Comparison Of *Certainty Factor* (CF) And *Case Based Reasoning* (CBR) To Diagnose Infertility In Women

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ABSTRACT

Infertility has now become a terrible and serious problem for women. Limited information about infertility suffered by women makes it difficult for them to predict the disease they are suffering from. Therefore we need an expert system that can predict infertility in women. The methods used in this research are Certainty Factor (CF) and Case Based Reasoning (CBR) methods. Certainty Factor (CF) is one of the techniques used to overcome uncertainty in decision making. Case Based Reasoning (CBR) is a problem solving method by remembering similar events that happened in the past and then using that knowledge or information to solve new problems. Based on the test results using 25 test data, the accuracy of the expert system for diagnosing infertility in women using the Certainty Factor (CF) method is 92%, while the curation of the expert system for diagnosing infertility in women using the Case Based Reasoning (CBR) method is 76%.

1. Introduction

Infertility refers to inability to get pregnant before giving birth to a live baby of any kind of contraception after deciding to have children [7]. Most members of our society still often find it difficult to get services and information about how to take care of their own health and how to choose the right action for family members who suffer from diseases, especially infertility or infertility. Most women are reluctant or embarrassed to go to the doctor for a variety of reasons, for example, they are not ready to receive a diagnosis from a doctor. Health checks or consultations need to be repeated for several months, treatment cycles are not easy to determine, treatment costs are very expensive, and people cannot consult experts or doctors regarding infertility. So they can not prevent it first place, and women will never know the infertility they may be experiencing.

Using technologies developed in field of artificial intelligence (AI) research, it is possible to study and imitate artificial intelligence, i.e. expert systems. An expert system is a system designed on a computer that can imitate the reasoning of experts in a particular field to solve problems that are usually solved by experts. This expert system will later be created to help determine initial diagnosis of infertility from symptoms and determine recommendations or treatment options that must be taken so that it can help shorten the time during next doctor's examination process. When using an expert system to diagnose infertility, there are several methods applied to the expert system, namely Certainty Factor (CF) and Case Based Reasoning (CBR).

2. Literatur Study / Hypotheses Development

A. Expert System

An expert system or better known as an expert system is a computer-based application that is used to solve problems as thought by experts [3]. Knowledge in expert systems can be in the form of an expert, or can be in form of knowledge that is generally found in books, magazines, websites, and people who have knowledge in certain fields. A good expert system aims to solve certain problems by imitating work of experts.

Characteristics of expert system are so broad that they can be explained asfollows [8]:

a. Having reliable information facilities.

b.Easy to modify.

c. Can be used in various types of computers.

d. Have the ability to learn to adapt.

e. Limited to certain professional fields.

f. Can provide reasons for uncertain data.

g. Can express a number of reasons given in a way that is easy to understand.

h. Based on certain rules or rules.

i. Designed to be developed gradually.

j. Knowledge and inference mechanisms are clearly separate.

k. Output is recommended.

B. Certainty Factor

Certainty Factor (CF) is one of techniques used to overcome uncertainty in decision making. Certainty Factor can appear in various conditions. To combine two or more rules, a knowledge-based system with several rules, each of which yields same conclusion but uncertainty factor is different, each rule can be presented as a piece of evidence that supports a common conclusion. The combination of certainty factor against the premise with following rules:

a. Certainty Factor with a single premise:

CFGejala = CF [user] * CF [expert]

b. If there is a rule with a similar conclusion or more than one symptom, then Certainty Factor is further calculated by equation:

CFcombine = CFold + CFgejala * (1-CFold)

c. Meanwhile, to calculate percentage of disease, Equation is used

CFpercentage = CFcombine * 100%

C. Case Based Reasoning

Case Based Reasoning (CBR) is a problem solving method by remembering similar events that occurred in the past and then using that knowledge/information to solve new problems, or in other words solving problems by adapting solutions that have been used in the past [1]. The retrieval technique used in this study is the Nearest Neighbor technique. The way this technique works is by comparing each new case attribute (target case) with the attributes

of stored cases (source case) on a case base and then using the similarity function to calculate the comparison. If the values compared are the same or close, then solution of stored case is used for the solution of the new case.

$$Similarity(Q,A) = \frac{(S_1 x W_1) + (S_2 x W_2) + ... + (S_n x W_n)}{W_1 + W_2 + ... + W_n} \quad (1)$$

Information :

S = Similarity (similarity value) that is 1 (same) and 0 (different)

W = weight assigned to attribute

n = number of attributes in each case

D. Related Research

Related research that uses Certainty Factor and Case Based Reasoning methods is the Development of an Expert System for Detecting Diseases in Cats Using Case Based Reasoning and Android-Based Certainty Factor Methods by Galuh Gupita, Budi Harijanto, and Yuri Ariyanto (2017). Application of Certainty Factor and Case Based Reasoning methods to build an expert system for diagnosing cat diseases based on various facts and symptoms. System created can detect disease based on symptoms during diagnosis process and system created has information facilities about cat diseases.

2. Methodology

A. Research Stages

The research will be carried out in several stages which can be seen in Figure 1.

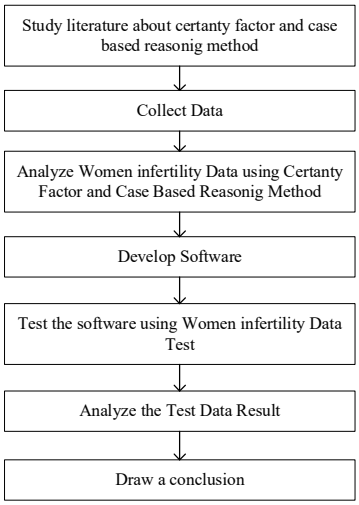

Figure 1. Research Framework

The explanation of Figure 1 is as follows:

1. Literature study of Certainty Factor and Case Based Reasoning methods

In the first stage, a literature study was conducted on the methods to be used, namely Certainty Factor and Case Based Reasoning. At this stage, an analysis of previous research related to the method to be used in this study was also carried out.

2. Collecting data

The data used in this study are in form of primary data and secondary data. Authorwill collect data that already exists directly at the Lahat District General Hospital. Then the author will also conduct interviews with experts in order to obtain information and data relating to the problem under study. The data will then undergo data pre-processing and be recapitulated in the form of an excel-formatted file so that it is ready to be used for this research.

3. Analyzing the Certainty Factor and Case Based Reasoning methods

The third stage after the data has been collected and has gone through pre-processing of the data is to analyze the Certainty Factor and Case Based Reasoning methods using infertility data on these women.

4. Doing software development

Software development using the Rational Unified Process. The reason for using the Rational Unified Process is to ensure that the resulting software meets user requirements and can be completed on time.

5. Carry out the testing process

The process of testing this research is to compare the results obtained through the use of the Certainty Factor and Case Based Reasoning methods with the actual result data obtained from the Lahat District General Hospital.

6. Analyze the test results

After testing the software, the next step is to analyze the results, whether the software results meet the manufacturing objectives, whether the resulting software functions properly, and whether the results provided by the software are accurate.

7. Make a conclusion

Make conclusions on the software that has been built.

4. Result And Discussion

A. Implementation

This expert system will implement the Certainty Factor and Case Based Reasoning methods for the disease diagnosis process. The following displays the results of the system implementation:

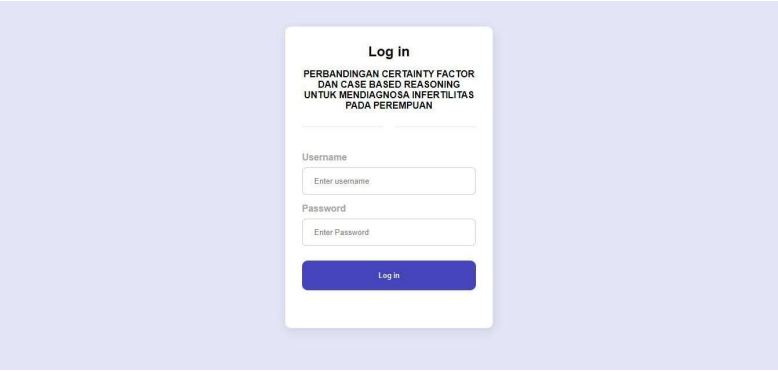

Figure 2. Login Page Interface

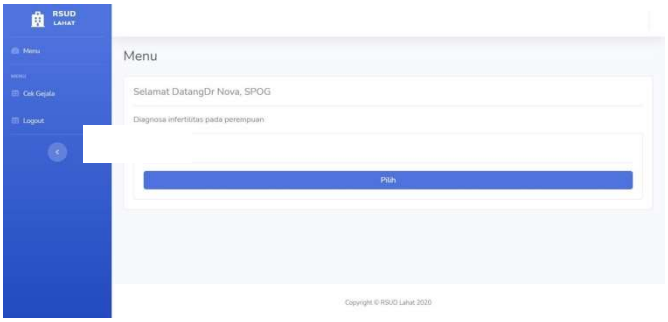

Figure 3. Patient Main Page Interface

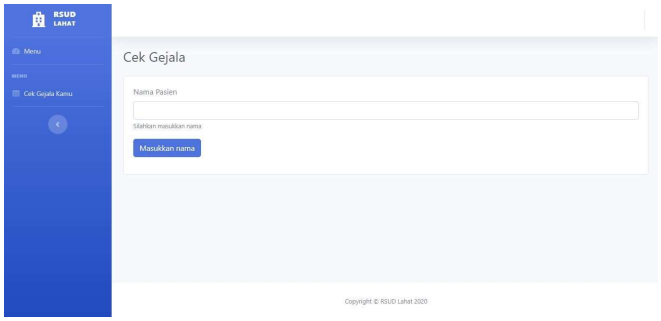

Figure 4. Patient Name Input Page Interface

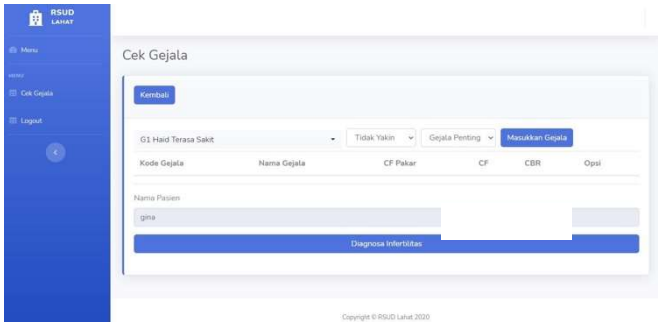

Figure 5. Patient Symptom Check Page Interface

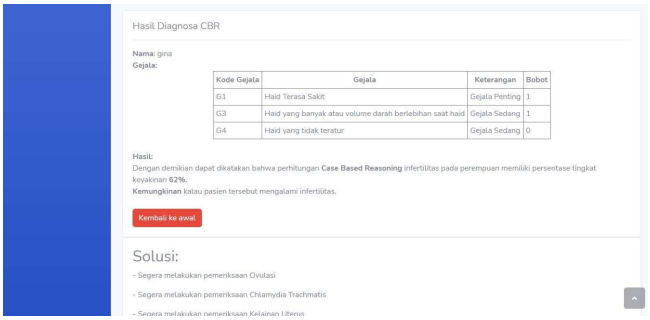

Figure 6. Patient Diagnosis Results Page Interface

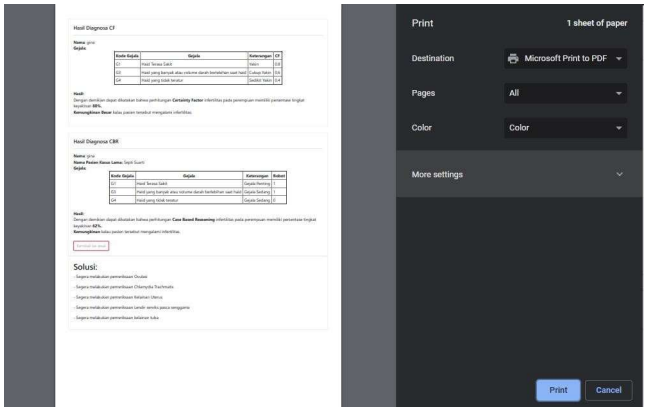

Figure 7. Print Interface of Patient Diagnostic Results

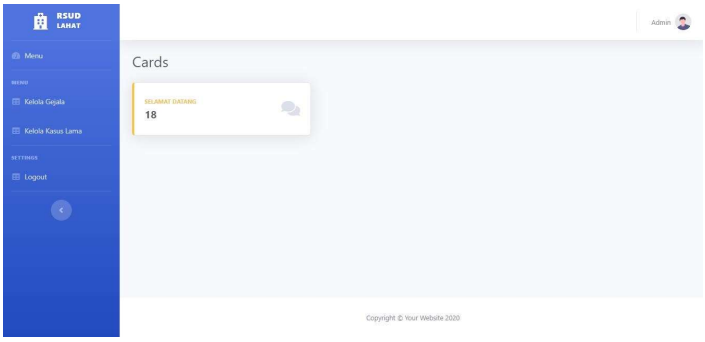

Figure 8. Admin Dashboard Page Interface

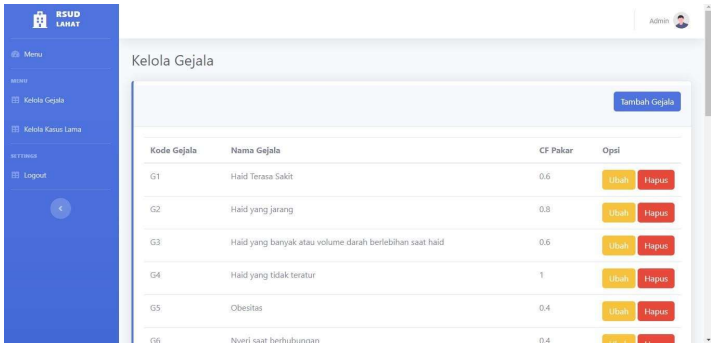

Figure 9. Admin Page Interface Manage Symptoms

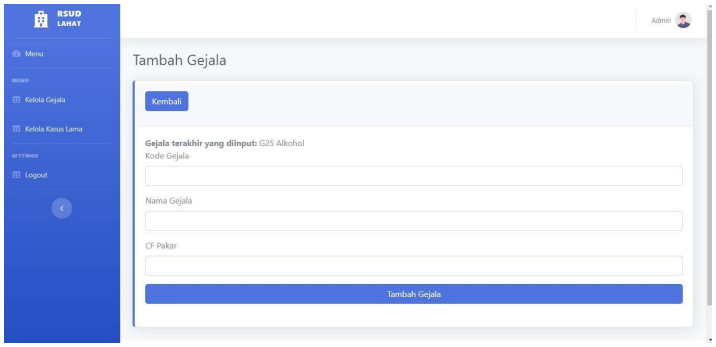

Figure 10. Admin Page Interface Add Symptoms

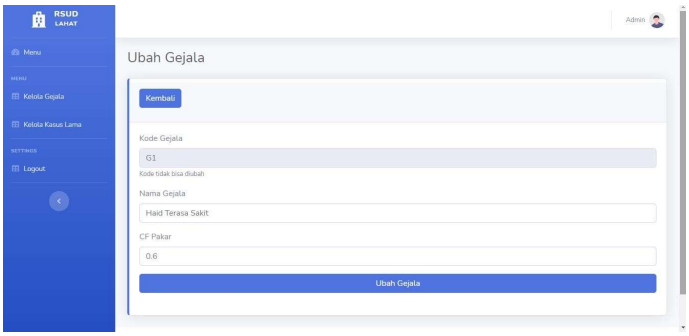

Figure 11. Admin Page Interface Change Symptoms

Figure 12. Admin Page Interface Manage Old Cases

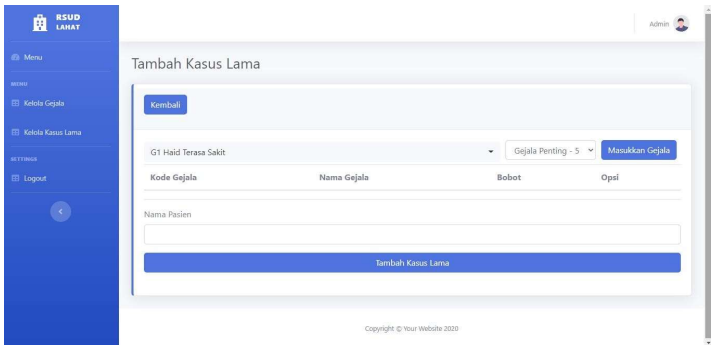

Figure 13. Admin Page Interface Add Old Case

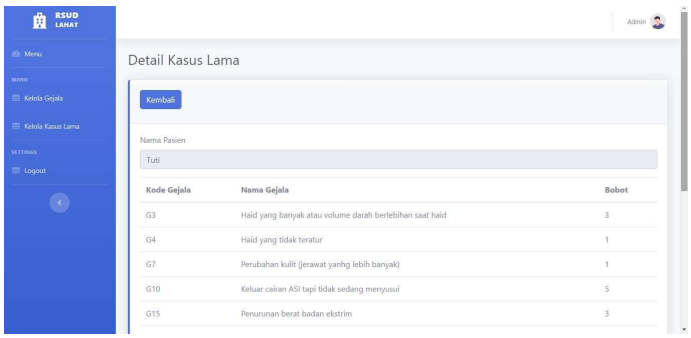

Figure 14. Old Case Detail Admin Page Interface

Based on results of tests that have been carried out on the suitability of software design and software implementation, it can be concluded that the units and interfaces built can run well. This is indicated by the conclusion that the scenario results in the test cases all show the same conclusion, which is accepted.

B. Research Analysis

Testing data on diagnosis of infertility in women with test data using the Certainty Factor and Case Based Reasoning methods has been successfully carried out. Previously, the author had explained in advance about the Certainty Factor and Case Based Reasoning methods to experts, because in calculating the Certinty Factor and Case Based Reasoning methods it was necessary to have a weighted value for each symptom to diagnose a disease. The weight value was successfully obtained from the results of interviews with experts. Analysis of the results of testing accuracy system can be seen in table 1 and table 2.

Table 1. Analysis of System Accuracy Test Results for Certainty Factor Method

Test Result		
Total Test Data	**Amount of "Appropriate" Data**	**Percentage Acuracy**
25	23	92%

Table 2. Analysis of System Accuracy Test Results for Case Based Reasoning Method

Test Result		
Total Test Data	**Amount of "Appropriate" Data**	**Percentage Acuracy**
25	19	76%

In table 1, software testing has been carried out using the Certainty Factor (CF) method using 25 random test data taken for testing, the results are 23 cases that are appropriate and 2 cases that are not. In table 2, software testing has been carried out using the Case Based Reasoning (CBR) method using 25 random test data taken for testing, the results are 19 cases that are appropriate and 6 cases that are not suitable. The test data whose output does not match the results of this expert's provision is most likely due to other considerations used by the expert/expert that cannot be determined by the system. Based on the calculations, the accuracy of the expert system for determining infertility in women using the Certainty Factor (CF) method is 92% and using the Case Based Reasoning (CBR) method is 76%.

5. Conclusion

Based on the results of the analysis of the Certainty Factor (CF) and Case Based Reasoning (CBR) methods to determine the diagnosis of infertility in women, it can be concluded that:

1. An expert system for diagnosing infertility in women using Certainty Factor (CF) and Case Based Reasoning (CBR) methods has been successfully implemented. This system can be used as a user to make it easier to diagnose infertility in women.

2. The design of an expert system using the Certainty Factor (CF) method can produce a better design than the Case Based Reasoning (CBR) method, it can be seen from the calculated accuracy value of 92%. While the expert system design uses the Case Based Reasoning (CBR) method, the accuracy value is calculated at 76%. The difference in the accuracy value of the two methods is caused by a fundamental difference in the calculations of the two, where the calculation of infertility in the Certainty Factor (CF) method is not related and is calculated separately while the Case Based Reasoning (CBR) calculation is interrelated between old cases and new cases, if weight of the symptoms of the old case and the new case is the same, then value is one, and if weight of symptoms of old case and new case is different then value is 0. This means that if the old case and new case have same symptoms and weight, the value calculation result will be high, and vice versa.
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