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Expert System for Early Detection of Public Anxiety Levels Against Covid-19 with the Comparison Method of Dempster-Shafer and Certainty Factor

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ABSTRACT

Anxiety can attack anyone, including society, against Covid-19. Excess anxiety can cause people to experience psychosomatic problems. Based on the existing problems, a system is needed that can help provide information to detect people's anxiety levels and deal with excessive anxiety levels quickly. The method used in this research is the Dempster-Shafer and Certainty Factor methods, which will then be compared to determine the accuracy value of each method. The method that has the highest accuracy value will be applied in the expert system to be created. From the calculation accuracy obtained on the certainty factor method, the accuracy results are 91% and the dhemster-shafer method the accuracy results are 54.5%. Then it can be concluded that the certainty factory method has a more accurate accuracy than the dhamster-shafer method in detecting early levels of anxiety society against covid-19. The research carried out aims to analyze the results of the comparison of the diagnosis of an expert system made in early detection of the level of anxiety in the community about Covid-19.

1. Introduction

Anxiety is a feeling of discomfort accompanied by fear of certain things, such as feelings of uncertainty as a signal that there is a warning about an impending danger, so you can anticipate it by taking action in dealing with this threat. Excessive anxiety can cause people to experience psychosomatic problems, which have several symptoms such as; have feelings of constant anxiety, tension, excessive fear, sleep disturbances, disturbances in intelligence, moodiness, and so on. When you are experiencing anxiety, the work system on the sympathetic nerves will automatically increase, so that it can cause changes in the body's response.

Expert system or what is also called artificial intelligence is a science in the field of computers that can mimic the behavior of human intelligence. An expert system is a system programmer, which contains the knowledge of an expert in solving a particular problem. Expert system can also be interpreted as a storage of knowledge that is owned by an expert in a certain field which is applied to a computer program, where the program can produce decisions in making intelligent reasoning.

Based on the above problems, the authors conducted research developed by a system using the comparison method, namely the Dempster-Shafer method and the Certainty Factor. It is hoped that this system can help diagnose early detection of abnormalities and early signs of disease at the level of public anxiety and treat excess anxiety levels early so that they can be anticipated. The research entitled "Expert System for Early Detection of Community Anxiety Levels Against Covid-19" is also a prerequisite for the final task to achieve the Bachelor's Degree in Starata One (S1) at the Faculty of Communication and Information Technology.

2. Theoretical basis

Subsequent research conducted by Doddy Teguh Yuwono et al (2019) discusses an expert system for diagnosing personality disorders using the dampster-shafer method. Obtaining the results on the implementation of a personality disorder diagnosis expert system with the Demster-Shafer method can be applied and produces an accuracy value of 85%.

Research conducted by Ira Lina Kendayata Panjaitan et al (2018) discusses the Comparative Analysis of the certainty factor method to diagnose stroke, obtaining better Certainty Factor method results with 90% accuracy value compared to the dempster shafer method which has 80% accuracy.

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Research by Teguh Ansyor Lorosae et al (2018) discusses the Expert System for Diagnosing Dental and Oral Diseases Using the Dempter Shafer and Certainty Factor Methods, getting a result in the form of a comparison of the accuracy of a process, a comparison of the two methods from experts who use the theory of confusion matrix, obtaining Dampster results. Shafer 9., 03% and Certainty Factor 98.41%.

Aryu Hanifah Aji et al. (2018) discussed research on an expert system for diagnosing pregnant women using the Certainty Factor (CF) method, obtaining results, the functionality of a pregnant woman's disease diagnosis can run according to the list of needs for a system with an accuracy level of 100%.

Research conducted by Adil Wahyudi et al (2018) entitled the design of an expert system for diagnosing diseases in infants using the Dampster-Shafer method obtained results, the expert system was able to diagnose toddler disease accompanied by a certainty value of 100% of the suitability of a system output, when compared to data from an expert on this system will provide solutions for treatment and prevention with a level of functionality testing of 100%.

Research conducted by Risvan Dwi Haryanto and Henny Leidiyana (2020) discusses an expert system for diagnosing joint disease using the Certainty Facto method. the system created can be used for the detection of joint diseases and ways of prevention to treatment.

3. Research methods

3.1 Data collection

The data obtained is secondary data by methods:

a. Interview

Interviews were conducted with a psychologist named Mrs. Alfath Hanifah Megawati. S.Ps., M.Psi

b. Literature review

This is done by collecting reading sources, both from internet media in the form of journals, e-books, or books from various kinds of research that are in accordance with the problems being taken.

c. Research Flowchart

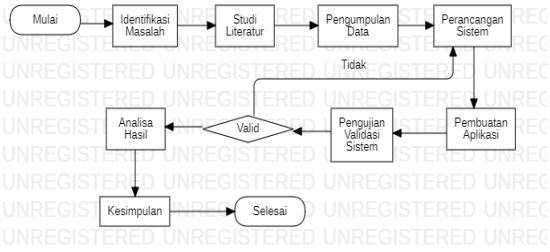

Fig 1. Research Flowchart

Figure 1 describes the research flow in which the first process of identifying problems in diseases and in the second stage of the process, a literature study is carried out which is one of the references in obtaining various related information. In the third stage of data collection, one must determine the data collection technique by interviewing a psychologist, or observing directly with students in the final semester. The fourth stage is a system design process, this is an illustration of the design of an application and also the process of implementing the system you want to build and the next stage is whether the information that has been input is valid or not, if it is not valid then the system will return to the system design, and if valid, the system will enter the next stage. The next stage, analysis of results, namely the process of translating valid results. The final stage is the result of the research which has been analyzed.

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d. System Flowchart

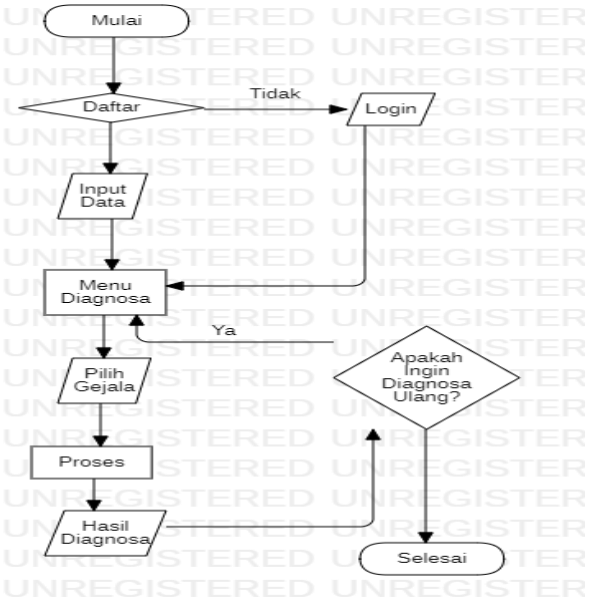

Fig 2. System Flowchart

Figure 2 is a system flowchart where the user must be asked to log in if he already has an account, and if the user does not have an account, the system asks the user to create an account first. When you can log in, the system displays the main menu on the web, then enters the diagnostic process by selecting symptoms. Then the system will perform calculations using the Dempster-shafer method and the Certainty Factor so that it issues the output in the form of a symptom diagnosis that has been selected by the user.

e. Use Case Diagram

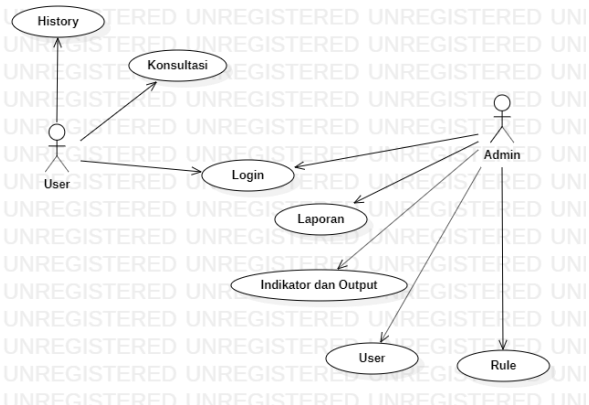

Fig 3. Use Case Diagram

Information :

a. Admin has access to all pages on that system.
b. Users can only access the consultation page and consultation history.

3.2 Dempster-Shafer

Demster-Shafer is a theory that proves based on the size of a believed symptom (believe) and a measure of not believed to a symptom (plausibility).

$$m_3(Z) = \frac{\sum X \cap Y = Z \; m_1(X).m_2(Y)}{1 - \sum X \cap Y = \emptyset m_1(X).m_2(Y)}$$

Information :

M3 (Z): mass function of proof (Z)

m1 (X): the mass function of evidence (X), which is obtained from the confidence value of the evidence multiplied by the disbelief value of the evidence.

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m2 (Y): mass function of the evidence (Y), which is obtained from the confidence value of the evidence multiplied by the disbelief value of the evidence.
$\sum X \cap Y = Z1$ (X). m2 (Y): Is the strength value of proof Z obtained from a combination of a set of proofs X and Y which has a slice. $\sum X \cap Y = 1$ (X) .m2 (Y): is the confidence value of various combinations of sets of X and Y.

Fig 4. Flowchart of the Dampster-Shafer Method

Information :
Figure 4 is a number of application steps in an expert system application that is made as the user starts selecting symptoms, after the symptoms are selected, the system will calculate with the existing system and will show a diagnostic result and will provide a treatment solution.

3.3 Certainty Factor

Certainty Factor is a method that proves the certainty value to measure the trustworthiness of an expert. Certainty Factor is defined as follows [6] [8] [9]: CF (H, E) = MB (H, E) - MD (H, E) (2)
Information :
CF (H, E): Hypothesis H is influenced by the symptoms E. The amount of CF ranges from 0 to 1. The value of 0 is distrust while the value of 1 indicates trust.
MD (H, E): The level of increased distrust (measure of increased disbelief) towards hypothesis H is influenced by the E phenomenon.

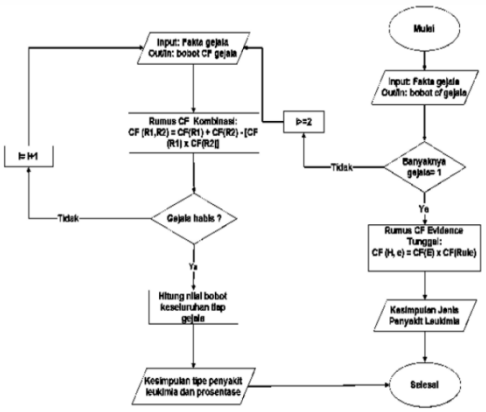

Fig 5. Flowchart of the Certainty Factor Method

Information :
The design of the knowledge base of the premise expert system is that symptoms and conclusions are types of anxiety, so the statement is that IF is a symptom while THEN is a type of anxiety / disease.

4. Results and Discussion

4.1 Knowledge Base

Table 1.
OCD Symptom Indicator

Code	Symptom Name	Mb	Md
G1.	TIRED EASY	0.2	0.1
G2.	DIZZY	0.2	0.1
G3.	THOUSAND	0.4	0.1
G4.	SHAKY	0.7	0.2

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Code	Symptom Name	Mb	Md
G5.	SWEATING	0.2	0.1
G6.	EXCESSIVE FEAR	0.7	0.2
G7.	TOUGH CONCENTRATION	0.4	0.1
G8.	EAT NOT REGULARLY	0.4	0.1
G9.	INSOMNIA	0.8	0.2
G10.	WORRIED	0.6	0.2
G11.	LESS CONFIDENT	0.5	0.1
G12.	FEELING TENSION	0.7	0.2
G13.	EXPRESSING THE PROBLEM	0.8	0.2
G14.	HIGH DEPENDENCE	0.3	0.1
G15.	DRY MOUTH	0.3	0.1
G16.	THOUGHT IS UNRACIAL	0.7	0.2
G17.	EASY TO GET ANGRY	0.7	0.2
G18.	EMPTY MIND	0.5	0.1
G19.	LOOK AT YOURSELF IS POWERFUL	0.4	0.1
G20.	AVOID SITUATION	0.3	0.1
G21.	FEELING WANTED TO RUN ON YOURSELF	0.3	0.1
G22.	Worry	0.3	0.1
G23.	NERVOUS	0.3	0.1
G24.	BEWARE OF EXCESSION	0.9	0.2
G25.	REFLEX	0.7	0.2
G26.	FEAR OF FAILURE	0.5	0.1
G27.	NAUSEA	0.2	0.1
G28.	DOING THINGS AGAIN	0.9	0.2
G29.	FEAR OF DIRTY	0.9	0.2
G30.	FEAR OF DISEASE	0.6	0.2
G31.	MAKING ITEMS IN THE SAME DIRECTION	0.7	0.2
G32.	FLASH BACK	0.4	0.1

Table 2.
OCD Disease Indicators

No.	Disease Indicator Name	Code
1.	An indication of Obsessive Compulsive Disorder (OCD) anxiety	01
2.	Not indicated Obsessive Compulsive Disorder (OCD) anxiety	02

Table 3.
Rules

Code	Name	Rule
1.	OBSESSIVE COMPULSIVE DISORDER IS INDICATED	G4, G6, G9, G10, G12, G13, G16, G17, G24, G25, G29, G30, G31
2.	OBSESSIVE COMPULSIVE DISORDER IS NOT INDICATED	G1, G2, G3, G5, G7, G8, G11, G14, G1, G18, G19, G20, G21, G22, G23, G26, G27, G28, G32

4.2 Calculation of the Certainty Factor and Dampster-Shafer Methods

Performing the system testing method, the user can choose at least three symptoms as follows:

a. Worried
b. Less confident
c. Tense

Indicator 1:
Worried (G10)
G10 Indicated (01)
m1 {O1} = 0.6
m1 {0} = 0.4
Indicator 2:
Less confident
G11 = Not indicated (O2)
m2 {O2} = 0.5
m2 {0} = 0.5

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		m2 0.5	{O2}	m2 {O} 0.5
m1 0.6	{O1}	{O1} 0.3		{O1} 0.3
m1 0.4	{θ}	{O1} 0.2		{θ} 0.2

m3 {O1} = = $0.8\frac{0.3+0.2+0.3}{1-0}$

m3 {θ} = 1 - 0.8 = 0.2

Indicator 3:

Tense

G12 = indicated (O1)

m3 {O1} = 0.7

m3 {0} = 0.3

		M4 0.7	{O1}	M4 {O} 0.3
M3 0.8	{O1}	{O1} 0.56		{O1} 0.24
M3	{θ} 0.2	{O1} 0.14		{θ} 0.06

m5 {O1} = = $0.318\frac{0.14}{1-0.56}$

m5 {O1} = = $0.545\frac{0.24}{1-0.56}$

m5 {θ} = 1 - (0.318 + 0.545) = 0.137

The greatest value is found in {O1}, which is not indicated for the level of anxiety with a value of 0. If it is converted to a percentage, then 0.545 x 100% = 54.5%

4.3 Calculation of the Certenty Factor Method

There are various ways that can be done in the process of calculating the certainty factor method. The first step is to determine the certainty factor value of the symptoms.

CF [H, E] $_1$ (Worried) = 0.6

CF [H, E] $_2$ (Lack of Confidence) = 0.5

CF [H, E] $_3$ (Tense) = 0.6

The next step is to combine the Certainty Factor value of each symptom:

G10 = MB = 0.6; MD = 0.2. CF = 0.6 - 0.2. CF = 0.4

G11 = MB = 0.5; MD = 0.1 CF = 0.5 - 0.1. CF = 0.4

G12 = MB = 0.7; MD = 0.2 CF = 0.7 - 0.2. CF = 0.5 CF (G10, G11, G12) = CF (R1) + [CF (R2), (R3)] x [1-CF (R1)]

= (0.4 + 0.4 + 0.5) x [1-0.4]

= 1.3 x 0.7

= 0.91

There is the final result of manual calculation of a certainty factor of 0.91, if it is presented in percent then 0.91 x 100% = 91%

4.3 System Interface

The following is a display on the early detection application system for the level of public anxiety about Covid-19 which is as follows:

a. Login

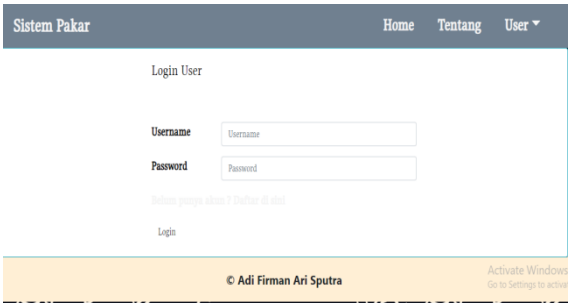

Fig 6. Login

In the login screen, if the user already has an account, the user can enter the username and password, if not, the user must create one first.

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b. Home

Fig 7. Menu Display

In the Home screen there are various features, if you want to start diagnosing then go to the consultation feature.

c. Consultation

Fig 8. Display Symptoms

In the consultation menu the user can select the symptoms that are being experienced, at least the user selects symptoms, namely three.

d. Dempster-Shafer results

Fig 9. Display of Dampshter-Shafer Results

e. Certainty Factor Results

Fig 10. Display of Certainty Factor Results

After the user selects a symptom, a display of the results of the symptoms that the user selects will appear as shown in the example image above.

5. Conclusion

The research conducted can be concluded that the system can detect the level of anxiety experienced by the community about Covid-19, based on the symptoms experienced by the user with a comparison of the accuracy of the calculation process results from the dhemster-shafer method and certainty factors, along with an expert's assessment.

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So the results obtained are the calculation accuracy with the certainty factor method in indicating anxiety is more accurate with a result of 0.91 or 91% compared to the dhemster-shafer method which gets a result of 0.545 or 54.5%. For the results indicated that anxiety is 0.6 - 1 if it is below 0.6 then there is no indication of anxiety.

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