

# Expert System with Diagnosis of Blood Cancer (Leukaemia) with the Certainty Factor Method

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## Abstract

*Blood cancer or called leukaemia usually affects children with a high risk of death. Lack of knowledge about leukaemia is the cause that affects parents to search for information. By looking at the condition of children who are still unable to think for themselves. Will make a concern for the people around him to help them overcome their problems. Parents or immediate family must supervise the child's development and development for the recovery of their child. To help the process of healing children who have leukaemia, parents must be active in seeking information about the disease. So that if there is a symptom, the parents are more sensitive. They can recognize and immediately prevent the leukaemia disease, in this study an application in the diagnosis of leukaemia is carried out using the help of an expert system which is used to assist in diagnosing leukaemia using certainty methods. Factor. The results of using the certainty factor method based on the symptoms and criteria possessed by patients with leukaemia patients will show a fairly high percentage and accuracy as a tool that shows the conditions experienced by people living with leukaemias.*

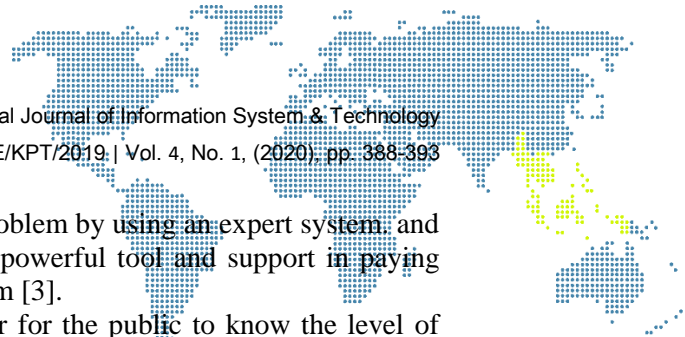
**Keywords:** *Leukemia, Expert System, Certainty Factor Method*

## 1. Introduction

If you talk about cancer, maybe you will imagine sharing organs that can be attacked by cancer. According to the National Cancer Institute, cancer can occur when blood cells are abnormal and divide uncontrollably and can also invade surrounding tissue. Cancer cells can spread to other parts of the body through the circulatory system and lymph nodes. There are various kinds of cancer, one of which is leukaemia or which is widely known by the public with blood cancer, this disease occurs in white blood cells. Which, if supposedly, the white blood cells help the human body fight infection, in leukaemia where the bone marrow produces abnormal white blood cells. Leukaemia can also develop rapidly so that sooner or later, it becomes chronic slowly [1].

In acute leukaemia, some cells are very abnormal and have a number that can increase rapidly. In adults can get any leukaemia, but with children who have leukaemia very often has an acute type. There are several leukaemia that can also be cured. But other types are difficult to cure. Types of treatment that can be done for people living with leukaemia can be in the form of chemotherapy, radiate and stem cell transplantation. Even if the symptoms disappear, the person with leukaemia may need to undergo therapy to prevent leukaemia relapse or apply an expert system [2].

An expert system is a system that exists based on the human ability to think about things that are based on the knowledge of an expert who knows in various fields contained in a system to make it easier and able to help ordinary people in solving problems that are and as a means of the consultation the good one. This expert system is also widely used as someone comes to an expert as a very appropriate place to find the information needed by someone who has a high enough level of confidence which is



formed into a structured system, in dealing with a problem by using an expert system, and can also use an approach to a method, it can be a powerful tool and support in paying attention to the level of accuracy of a designed system [3].

This expert system was created to make it easier for the public to know the level of possibility that a person is exposed to leukaemia or not, to help provide knowledge and identify this type of disease in detail, the symptoms that indicate the body is having a disease or not. This expert system uses an approach method to get the results of a problem with the technique of the accuracy of the data from calculations using the certainty factor method [4].

In previous studies using the certainty factor (CF) method, it is usually used in a study of an expert system that has knowledge of health such as research "Designing an Expert System for Diagnosis of Renal Tubular Acidosis Using the Certainty Factor Method", "Expert System for Diagnosing Pregnant Women Using Certainty factor method ", and the diagnosis of kidney disease using the certainty factor method". This method is widely used in helping diagnose several serious diseases that have a high level of accuracy; this method is usually used to accommodate the uncertainty of information that is obtained from an expert's thought so that using this method can see the level of accuracy of something. The problem and describe a deep level of confidence to solve a problem [5] [6].

## **2. Research Methodology**

This research has the nature of quantitative research, namely a study that has the nature of reasoning with numbers and systematic mathematics as a result of a study in the form of the level of accuracy of the data being managed and tested. Tests perform quality data collection as a consideration for conducting research.

### **2.1. Expert System**

The express system, which is commonly known as the system, is also one of the branches in the application of computer science in a society's life, such as the application of a science such as the knowledge of an expert in the field of scientific disciplines that is entered into a computer-based system, this system is designed to match the quality of an expert and can also replace the function of an expert to help the community solve a problem [7].

### **2.2. Diagnosis**

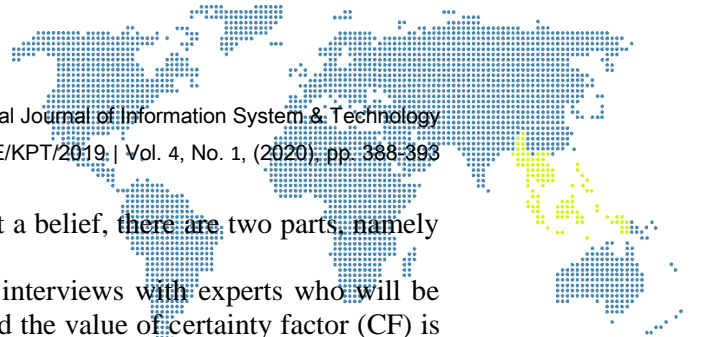
Diagnosis is the determination of a decision on something, in the large dictionary of indonesian it is usually applied in an explanation to a type of disease based on the symptoms experienced through the results of a medical examination. an attempt of problem solving [8].

### **2.3. Leukemia or Blood Cancer**

In general, the cause of blood cancer is still not known with certainty. However, there are some experts who suspect that changes in DNA can turn healthy blood cells into cancer. In addition, blood cancer also has a genetic or hereditary tendency. The draw is that if someone from your closest family such as your parents, siblings, or grandparents has a history of leukemia, then there is a chance that you will also be at risk. And there are also other factors such as dangerous chemicals, radiation exposure, and viral infections, it can also be one of the causes of blood cancer [9].

### **2.4. Certainty Factor (CF)**

This certainty factor (CF) method is a method that accommodates certainty in a thought that is owned by an expert. This method was triggered by two people named Shorttife Dana Buchana who was bolted in 1975 where this method is usually used to



measure levels. belief in every expert, in order to get a belief, there are two parts, namely [10] [11]:

- Using a data collection system in the form of interviews with experts who will be taken in the form of a result of the interview and the value of certainty factor (CF) is obtained from the value based on direct level or in the form of an interpretation (term) from an expert, a data that is I change it to a value based on its level.
- Obtain a certainty level with the certainty factor (CF) method combine using a calculation as follows:

$$CF_{Combine}(H, E) = CF(H) \times CF(E) \quad (1)$$

$$CF(H, E)_{1,2} = CF(H, E)_1 + CF(H, E)_2 \times (1 - CF(H, E)_1) \quad (2)$$

$$CF_{Combine}(H, E)_{old3} = CF(H, E)_{old} + CF(H, E)_3 \times (1 - CF(H, E)_{old}) \quad (3)$$

Where:

$CF(Rule)$  = faktor kepastian

$H$  = ukuran kepercayaan terhadap hipotesis  $H$

$E$  = evidence yang berarti sebuah peristiwa

### 3. Results and Discussion

In the study, stages were carried out that can diagnose a leukemia disease by using the approach to the certainty factor (CF) method which will start from making the symptom weighting which will serve as a guide in making decisions, to find a level of accuracy of the leukemia diagnosis data. In this study also has a level of value for an answer that will be generated from several questions that will be bolted to determine the type of symptoms that leukemia patients have.

This type of leukemia is also similar to lymphoma or also known as lymph node cancer, a disease that is often diagnosed as leukemia. Because both are cancerous and cause abnormal blood cells, the only difference lies in the organ that is the source of the disease. So it is necessary to do a calculation to see a level of accuracy of this type of disease so that there is no nuclear diagnosis of the disease. The following is a flow in problem solving using the Certainty Factor (CF) method:

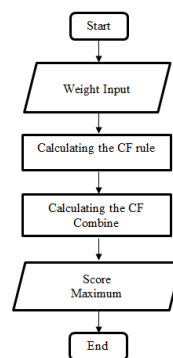


Figure 1. Calculation of the CF method

#### 3.1. Calculation Using the Certainty Factor (CF) Method

The following is a problem solving in diagnosing Luekemia using the certainty factor (CF) method based on the symptoms that have been input by the user:

Table 1. Answers to Weight Value

Symptoms	CF
Yes	0,6
No	0,4

This calculation uses the certainty factor (CF) combine (combined) calculation method, starting with knowing the results of the answers to the questions or consultation sessions with experts and giving a weight to the answers that have been provided further to determine the value or hypothesis of some symptoms of leukemia.

**Table 2. Symptoms of Disease**

DI	Symptoms	CF
01	Tired All The Time	0,6
02	Weight Loss	0,6
03	Fever	0,6
04	Repeated Infections	0,6
05	Blood that is hard to clot	0,6

Then an assessment will be carried out and will be given a weight on each answer that has been obtained and will be summarized in the form of a rule, each user or resource person will fill in each question according to the symptoms felt by the user and will be accumulated in the form of calculations using the method certainty factor (CF), where the results to be given are in the form of a percentage of the highest level produced by a person's condition based on the symptoms of each user.

After getting the weighted value of the questions and symptoms indicated by leukemia, in this case the calculation will use the certainty factor (CF) method which will process each symptom present in the user to see the highest value generated by the calculation using the certainty factor (CF) method).

**Table 3. User Data**

No	User	Symptoms				
		Tired All The Time	Weight Loss	Fever	Repeated Infections	Blood that is hard to clot
001	yayan	No	Yes	Yes	No	Yes
002	Wawan	Yes	Yes	Yes	No	No

The next step is to do an assessment of symptoms and the value of answers from the user who has been obtained based on the questions given by the expert, this calculation will use the explanation of a user as follows:

Rule user 001

$$CF_1(H, E) = CF(H_1) \times CF(E_1)$$

$$= 0,6 \times 0,4$$

$$= 0,24$$

$$CF_2(H, E) = CF(H_2) \times CF(E_2)$$

$$= 0,6 \times 0,6$$

$$= 0,36$$

$$CF_3(H, E) = CF(H_3) \times CF(E_3)$$

$$= 0,6 \times 0,6$$

$$= 0,36$$

$$CF_4(H, E) = CF(H_4) \times CF(E_4)$$

$$= 0,6 \times 0,4$$

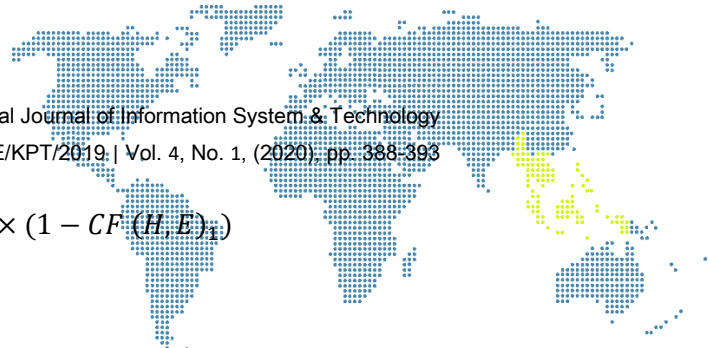
$$= 0,24$$

$$CF_5(H, E) = CF(H_5) \times CF(E_5)$$

$$= 0,6 \times 0,6$$

$$= 0,36$$

Furthermore, the combination is carried out using the following combination CF method:



$$\begin{aligned} CF_{combine} CF(H, E)_{1,2} &= CF(H, E)_1 + CF(H, E)_2 \times (1 - CF(H, E)_1) \\ &= 0,24 + 0,36 \times (1 - 0,24) \\ &= 0,5136 \end{aligned}$$

$$\begin{aligned} CF_{combine} CF(H, E)_3 &= CF(H, E)_{old} + CF(H, E)_3 \times (1 - CF(H, E)_{old}) \\ &= 0,5136 + 0,36 \times (1 - 0,5136) \\ &= 0,688704 \end{aligned}$$

$$\begin{aligned} CF_{combine} CF(H, E)_4 &= CF(H, E)_{old3,4} + CF(H, E)_4 \times (1 - CF(H, E)_{old3,4}) \\ &= 0,688704 + 0,24 \times (1 - 0,688704) \\ &= 0,76341504 \end{aligned}$$

$$\begin{aligned} CF_{combine} CF(H, E)_3 &= CF(H, E)_{old} + CF(H, E)_3 \times (1 - CF(H, E)_{old}) \\ &= 0,76341504 + 0,36 \times (1 - 0,76341504) \\ &= 0,8485856256 \end{aligned}$$

The user with the name Yayan can be concluded with the level of confidence in the diagnosis of leukemia at the percentage level of 84%. Furthermore, to count other users using the same method to see the percentage of diagnoses of leukemia experienced by each user.

#### 4. Conclusion

In the discussion above, we can use the certainty factor (CF) method to see the conclusion or diagnosis of leukemia that is on average 80% of the disease 100% can also be called a fairly high percentage and level of confidence in the diagnosis, further diagnosis can performed by using re-calculation, the highest percentage shows the level of seriousness of the disease suffered by the listed patients, if the lower the results obtained indicate a better body condition.

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