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Certainty Factor Method Analysis for Identification of Covid-19 Virus Accuracy

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Abstract

Corona virus or often called COVID-19 is a virus caused by SARS CoV 2, where the incident was uploaded in the world of health or we often call WHO. Even the World Health Organization (WHO) has declared that the corona virus outbreak is a Public Health Emergency of International Concern (PHEIC) or an international public health emergency. Not only has an impact on health, but this virus outbreak has also had a major impact in various sectors such as disrupting the country's economy, disrupting the education process and so on. This impact is caused by the very fast spread of the virus. Therefore, the author will analyze the level of accuracy in the covid-19 virus by using the certainty method model which aims to make it easier for local governments to monitor the spread of the COVID-19 virus and can determine future policies so that the spread is not more easily exposed to the community. this method will produce data analysis and diagnoses regarding identifying the covid-19 virus with results in the form of accuracy, namely someone is indicated as COVID-19 POSITIVE.

Keywords: Certainly Factor; Public Health; Covid-19 Classification; Artificial Intelligence

1. Introduction

Health is an important thing for humans, but most ordinary people pay little attention to health problems. They often underestimate the disease Covid-19 [1], and if it is not treated immediately it will become more serious. A symptom of a disease that arises can be an indication of a disease that will be suffered or is being suffered.

In the development of modern technology, a technology system is also developed that is able to adapt human processes and ways of thinking, namely Artificial Intelligence. Expert System is part of artificial intelligence that combines knowledge and data tracking that is able to solve problems like an expert [2].

Quick and precise information from an expert is needed. This is what prompted the creation of an expert system for diagnosing Covid-19 using the certainty factor method [3]. This research method is in the form of a survey, collecting data taken by researchers using primary data collection in the form of interviews with several experts, in this case the Covid-19 Specialist Doctor and making a number of direct observations or observations and secondary data in the form of documents directly related to Covid-19 [4].

Furthermore, the systematic steps used in the Certainty Factor Method are used to calculate the possible values of MB, MD, and CF [5]. For modeling in expert applications with the Certainty Factor method includes the first stage, namely the Foreground process, the second stage is the Visible process, the third stage is the Server process, the fourth stage is the Background process and the last stage is the Empty Process. By using the Certainty Factor Method [6].

The research instrument used interview techniques with several experts, namely covid-19 specialists and a recorder using a mobile phone as a recording device for data storage in interviews with experts from the Department of Health and Spatial Doctors handling Covid-19 [7].

Rice Plant Disease Diagnostic Expert System Provides information about plant pests and diseases and can diagnose symptoms of plant diseases, especially rice plants, as well as provide solutions to overcome them, which can later be used to reduce or minimize the risk of web-based plant damage. Another research on web-based expert system applications has been conducted by David [6] by utilizing the Application of Fuzzy Moora in the Diagnostic Expert System for Dengue Hemorrhagic Fever [8], which is intended to assist doctors in their duties and complement the ability of these doctors to make optimal decisions through computer processing. The next research is the Application of Rule Based Forward Chaining in Expert Systems for Diagnosing Skin Diseases, which discusses expert systems with forward chaining techniques [9] which is combined with rule based which is used as a diagnostic simulation based on complaints or symptoms that arise.

This study uses the Certainty Factor method and the certainty factor for the diagnosis of the Covid-19 virus based on the symptoms felt by the patient [10]. His reasoning uses the certainty factor method to calculate the certainty level of the Covid-19 virus he is suffering from. With the creation of this expert system, it is hoped that it will make it easier for doctors and medical staff to diagnose the Covid-19 virus based on the symptoms felt, thereby minimizing diagnostic errors and getting the right treatment in the future. The purpose of this study is to analyze the expert system with the certainty factor method used to diagnose the Covid-19 virus with the certainty factor method inference engine to make it easier for doctors to diagnose [10].

AI expert system is a program with a knowledge base obtained from expert experience, knowledge, and expertise in solving problems in a particular field. AI Expert System is also known as a system with a powered Inference engine which has reasoning or tracking the facts of things and rules in the knowledge base [11] . An expert system or expert system or expert system, also known as a Knowledge Based System, is a computer application that is intended to assist decision making or problem solving in a specific field. This system works by using knowledge and analysis methods that have been defined in advance by experts in accordance with their areas of expertise. This system is called an expert system because its functions and roles are the same as an expert who must have knowledge and experience in solving a problem. The system usually functions as an important key that will help a decision support system or executive support system [12] .

2. Literature Review

The Certainty Factor (CF) Method Analysis is a statistical method used in Artificial Intelligence to evaluate the accuracy of an expert system. This method can be used to evaluate the accuracy of different systems used to identify the COVID-19 virus. In the context of COVID-19, the CF method can be used to determine the confidence level of a diagnostic system in identifying the virus based on the symptoms, medical history, and other relevant factors. The CF method involves calculating a value for each rule used in the diagnostic system and combining these values to determine the overall confidence level of the system [13].

To use the CF method, the diagnostic system must have a set of rules that describe the relationship between the symptoms and the presence of COVID-19. For example, if a patient presents with a high fever and a dry cough, the system may assign a high CF value to these symptoms, indicating a higher probability of COVID-19 [14]. Once the CF values have been assigned to each symptom, they are combined to give a single overall CF value for the diagnosis. This value represents the confidence level of the system in its diagnosis. The higher the CF value, the higher the confidence level of the system in the diagnosis [15].

It is important to note that the CF method does not guarantee accuracy, but it provides a way to evaluate the performance of the diagnostic system. The accuracy of the system depends on the quality of the rules used and the data used to train the system. The CF method can be used to identify areas where the system needs improvement and to make changes to improve its accuracy [16,17]. In addition to evaluating the accuracy of the diagnostic system, the CF method can also be used to evaluate the accuracy of other types of systems used to identify COVID-19, such as rapid diagnostic tests or imaging systems. This can provide valuable information to healthcare providers and researchers in determining the most effective methods for identifying the virus [18-20].

In conclusion, the Certainty Factor Method Analysis is a valuable tool in the fight against COVID-19. By evaluating the accuracy of diagnostic systems, it provides valuable information to healthcare providers and researchers in determining the most effective methods for identifying the virus. The CF method should be used in conjunction with other methods to ensure that the diagnosis of COVID-19 is accurate and reliable.

3. Research Method

The method used is by interviewing patients who will be examined by asking about the symptoms they are experiencing. After the interviews were conducted and the results of the interviews were inputted into the system, a CF calculation was carried out, namely a method to be able to prove whether a fact that occurred was called certain or uncertain in the form of a matrix [13]

CF uses a value to assume an expert's degree of belief in a value. This method uses a calculation based on similarity divided by a predetermined weight. The CF method shows a measure of certainty about a fact or rule. CF is a clinical parameter given by MYCIN which is used to show the level of trust [6]. The basic formula of CF namely:

$$CF(h,e) = MB(h,e) - MD(h,e) \quad (1)$$

$CF(h,e)$ = The certainty factor in the h hypothesis which is influenced by the evidence

$MB(h,e)$ = Measure of believe is a measure of the trust of the hypothesis h which is influenced by evidence e

$MD(h,e)$ = The measure of disbelief is a measure of the distrust of the hypothesis h

h = The resulting hypothesis or conclusion is between 0 and 1

e = Evidence or facts (symptoms)

The next calculation is the calculation of a combination of two or more rules with different facts or symptoms but in the same hypothesis :

Rule 1

$$CF(h,e1) = CF1 = C(e1)\ x\ (CF\ Rule\ 1) \quad (2)$$

Rule 2

$$CF(h,e2) = CF2 = C(e2)\ x\ (CF\ Rule\ 2) \quad (3)$$

CF Combination

$$[CF1,\ CF2] = CF1 + CF2\ (1 - CF1) \quad (4)$$

4. Result and Discussion

4.1. Data Collection Technique

Data collection, this activity is to collect research data from various sources, in the form of data on symptoms and complaints of Covid-19 patients. The data collection method used in this study is as follows :

1) Literature Study Collecting data by means of literature, journals, papers and readings related to the research title.
2) Observation Data collection techniques by conducting research and direct observation of stable problems.
3) Interview Data collection techniques by holding direct questions and answers that have something to do with the research being taken.

4.2. Certainty Factor Research Workflow

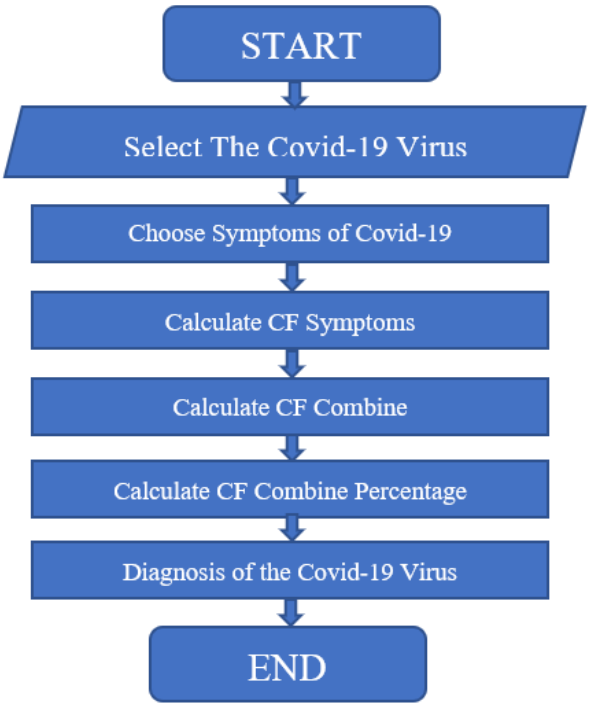

Fig. 1. Certainty factor research workflow

4.3. Certainty Factor Calculation Method

Rule 01 (Negatif Covid-19)

Rule 1.1 :

$$IF\ G05\ THEN\ K02$$
$$CFuser\ =\ 0,5 \quad (5)$$
$$CFrule\ =\ 0,8$$

Rule 1.2 :

$$IF\ G14\ THEN\ K02$$
$$CFuser\ =\ 0,8 \quad (6)$$
$$CFrule\ =\ 0,2$$

Rule 1.3 :

$$IF\ G01\ THEN\ K02$$
$$CFuser\ =\ 0,8 \quad (7)$$
$$CFrule\ =\ 0,8$$

Rule 1.4 :

$$IF\ G01\ THEN\ K02$$
$$CFuser\ =\ -\ 0,5 \quad (8)$$

$$CFrule = -0,8$$

Rule 1.5 :

$$IF\ G17\ THEN\ K02$$
$$CFuser = 0,5 \quad (9)$$
$$CFrule = 0,5$$

Rule 1.6 :

$$IF\ G21\ THEN\ K02$$
$$CFuser = 1\ CF\ rule = 0,8$$
$$CF\ combine\ 4(CFold3\ ,\ CFsymptoms17)$$
$$= CFold3 + CFsymptoms17 * (1 - CFold3) \quad (10)$$
$$= 0,8746956 + 0,16 * (1 - 0,8746956)$$
$$= 0,8746956 + 0,052048704\ CFold4$$
$$= 0,726744$$

To get the value in percentage form, use the CF Percentage formula as follows

Manual calculation process for rules 1.1 :

$$CF\ symptoms\ 05 = CF(User) * CF(Expert)$$
$$= 0,5 * 0,8 \quad (11)$$
$$= 0,40$$

Manual calculation process for rules 1.2 :

$$CF\ Symptoms\ 14 = CF(User) * CF(Expert)$$
$$= 0,8 * 0,2 \quad (12)$$
$$= 0,12$$

Manual calculation process for rules 1.3 :

$$CF\ Symptoms\ 01 = CF(User) * CF(Expert)$$
$$= 0,8 * 0,8 \quad (13)$$
$$= 0,16$$

Manual calculation process for rules 1.4 :

$$CF\ Symptoms\ 11 = CF(User) * CF(Expert)$$
$$= -0,5 * -0,8 \quad (14)$$
$$= 0,40$$

Manual calculation process for rules 2.5 :

$$CF\ Symptoms\ 17 = CF(User) * CF(Expert)$$

$$= 0,5 * 0,5 \quad (14)$$
$$= 0,16$$

Manual calculation process for rules 2.6 :

$$CF\ Symptoms\ 21 = CF(User) * CF(Expert)$$
$$= 1 * 0,8 \quad (15)$$
$$= 0,8$$

Rule 02 (Positive Covid-19)

Rule 2.1 :

$$IF\ G02\ THEN\ K07$$
$$CFuser = 0,8 \quad (16)$$
$$CFrule = 1$$

Rule 2.2 :

$$IF\ G10\ THEN\ K07$$
$$CFuser = -0,8 \quad (17)$$
$$CFrule = -1$$

Rule 2.3 :

$$IF\ G03\ THEN\ K07$$
$$CFuser = 0,8 \quad (18)$$
$$CFrule = 1$$

Manual calculation process for rules 2.1 :

$$CF\ Symptoms\ 02 = CF(User) * CF(Expert)$$
$$= 0,8 * 1 \quad (19)$$
$$= 0,8$$

Manual calculation process for rules 2.2 :

$$CF\ Symptoms\ 10 = CF(User) * CF(Expert)$$
$$= -0,8 * -1 \quad (20)$$
$$= 0,8$$

Manual calculation process for rules 2.3 :

$$CF\ Symptoms\ 03 = CF(User) * CF(Expert)$$
$$= 0,8 * 1 \quad (21)$$
$$= 0,8$$

$$CFcombine\ 2(CFold1\ ,\ CFsymptoms03)$$
$$= CFold1 + CFsymptoms03\ *\ (1 - CFold1)$$
$$= 0,92 + 0,8\ *\ (1 - 0,92) \quad (22)$$
$$= 0,92 + 0,064\ CFold2$$
$$= 0,984$$

Because there is more than one symptom, equation (2) is used to determine the abnormal cardiac CF:

$$CFcombine1(CFsymptoms02, CFsymptoms10)$$
$$= CFsymptoms02 + CFsymptoms10\ *\ (1 - CFsymptoms02)$$
$$= 0,8 + 0,8\ *\ (1 - 0,8) \quad (23)$$
$$= 0,8 + 0,32\ CFold1$$
$$= 0,92$$

$$CFcombine\ 2(CFold1\ ,\ CFsymptoms03)$$
$$= CFold1 + CFsymptoms03\ *\ (1 - CFold1)$$
$$= 0,92 + 0,8\ *\ (1 - 0,92) \quad (23)$$
$$= 0,92 + 0,064\ CFold2$$
$$= 0,984$$

To get the value in percentage form, use the CF Percentage formula as follows :

$$CF\ Percentage\ = CF\ old2\ x\ 100$$
$$= 0,984\ x100 \quad (24)$$
$$= 98,4\ \%$$

4.4. Calculating the Accuracy Level

After conducting data analysis it is necessary to look for the level of accuracy to find out whether the results of the analysis that has been carried out have a high or low level of accuracy. The method used to calculate the value. The accuracy in this study is the success rate and kappa statistics method.

$$True\ Positive\ rate\ = TP/(TP + FN)$$
$$= 0,1$$
$$False\ Positive\ Rate\ = FP/\ (FP + TN)$$
$$= 0 \quad (23)$$
$$Success\ rate\ = (TP + TN)/(TP + TN + FP + FN)$$
$$= 0,55$$
$$Error\ rate\ = 1 - Success\ Rate.\ = 0,45$$

5. Conclusion

The conclusions that can be drawn from the analysis of the certainty factor method from the research that has been done can be concluded that the Expert system is for diagnosing the COVID-19 virus by grouping patient status to ensure that the patient has tested positive or negative for COVID-19 infection. From the calculation of the CF values of the 6 patients inputted in this study, it resulted that each had an average CF value of 89.07%% for the negative rule and 98.4% for the positive rule with an accuracy rate of analyzing the Covid-19 virus in patients of 55 %.

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