

Expert System for Diagnosing Scabies using the Case Based Reasoning Method

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Abstract

Health is very important for humans, people who don't take care of their health can trigger diseases. Currently, diseases that are not given enough attention are skin diseases, one of which is scabies. Scabies is a disease caused by the mite *Sarcoptes scabiei* which is characterized by scabs and itching of the skin. Scabies disease is easily spread either directly or indirectly. At present, people do not really care about scabies because scabies has symptoms that are just ordinary itching, this happens due to the lack of public knowledge about scabies. To obtain a diagnosis of scabies, you can usually consult a doctor, but due to the limited time for consulting a doctor, there are often problems that make it difficult to obtain information on a diagnosis of scabies. Therefore an expert system was designed to find out and get information quickly about the symptoms that are felt associated with scabies. The method used in expert systems is Case Based Reasoning (CBR). The CBR method is to solve problems by recalling the same or similar events (similarities) that have occurred in the past and then using knowledge or information. This expert system can provide solutions for scabies with the diagnosis process being carried out efficiently and saving time. This web-based expert system application was built using the PHP and MySQL programming languages.

Keywords: Expert System, Case Based Reasoning, Scabies, Diagnosis, Symptoms.

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that makes computers act and act as well as humans or mimic the work of the human brain [4].

1. Introduction

Health is a very important thing for humans, people who don't take care of their health can trigger diseases. Currently, diseases that are not given enough attention are skin diseases. Skin health needs to be considered because the skin is the most vital part and is a mirror of health and life. The skin in humans has a very important role, in addition to the main function that guarantees survival, it also has another meaning, namely race, and a means of nonverbal communication between individuals with one another. Many skin diseases cause itching and discomfort for long periods of time. Skin disease is a disease that attacks humans in everyday life due to a lack of awareness of environmental hygiene or self, among others caused by climatic factors, environment, place of residence, unhealthy living habits, allergies, animals and others. But it is wrong because [1]

The system is a complete element consisting of several components that are interconnected and interact to complete a certain goal [2].

Experts are people who have specific knowledge, opinions, experience with methods, and the ability to apply this expertise to solve problems [3].

Artificial intelligence comes from the word Artificial Intelligence which means imitation or intelligence. Literally Artificial Intelligence is artificial intelligence. Artificial intelligence is a field in computer science

Expert systems are systems that try to adopt human knowledge into computers, so that computers can help solve problems that are usually solved by experts. As for some of the benefits of the Expert System, namely that it can increase productivity because the Expert System can work faster than humans, it can make an ordinary person work like an Expert. The method for implementing this Expert System uses Case Based Reasoning [5].

An expert system is a piece of software or computer programming that is intended as an advisory facilitator and media aid in solving problems in certain sectors such as science, medicine, education and so on [6]. In essence, the Expert System is an information system that contains insights from experts so that it can be used for consultation [7].

The Case Based Reasoning (CBR) method is a process for finding similarities between new cases and old cases, a process for choosing the right solution for users [8]. Some of the advantages of Case Based Reasoning include being more efficient because it uses old knowledge and is able to adapt new knowledge, unlike expert systems which always generate rules or rules every time they solve a problem.

Case Based Reasoning (CBR) is a method for solving problems by recalling the same or similar events

(similarities) that have occurred in the past and then using that knowledge or information to solve problems by adopting solutions that have been used in the past [9].

Scabies is a disease caused by the mite *Sarcoptes scabiei* which is characterized by the presence of scabs and itching of the skin. The mites will dig into the skin and nest in the skin, when they are lodged in the skin, symptoms will appear such as itching of the skin. Scabies is easily spread either directly through direct contact with sufferers or indirectly through clothes, towels, pillows and water [10].

The CBR method is widely used in expert systems such as diagnosing heart disease [11], sexually transmitted diseases (HIV/AIDS) [12], hemophilia in humans [13], diseases of onion plants [14], diseases in cats [15], detection of damage to laptops [16], dental and oral diseases [17], and many others.

At this time, people don't really care about scabies because scabies has symptoms that are just ordinary itching, this happens because people's knowledge of scabies is weak. To obtain a diagnosis of scabies can usually be done in consultation with a doctor, but due to the limited time for consulting a doctor there are often problems that make it difficult to obtain information on a diagnosis of scabies. Therefore an expert system was designed to determine the classification of scabies. This expert system can provide information and solutions regarding scabies with the diagnosis process being carried out efficiently and saving time

2. Research methodology

A research framework is a concept or sequence of activities to be carried out in a study. So that the steps taken by the author in this design are not deviated from the subject of discussion and are easier to understand. The sequence of steps to be made in this study can be seen in Figure 1 below:



Figure 1. Research Framework

The research stage is a sequence of processes or steps that will be carried out in completing this research. The stages of this research are as follows:

2.1 Preliminary Research

From a research first is to do an analysis of the object to be processed. Study how the object can solve its problems, environmental factors and the impact of the object. Preliminary research can provide initial evidence that the problems we will examine in the field really exist. Therefore it takes time for data collection, research time, research locations, research methods, field research, library research.

2.2 Data collection

In this study, data were collected from various sources by searching for references such as books, scientific works and journals, both in the library and on the internet related to research. Data was also obtained from field studies by conducting direct observations and interviews with experts.

2.3 Analysis

The analysis phase is the identification of the problem as a whole with the aim of obtaining a fact based on the research method used. The data obtained from the research method will be analyzed in order to obtain a set of rules (rule base).

2.4 Design

At the design stage, researchers used UML (Unified Modelling Language) diagrams. But not all diagrams provided by UML are used in designing this system. Only a few UML diagrams are used, namely Use Case Diagrams, Activity Diagrams, Class Diagrams, Sequence Diagrams.

2.5 Implementation

System implementation is the stage of implementing a system that has been designed or designed, so that the system that has been created can be operated and used optimally according to needs. At this stage the design of the Expert System application is carried out using the PHP programming language and MySQL database.

2.6 Testing

After the implementation phase is complete, testing will be carried out which aims to test the system that has been designed, correcting the system that has been built. Testing is done by seeing whether the application is running correctly and in accordance with the design that is done.

3. Results and Discussion

The research results include stages consisting of analysis and design of expert systems and implementations that have been made to determine the level of success of the system

3.1 Data analysis

This stage includes an analysis of system requirements in designing an expert system for diagnosing scabies . To conduct this research, disease data and symptoms of scabies are needed, which can be seen in Table 1 below:

Table 1 Data on Symptoms and Weight			
Disease Name	Symptom Code	Symptom	Weight
Scabies Of Cultivate	G01	Severe Itching At Night	1
	G02	Has a Spotted Rash	1
	G03	Chafed and Crusty Skin	1
	G04	Itching Between Fingers And Wrists	1
	G05	Itching Around Stomach And Navel	1
Scabies Transmitted Through Animals	G01	Severe Itching At Night	1
	G04	Itching Between Fingers And Wrists	1
	G05	Itching Around Stomach And Navel	1
Norwegian scabies	G06	Interact Or Contact With Animals	3
	G01	Severe Itching At Night	1
	G07	Itching on the Outer Surface of the Elbow	1
	G08	Scalp Itching	1
	G09	Itching of the Palms and Feet	1
	G10	Nail Thickening	3
	G11	There are crusts or scabs	3
	G01	Severe Itching At Night	1
	G05	Itching Around Stomach And Navel	1
	G12	Shaped like a chest of reddish brown nodules	3
Scabies Nodularis	G13	Itching in the area covered by clothing	3
	G14	Itching in the Genitals	1

3.2 Case Based Reasoning Method Analysis

The stages of process analysis are carried out using the Case Based Reasoning method. The new cases can be seen in Table 2 below:

Table 2 New Cases	
Symptom Code	Symptoms You Feel
G01	Severe Itching At Night
G03	Chafed and Crusty Skin
G04	Itching Between Fingers And Wrists
G11	There are crusts or scabs
G13	Itching in the area covered by clothing

a. Retrieve Process

The retrieve process is the process of searching for new cases with existing cases in the knowledge base. The similarity search is carried out by matching the symptoms entered by the user with the existing symptoms in the knowledge base. The processing stages of weight similarity will be calculated using the following formula:

$$\text{Similarity}(T, S) = \frac{S1 \times W1 + S2 \times W2 + \dots + Sn \times Wn}{W1 + W2 + \dots + Wn} \quad (1)$$

Where S = Similarity (value of similarity), in similarity if there is a similarity of cases it will be worth 1, while not similar, it will be worth 0. Meanwhile W = Weight (weight given) if symptoms are ordinary it is worth 1 and if symptoms are dominant it is worth 3 .

1. Calculation of scabies of cultivate cases

Table 3 Table of Scabies of Cultivate Cases			
Symptom Code	Weight	Preliminary Symptom Code	Weight
G01	1	G01	1
G03	1	G02	1
G04	1	G03	1
G11	3	G14	3
G13	3	G15	3

Similarity (problem, case)

$$= \frac{S1 \times W1 + S2 \times W2 + \dots + Sn \times Wn}{W1 + W2 + \dots + Wn}$$

Similarity (x, x)

$$= \frac{(1 \times 1) + (0 \times 1) + (1 \times 1) + (1 \times 1) + (0 \times 1)}{1 + 1 + 1 + 1 + 1} = \frac{3}{5} = 0,6 \times 100\% = 60\%$$

From the calculation of the case above, it has a level of similarity with the old case. So from the calculation of similarity of 60%.

2. Calculation of cases of scabies transmitted through animals.

Table 4 Table Cases transmitted through animals			
Symptom Code What is felt	Weight	Preliminary Symptom Code	Weight
G01	1	G01	1
G03	1	G04	1
G04	1	G05	1
G11	3	G06	3
G13	3		

Similarity (problem, case)

$$= \frac{S1 \times W1 + S2 \times W2 + \dots + Sn \times Wn}{W1 + W2 + \dots + Wn}$$

$$\text{Similarity}(x, x) = \frac{(1 \times 1) + (1 \times 1) + (0 \times 1) + (0 \times 3)}{1 + 1 + 1 + 3} = \frac{2}{6} = 0,3333 \times 100\% = 33,3\%$$

From the calculation of the case above, it has a level of similarity with the old case. So from the calculation of similarity of 33.3 %

3. Norwegian scabies case count

Table 5 Norwegian Scabies Case Table

Symptom Code What is felt	Weight		Preliminary Symptom Code	Weight
G01	1	x	G01	1
G03	1		G07	1
G04	1		G08	1
G11	3		G09	1
G13	3		G10	3
			G11	3

Similarity (problem, case)

$$= \frac{S1 \times W1 + S2 \times W2 + \dots + Sn \times Wn}{W1 + W2 + \dots + Wn}$$

Similarity (x, x)

$$= \frac{(1 \times 1) + (0 \times 1) + (0 \times 1) + (0 \times 1) + (0 \times 3) + (1 \times 3)}{1 + 1 + 1 + 1 + 3 + 3}$$

$$= \frac{4}{10} = 0,4 \times 100\% = 40\%$$

From the calculation of the case above, it has a level of similarity with the old case. So from the calculation of similarity of 40%

4. Calculation of nodular scabies cases

Table 6 Table of Scabies Nodularis Cases

Symptom Code	Weight		Preliminary Symptom Code	Weight
G01	1	x	G01	1
G03	1		G05	1
G04	1		G12	3
G11	3		G13	3
G13	3		G14	1

Similarity (problem, case)

$$= \frac{S1 \times W1 + S2 \times W2 + \dots + Sn \times Wn}{W1 + W2 + \dots + Wn}$$

Similarity (x, x)

$$= \frac{(1 \times 1) + (0 \times 1) + (0 \times 3) + (1 \times 3) + (0 \times 1)}{1 + 1 + 3 + 3 + 1}$$

$$= \frac{4}{9} = 0,4444 \times 100\% = 44,4\%$$

From the calculation of the case above, it has a level of similarity with the old case. So that from the calculation of similarity of 44.4 %

b. Reuse Process

From the calculation of the cases above, the case that has the highest similarity weight to the old case is scabies of cultivate by 60%.

In the reuse process, the solution given is the solution with the highest weight of the similarity of existing cases in knowledge to new cases.

c. Revise Process

This process is carried out to improve the proposed solution and then test it on real cases (simulations) and it is needed again to improve the solution so that it fits the new case [8].

d. Retain Process

The retain process is storing parts of the experience that might be useful for solving problems in the future [9], this process consists of selecting what information from the case will be stored, stored in what form, how to arrange cases so that they are easy to find similar problem, and how to integrate the new case on the memory structure.

3.3 Interface Testing System

1. Home Page Display

The Home page is the page that is seen the first time when a user visits the system. The display of the home page can be seen in Figure 2 below:



Figure 2 Display Home Page

2. Login View

The login view is accessible to all users. It can be seen as shown in Figure 3 below:



Figure 3 Login Display

3. Disease Info Display

The disease info display is a display form that contains the types of diseases, definitions, and solutions for scabies which can be seen in Figure 4 below:



Figure 4 Disease Info Display

4. Consult View

The consultation display is a display form that contains the symptoms of scabies, the patient is asked to checklist what symptoms he is feeling which can be seen in Figure 5 below:



Figure 5 Display Consultation

5. Display Consultation Results

The display of the results of the consultation is a form of display that contains the symptoms felt by the patient as well as the diagnosis of the disease with definitions and solutions which can be seen in Figure 6 below:



Figure 6 Display of Consultation Results

4. Conclusion

Based on the process of designing and developing an expert system for diagnosing scabies using the Case Based Reasoning method, it can make it easier for patients or users to diagnose scabies and know the symptoms of scabies correctly, making it easier for patients to get solutions or treatment for scabies . properly, and facilitate doctors and patients in conducting consultations effectively and efficiently

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