diagnosis of Pulmonary Tuberculosis. The data collection techniques carried out in this study are as follows:

Interviews were conducted to obtain information in the form of data directly from the source. The interview was conducted with a Pulmonary Tuberculosis expert, Mrs. Rahaylu Ningsih S.Kelb.Bd by submitting questions.

Conducting direct data collection by reviewing the research location, namely the Mellati Health Center, to obtain data on the characteristics and symptoms of Pulmonary Tuberculosis and expert assessment data for each symptom experienced which will be calculated using the celrtaintyl factor method.

Literature Study is conducted by collecting various references and supporting information from various sources such as intelligence, books and journals related to the expert system, Pulmonary Tuberculosis, Celrtaintyl Factor and other things related to the research.

The data in this analysis, namely Pulmonary Tuberculosis disease, were obtained from external sources. The source of knowledge was obtained through interviews at the Mellati Health Center with experts and literature studies on materials related to diagnosing Pulmonary Tuberculosis disease. The following is a description of the disease in Pulmonary Tuberculosis:

Table 1. Tuberculosis Symptoms

Disease Type Code	Name of Disease Type
P01	Extra Pulmonary Tuberculosis
P02	Pulmonary Tuberculosis
P03	Chronic Tuberculosis
P04	Miliary Tuberculosis

Table 2. Pulmonary Tuberculosis Symptoms and Weight Values

Code	Symptom Name	MB	MD
G001	The cough continued to erupt for two weeks.	0,6	0,1
G002	Cough with liquid phlegm.	0,8	0,2
G003	Cough with colored phlegm green.	0,5	0,1
G005	Cough with blood phlegm.	0,6	0,3
G009	Feeling unwell/malaise.	0,6	0,1
G010	Night sweats without any physical activity.	0,8	0,2
G011	Fever.	0,4	0,1
G012	Prolonged chills.	0,6	0,1
G013	Shivering.	0,8	0,1
G014	The appearance of lumps in affected areas such as the neck, armpits, or groin area.	0,6	0,1
G015	The lumps continue to grow both in size and number.	0,8	0,1
G016	The lump feels rubbery when touched.	0,6	0,2

User certainty value data is a list of answer choices from the user along with the weight value that will later be displayed in the application when the user chooses the answer that matches the symptoms they feel (Trio Alfianto, 2018).

Table 3. User Certainty Value Data

No	Information	User value
1	No	0
2	Don't know	0.1-0.2
3	Possible	0.3-0.4
4	A Little Bit Sure	0.5-0.6
5	Almost Sure	0.7-0.9
6	Very sure	0.9-1

Table 4. Knowledge Base

Kode Gejala	P01	P02	P03	P04
G001	☐	☐	☐	☐
G002	☐	☐	☐	☐
G003	☐	☐	☐	☐
G004	☐			
G005	☐	☐	☐	☐
G006	☐	☐	☐	☐
G007	☐	☐	☐	☐
G008	☐			
G009	☐			
G010	☐			
G011	☐			
G012	☐			
G013	☐			
G014		☐		
G015			☐	
G016				☐

In the flowchart above, it can be seen that first the process is to enter user data, then enter the symptoms data that are felt, the selected symptoms data will be processed using the Celrtaintyl Factor method, then it will produce a diagnosis.

The Celrtaintyl Factor formula is as follows:

CF[H,EL] = CF[H] * CF [EL]

Description:

CF[H]: User Confidence Size

CF[EL]: Expert Confidence Size

CF [H,EL]: Certainty Factor

1. Extrapulmonary Tuberculosis

$$CF[HE_l] = CF[MB]1 + CF[MB]2 * (1 - CF[MB]1)$$
$$= 0.6 + 0.8 * (1-0.6)$$
$$= 0.6 + (0.8 * 0.4)$$
$$= 0.6 + 0.32$$
$$= 0.92$$

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CF [HE] = CF[MD]1+CF[MD]2*(1-CF[MD]1)

$\quad\quad$ = 0.1 + 0.2 * (1-0.1)

$\quad\quad$ = 0.1 + (0.2 * 0.9)

$\quad\quad$ = 0.1 + 0.18

$\quad\quad$ = 0,28

CF [HE]1= 0.92 – 0.28

$\quad\quad$ = 0.64

CF[HE]=CF[MB]COM1+CF[MB]3*(1-CF[MB]COM1)

$\quad\quad$ = 0.92 + 0.5 * (1-0.92)

$\quad\quad$ = 0.92 + (0.5 * 0.08)

$\quad\quad$ = 0.92 + 0.04

$\quad\quad$ = 0.96

CF[HE]=CF[MD]COM1+CF[MD]3*(1-CF[MD]COM1)

$\quad\quad$ = 0,28 + 0.1 * (1-0,28)

$\quad\quad$ = 0,28 + (0.1 * 0,72)

$\quad\quad$ = 0,28 + 0,072

$\quad\quad$ = 0,352

CF [HE]2= 0.96 – 0,352

$\quad\quad$ = 0,608

CF[HE]=CF[MB]COM2+CF[MB]4*(1-CF[MB]COM2)

$\quad\quad$ = 0.96 + 0.6 * (1-0.96)

$\quad\quad$ = 0.96 + (0.6 * 0.04)

$\quad\quad$ = 0.96 + 0.024

$\quad\quad$ = 0.984

CF[HE]=CF[MD]COM2+CF[MD]4*(1-CF[MD]COM2)

$\quad\quad$ = 0,352 + 0.3 * (1-0,352)

$\quad\quad$ = 0,352 + (0.3 * 0,648)

$\quad\quad$ = 0,352 + 0,1944

$\quad\quad$ = 0,5464

CF [HE]3= 0.984 – 0,5464

$\quad\quad$ = 0,4376

Persentase = 0,4376 * 100%

$\quad\quad$ = 43,76%

2. Pulmonary Tuberculosis

CF [HE]=CF[MB]6+CF[MB]7*(1-CF[MB]6)

$\quad\quad$ = 0.8 + 0.8 * (1-0.8)

$\quad\quad$ = 0.8 + (0.8 * 0.2)

$\quad\quad$ = 0.8 + 0.16

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$$= 0.96$$
$$CF\,[HE] = CF[MB]6 + CF[MB]7*(1-CF[MB]6)$$
$$= 0.1 + 0.2 * (1-0.1)$$
$$= 0.1 + (0.2 * 0.9)$$
$$= 0.1 + 0.18$$
$$= 0{,}28$$

$$CF[HE]1 = 0.96 - 0.28$$
$$= 0.68$$
$$Persentase = 0.68 * 100\%$$
$$= 68\%$$

RESULTS AND DISCUSSION

The Initial Display Menu is a page that contains the Home, Login and Register buttons, where this display appears first before logging in.

Figure 1. Initial Menu Display

Login is the gateway for experts in updating disease, symptoms, rules in diagnosing disease.

Figure 2. Login View

The main menu is a page that contains buttons for disease, symptoms, rules, password, logout and consultation.

Figure 3. Main Menu Display

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A page containing buttons to add, update, delete and cancel the list of contacts.

Figure 4. Disease List View

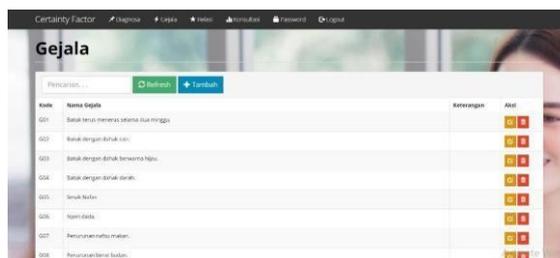The page contains buttons to add, update, delete and delete disease symptoms.

Figure 5. List of Disease Symptoms Display

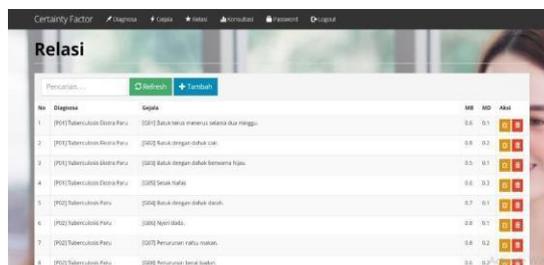This page contains a list of symptoms that may occur. This knowledge base page may be updated or deleted.

Figure 6. Relationship List View

On this page, experts and users can use the system without having to log in to the system. This page is to diagnose diseases based on input from the symptoms experienced. The system will analyze and provide disease types and solutions to deal with the disease experienced, then display the results of the diagnosis from the user.
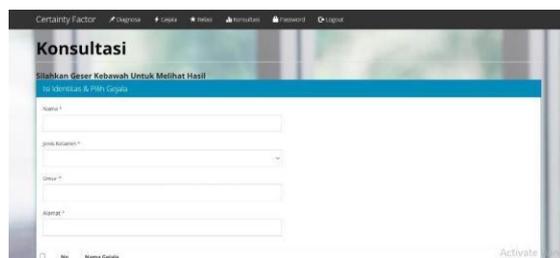

Figure 7. Consultation View

Figure 8.Diagnostic Results

CONCLUSION

This study was designed with UML modeling which is explained in the form of use case diagrams, Activity diagrams and class diagrams. With this research, it can increase knowledge, so that the results of the implementation can be applied according to the design that has been made, the expert system that diagnoses Pulmonary Tuberculosis disease with the molecular weight factor can be used in solving the problem of diagnosing Pulmonary Tuberculosis disease with an accuracy value of 68%. The final result of the diagnosis is in the form of several questions that will be answered by the patient according to the conditions felt.

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