

EXPERT SYSTEM USING CASE BASED REASONING (CBR) FOR SCALP DISEASE DIAGNOSIS

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Abstrak

Scalp disease is usually general which tends to be ignored by sufferers because it is often considered harmless, this is a major factor that slows to detection of scalp disease so that if left untreated the sufferer can be affected by acute scalp disease which is very dangerous. This research builds an expert system to diagnose scalp disease earlier based on the symptoms that appear so that it is expected to assist medical personnel in identifying types of diseases, prevention solutions, and optimal treatment. This research uses Case Based Reasoning (CBR) method which combines similarity methods Similarity Measure introduced by Tversky with 10 types of diseases, 29 symptoms consisting of 110 cases of scalp disease. The results obtained in this study are a diagnosis of scalp disease, prevention solutions, and treatment. From the research, the conclusions are diagnosis of scalp disease, prevention solutions, and treatment.

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Key Words

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Introduction

There are lots of fields that are not related to computer technology using computer technology to facilitate their work, for example in the fields of health, physical infrastructure, psychology, communication, virtual reality, modeling, and many other fields. [1]. Computer applications in the health sector have been widely used to help work efficiency. One of them is the expert system [2], [3]. The expert system application is one of the branches of AI (Artificial Intelligence) which can be described as a computer device that has a knowledge base for a certain field that uses reasoning resembling an expert in solving a problem [4], [5].

Scalp disease is usually a general disease that sufferers tend to ignore because it is often considered harmless, so sufferers usually ignore to check for symptoms of the disease to the doctor, this causes slow detection of the type of scalp disease, and not knowing how to handle, prevent, correct treatment solutions, and lack of information about the symptoms of the disease are the main factors causing sufferers to suffer from a very dangerous level of acute scalp disease. Scalp disease has almost the same indications and symptoms as the type of scalp disease that is suffered, this is what causes many ordinary people, even medical personnel, to find it difficult to recognize the type of scalp disease they suffer. And also the drugs that are given are sometimes almost the same for various types of scalp diseases. One of the solutions given to overcome this problem can be assisted by an expert system that can help both the medical and the sufferer determine the types of illnesses suffered early so that it can prevent someone from suffering from an acute level of scalp disease.

Expert systems were created not to replace an expert's job, but as a method used to adopt specialist/expert knowledge into a system that can be accessed via a computer, smartphone, or another device.[3], [6], [7]. Case-Based Reasoning (CBR) [8], [9] Method is one method of solving problems by using a solution that has been used previously against similar issues [9], the use of CBR methods on the diagnosis with its similarity method "Similarity Measure"

Research Methods

The term expert system comes from the term knowledge-based expert system which is a branch of Artificial Intelligence (AI) that was first developed in 1960, an expert system is a system that uses an expert's knowledge that is entered into a computer. Someone who is not an expert uses an expert system to improve problem-solving abilities, while an expert uses an expert system for knowledge assistants [2], [10].

Expert systems have become very popular because of the many abilities and benefits provided by them, such as being able to find solutions, explaining every step that must be taken, and being able to provide suggestions and conclusions similar to those given by an expert [11].

An expert is someone who has special knowledge, experience and methods, and can apply them to solving problems or giving advice [12]. Knowledge in an expert system can be sourced from an expert or knowledge found from journals, articles, books, and someone who masters a certain field, an expert system has two main parts, namely a knowledge base that contains knowledge, and an inference engine that includes procedures regarding problem-solving and then draw conclusions from the existing knowledge base [13], [14].

Case Based Reasoning (CBR) method is a model for building expert systems with reasoning that combines problem-solving, understanding, and learning and integrates all of them with memory processing. This task is carried out by utilizing cases that have been experienced by the system, where cases are knowledge in a certain context that represents an experience that becomes the basis for learning to achieve system goals. In another definition, CBR is a method of solving problems/new cases by adapting to the methods used to solve old problems/cases. There are four steps to the CBR process in solving problems, Retrieve the most similar case, Reuse (using) information and knowledge of the case to solve the problem, Revise (repair) the proposed solution, and Retain (s) part of the experience that might be useful for solving problems in the future [6], [8], [15] see figure 1 for diagram process Case-Based Reasoning.

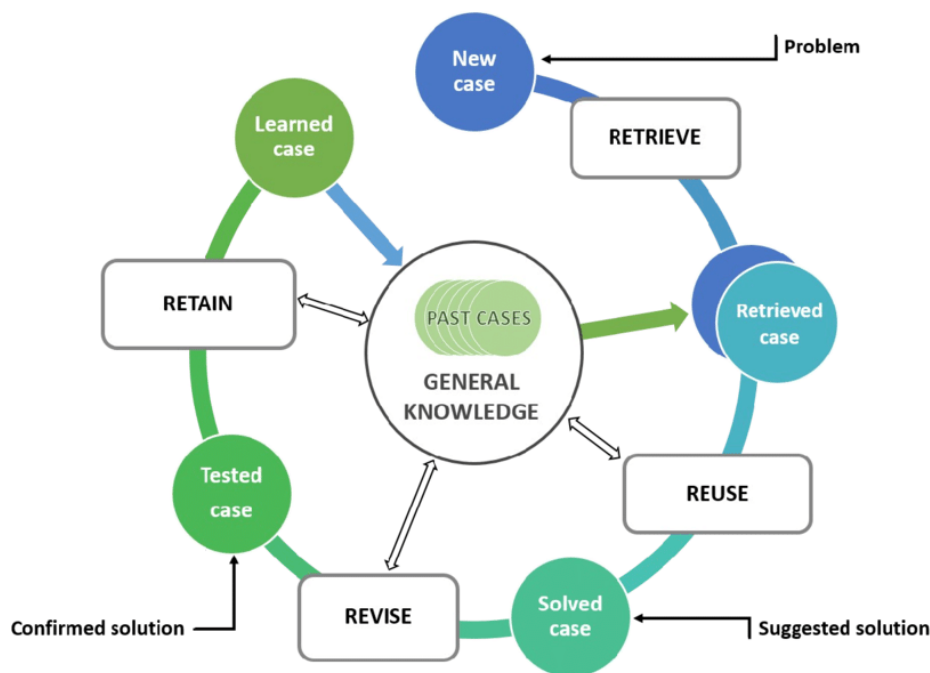


Figure 1. Case Based Reasoning Method [15]

In looking for the old case which has similarities with the new case the method is used similarity measure introduced by Tversky 1977, with the following formula.

$$SM_{pq} = \frac{\alpha(\text{common})}{\alpha(\text{common}) + \beta(\text{different})} \quad (1)$$

Where “SM” is the similarity measure where “p” is the new case and “q” is the case stored in the old case/case base. “Common” is the number of the same attributes, meanwhile “different” is the number of different attributes.

1. If the attribute is in the new case and there is in the old case then it is assigned a value of 1 (One).
2. If the attribute does not exist in the new case and does not exist in the old case then it is assigned a value of 1 (One).
3. If the attribute exists in the new case and does not exist in the old case then it is assigned a value of 0 (Zero).
4. If the attribute does not exist in the new case and exists in the old case then it is assigned a value of 0 (Zero).

Results and Discussion

This test uses data from RSUD Selasih at Pelalawan Regency which consist of 10 types of scalp diseases (*Furunculosis, Korbunkulosis, Dermatitis Papilaris Capilliti, Pediculosis Capitis, Scabies, Folikulitis, Psoriasis, Dry Seborrheic Dermatitis, Wet Seborrheic Dermatitis, Tinea Capitis*) 29 symptoms consisting of 110 cases of scalp disease, through this data the application of Case-Based Reasoning for the diagnosis of scalp disease requires new cases that have 4 symptom data: oily scalp, red bumps on the scalp, small edged lumps (pustules), and abscesses of the scalp.

Table 1. Data for Symptoms and New Cases

No	Symptoms	New Case
1	Normal scalp	0
2	Dry scalp	0
3	<i>Oily scalp</i>	1
4	Scaly scalp	0
5	Crusty scalp	0
6	Yellow crusty scalp Inflamed Scalp	0
7	Inflamed Scalp	0
8	Rash on the scalp	0
9	Red rash on the scalp	0
10	Round, red rash with raised margins	0
11	Thickened scalp (plaque)	0
12	The scalp peels off	0
13	White powder on hair	0
14	Ulcers on the scalp	0
15	<i>Red bumps on the scalp</i>	1
16	<i>Small edged lumps (pustules)</i>	1
17	A large lump with more than one eye	0
18	fleas	0

19	smelly scalp	0
20	<i>Abscess of the scalp</i>	1
21	Bleeding scalp	0
22	Watery scalp	0
23	The scalp hurts	0
24	The scalp feels itchy	0
25	Scalp burns hot	0
26	Hair loss	0
27	Baldness	0
28	Occurs in the navel of the scalp	0
29	Occurs on the back of the scalp	0

With the process of calculating the value of similarity (similarity) between new cases in Table 1 and the old case on case bases, resulting in new case bases in Table 2 and Table 3, number 1 which means the value of similar cases, number 0 which means the value of cases is not similar. For example, the calculation of the similarity value (similarity) has been discussed in the previous chapter. If the symptom in the new case is 0 and the symptom on the old case is 0, then the similarity value is 1, if the symptom in the new case is 1 and the symptom in the old case is 1, the similarity value is 1, and if the symptom in the new case is 0 and the symptom on the old case is 1, then the similarity value is 0 and vice versa.

Table 2. Case Bases 1-10

New Case	Cas e001	Cas e002	Cas e003	Cas e004	Cas e005	Case 006	Cas e007	Cas e008	Cas e009	Case 010
0	0	0	0	0	0	0	0	0	0	0
0	1	1	1	1	1	1	1	1	1	1
1	0	0	0	0	0	0	0	0	0	0
0	1	1	1	1	1	1	1	1	1	1
0	1	1	1	1	1	1	1	1	1	1
0	1	1	1	1	1	1	1	1	1	1
0	1	1	1	1	1	1	1	1	1	0
0	1	1	1	1	1	1	1	1	1	1
0	1	1	1	1	1	1	1	1	1	1
0	1	1	1	1	1	1	1	1	1	1
0	1	1	1	1	1	1	1	1	1	1
0	1	1	1	1	1	1	1	1	1	1
0	1	1	1	1	1	1	1	1	1	1
0	1	1	1	1	1	1	1	1	1	1
0	1	1	1	1	1	1	1	1	1	1
1	0	0	0	0	0	0	0	0	0	0
1	1	1	1	1	1	1	1	1	1	1
0	1	1	1	1	1	1	1	1	1	1
0	1	1	1	1	1	1	1	1	1	1
0	1	1	1	1	1	1	1	1	1	1
1	0	0	1	1	1	1	1	1	1	1
0	1	1	1	1	1	1	1	1	1	1
0	1	1	1	1	1	1	1	1	1	1
0	0	0	0	1	1	0	1	1	1	0
0	1	1	0	1	1	1	1	1	1	1

0	1	1	1	1	1	1	1	1	1	1
0	1	1	1	1	1	1	1	1	1	1
0	1	1	1	1	1	1	1	1	1	1
0	1	1	1	1	1	1	1	1	1	1
0	1	1	1	1	1	1	1	1	1	1

Table 3. Case Bases 101-110

New Case	Cas e 101	Cas e 102	Case 103	Cas e 104	Cas e 105	Case 106	Cas e 107	Cas e 108	Cas e 109	Case 110
0	0	0	0	0	0	0	0	0	0	1
0	1	1	1	1	1	1	1	1	1	0
1	0	0	0	0	0	0	0	0	0	0
0	0	1	0	0	1	0	0	0	1	1
0	1	1	1	1	1	1	1	1	1	0
0	1	1	1	0	1	0	1	1	1	1
0	0	0	0	0	0	0	0	0	0	1
0	1	1	1	1	1	1	1	1	1	1
0	1	1	1	1	1	1	1	1	1	1
0	1	1	1	1	1	1	1	1	1	1
0	1	1	1	1	1	1	1	1	1	1
0	1	1	1	1	1	1	1	1	1	1
0	1	1	1	1	1	1	1	1	1	1
0	1	1	1	1	1	1	1	1	1	1
0	1	1	0	1	1	1	0	0	1	0
1	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0	0
0	1	1	1	1	1	1	1	1	1	1
0	1	1	1	1	1	1	1	1	1	1
0	1	1	1	1	1	1	1	1	1	1
1	0	0	0	0	0	0	0	0	0	0
0	1	1	0	1	1	1	0	0	1	1
0	1	1	1	1	1	1	1	1	1	1
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0	1	1	1	1	1	1	1	1	1	1
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	1	1	1	1	1	1	1	1	1	1

And then in Table 4 and Table 5 shows the results of the calculation of case 1 to case 110 in Table 2 and Table 3 the number of similar cases is taken from the total value 1 in the case bases table, and the number of dissimilar cases is taken from the total value 0 in case bases table, for each case 1 to case 110. The results of the similarity value are obtained after being calculated using formula (1).

Table 4. Results of Calculation Case Bases 1-10

Case Bases	Number of Similar Cases	Number of Unequal Cases	Similarity
Case 1	24	5	0.827586
Case 2	25	4	0.862069
Case 3	23	6	0.793103
Case 4	26	3	0.896552
Case 5	26	3	0.896552
Case 6	25	4	0.862069
Case 7	26	3	0.896552
Case 8	26	3	0.896552
Case 9	26	3	0.896552
Case 10	24	5	0.827586

Table 5. Results of Calculation Case Bases 101-110

Case Bases	Number of Similar Cases	Number of Unequal Cases	Similarity
Case 101	17	12	0.586207
Case 102	18	11	0.62069
Case 103	15	14	0.517241
Case 104	16	13	0.551724
Case 105	18	11	0.62069
Case 106	16	13	0.551724
Case 107	14	15	0.517241
Case 108	15	14	0.517241
Case 109	19	10	0.655172
Case 110	18	11	0.62069

Based on Table 1, there are new cases with symptoms of an oily scalp, red bumps on the scalp, small edged lumps (pustules), and abscesses of the scalp. Then this new case goes into the retrieve process to look for the similarity of the new case to the old case in Table 2 and Table 3. Based on the number of similar cases and the number of different cases using the similarity measure formula (1) which can be seen in Table 4 and Table 5, So it can be concluded that the similarity of the new and old cases is in the 5th, with a similarity value of 0.89 (89%) *furunculosis* disease.

The use of case-based reasoning methods in Table 1 is completed in an expert system.



Figure 2. Main Display

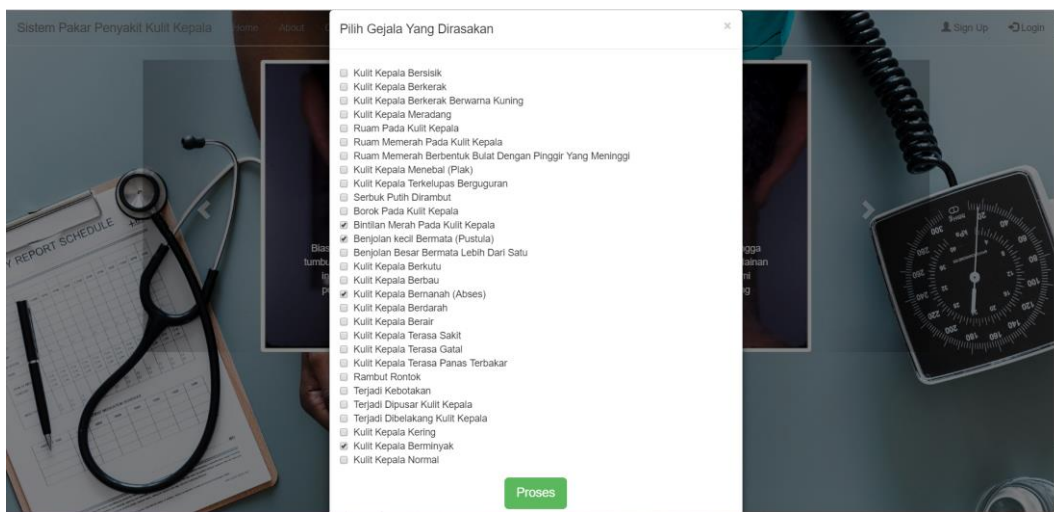


Figure 3. Diagnosis Form

Figure 2 displays information on the amount of disease data, symptom data, solution data, and diagnosis history data; Figure 3 shows diagnosis forms that have 4 symptom data: oily scalp, red bumps on the scalp, small edged lumps (pustules), and abscesses of the scalp.



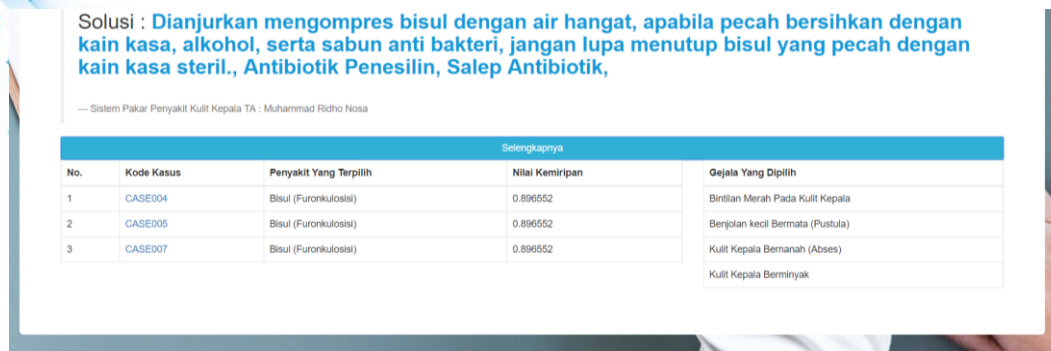


Figure 4. Display Diagnosis Results

From Figure 4 the results of the calculation process through the system are the same as the results of manual calculations in Table 4 so that testing and implementation using the case-based reasoning method in an expert system can help both the medical and the sufferer determine the types of illnesses suffered early to prevent someone from suffering from an acute level of scalp disease.

Conclusions

Based on the results of data analysis and manual calculations, it can be concluded that this system can be applied well to Scalp Disease. This system can help medical personnel and patients to identify early types of diseases, optimal solutions, prevention, and treatment of Scalp Diseases.

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