Application of the Certainty Factor Method for Diagnosing Mental Illness Disease

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Abstract: Mental illness is a disease that is widespread among Indonesian people. Mental illness, also known as mental health disorder, is a term that refers to various conditions that can affect a person's thoughts, moods, feelings or behavior. However, there are still many Indonesian people who do not recognize and indicate the existence of mental illness because many people do not pay attention to their mental health or those around them. the small number of psychiatrists available in each area and the costs required are also not small, causing ordinary people to be reluctant to carry out examinations with psychiatrists, this of course leads to delays in treatment which can even be fatal. To prevent the increase in sufferers of mental illness, a system is needed that can store the knowledge of experts or psychologists who understand how to handle mental illness. An expert expert system is an artificial intelligence program that combines a knowledge base with an inference system to emulate an expert. The certainty factor method is a method used to solve cases of uncertainty, where the size is based on a fact or rule that can be used in expert systems. With the existence of an expert system for diagnosing mental illness, the general public can recognize early symptoms of mental illness, so treatment can be done earlier. From the results of the trials conducted, the results of the mental illness expert system were obtained with the highest score, namely depression with a confidence value of 90.02%.

Keywords : Certainty Factor, Mental Illness, Expert System.

1. Introduction

Mental illness, also known as mental health disorder, is a term that refers to various conditions that can affect a person's thoughts, moods, feelings or behavior. This condition can occur occasionally or last for a long time. Mental illness is a disease that is widespread among Indonesian people. However, there are still many Indonesian people who do not recognize and indicate the existence of mental illness because many people do not pay attention to their mental health or those around them.

Diagnosis of mental illness should indeed be done by a psychiatrist or psychologist.

However, the small number of psychiatrists in each area and the costs required are also not insignificant, causing ordinary people to be reluctant to examine psychiatrists, this of course leads to delays in treatment which can even be fatal. With the existence of an expert system for diagnosing mental illness, it is certainly hoped that it can provide knowledge to the general public so that they can better recognize the early symptoms of mental illness, as well as minimize late actions.

An expert system is an artificial intelligence program that combines a knowledge base with an inference system to emulate an expert. An expert system is a system that seeks to adopt human knowledge into computers, so that computers can solve problems like experts do. It is expected that with this expert system users can solve certain problems without the help of experts in that field.

Based on sources from the Polbeng Inovtek Journal-Informatics Series, Vol. 3, No. 2 , November 2018 ISSN : 2527-9866 by (Putri, 2018) entitled "Expert System for Diagnosing Mental Illness Psychosis Using the Certainty Factor Method", discussing the problem of the small number of psychiatric hospitals in each region, causing delays in treatment. So to provide a solution to this problem is the implementation that is applied to expert systems in the field of psychology to provide knowledge and prevent delays in dealing with the disease. In the second study, sourced from the National Scientific Journal of Application Research and Informatics Engineering Vol. 02 No. December 2, 2020 E-ISSN: 2714-8467 by (Suhendi & Supriadi, 2020) in the journal "An Expert System for Diagnosing Anxiety Disorders Using the Website-Based Certainty Factor Method" discusses the problem of the large number of people who think that the anxiety disorders they experience are mental disorders, they don't even realize they have an anxiety disorder. So to overcome this problem is to develop a website-based expert system application to provide diagnosis results in the form of information and initial solutions for each type of anxiety disorder. The third research is sourced from the Journal of Information Systems and Technology Vol.3 No.4 2021 e-ISSN: 2686-3154 by (Putra & Yuhandri, 2021) in the journal "Expert System in Analyzing Mental Disorders Using the Certainty Factor Method" which discusses the scientific influence social which affects one about psychiatric disorders starting from the type of disease and others, then a psychiatric study is carried out, early symptoms of the disease and patient diagnosis data using the certainty factor method.

Certainty Factor is a method used to solve cases of uncertainty, where the measure is based on a fact or rule. The certainty factor method is a method for proving whether a fact is certain or uncertain in the form of a metric which is usually used in expert systems.

2. Literature

An expert system is an artificial intelligence program that combines a knowledge base with an inference system to emulate an expert. An expert system is a system that can be used by ordinary people or experts to help in deciding something related to problems that usually can only be solved by an expert.

Mental illness, also known as mental health disorder, is a term that refers to various

conditions that can affect a person's thoughts, moods, feelings or behavior. This condition can occur occasionally or last for a long time. Mental illness has several symptoms including difficulty concentrating, bad mood, crying easily, changes in eating patterns, changes in sleeping patterns, feelings of worry and fear and negative thoughts arise. According to the National Health Call Center Network (Healtdirect) https://www.healthdirect.gov.au/mental-illness The causes of this mental health disorder can occur due to various factors including genetics, how the brain works, how a person grows up, environment, social groups, and one's life experiences. The types of mental illness used in this study consisted of anxiety disorder, schizophrenia, depression and post-traumatic stress disorder.

Certainty factor is a method used to solve cases of uncertainty, where the measure is based on a fact or rule. Certainty factor is a numerical value of an evidence that is accepted as a conclusion. Certainty Factor (CF) theory was proposed by Shortliffe and Buchanan in 1975 to accommodate the inexact reasoning of an expert. An expert, for example a doctor analyzes existing information with phrases such as "maybe", "most likely", "almost like". To accommodate this we use Certainty Factor (CF) to describe the level of expert confidence in the problem at hand.

3. Methods
3.1. Calculation Analysis with the Certainty Factor Method
The certainty factor method uses one value to assume the degree of confidence of an expert in one data. The certainty factor method will make it easier to compile a knowledge base and rules and facilitate the certainty factor of each implementation of a diagnosis of mental illness.

Table 1. Combination of Diseases and Symptoms

No	Symptom	Disease			
		Anxiety Disorders	Schizophrenia	Depression	PTSD
1	Difficulty thinking or concentrating	✓	✓	✓	✓
2	shaking	✓			
3	Feeling uneasy	✓			
4	Withdraw from social circles		✓	✓	
5	Prolonged fatigue			✓	
6	Hard to sleep	✓	✓	✓	✓
7	Easy cry			✓	
8	Negative thoughts or feelings arise				✓

No	Symptom	Disease			
		Anxiety Disorders	Schizophrenia	Depression	PTSD
9	Hallucinations		✓		
10	Changes in behavior and emotions		✓		✓

Table 2. Expert and CF User Certainty Factor Values

No	Information	CF
1	No	0
2	Possible	0.4
3	Most likely	0.6
4	Almost Certain	0.8
5	Certain	1

3.2. Application of the Method

Case:

A person named JB (25 years) suffers from mental illness, the symptoms are as follows:
1. Difficulty thinking and concentrating
2. Difficulty sleeping
3. Easy to cry
4. Withdraw from the social environment
5. Prolonged fatigue

During the consultation session, the user is given a choice of answers for each symptom with the following values:

Table 3. User Weight Value

Symptom	Information	*User* Value
Difficulty thinking and concentrating	Most likely	0.6
Withdraw from social circles	Possible	0.4
Prolonged fatigue	Possible	0.4

| Hard to sleep | Certain | 1 |
| Easy cry | Almost Certain | 0.8 |

After the user provides answers to the symptoms experienced, the expert will then give a weight value as follows:

Table 4. Expert Weight Value

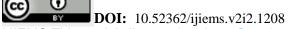| Symptom	Information	*User* Value
Difficulty thinking and concentrating	Almost Certain	0.8
Withdraw from social circles	Possible	0.4
Prolonged fatigue	Possible	0.4
Hard to sleep	Most likely	0.6
Easy cry	Possible	0.4

From the table described above, then calculate the CF value by multiplying CFuser with CFexpert to become:

1. For the MB value on Anxiety Disorder

CF[H1,E1]   = CFuser * CFexpert
              = 0.6 * 0.8
              = 0.48
CF[H1,E6]   = CFuser * CFexpert
              = 1 * 0.6
              = 0.6

Combining CF values on Anxiety Disorder
CFcombineCF[H,E]1,6   = CF[H1,E1] + CF[H1,E6] * (1 - CF[H1,E1]
                      = 0.48 + 0.6 * (1 - 0.48)
                      = 0.792

The results of the CF value of Anxiety Disorder are:
Confidence percentage   = CF * 100%
                        = 0.792 * 100%
                        = 79.2%

2. For MB values in Schizophrenia

CF[H2,E1] = CFuser * CFexpert
           = 0.6 * 0.8
           = 0.48
CF[H2,E4] = CFuser * CFexpert
           = 0.4 * 0.4
           = 0.16
CF[H2,E6] = CFuser * CFexpert
           = 1 * 0.6
           = 0.6

Combining CF values in Schizophrenia
CFcombineCF[H,E]1,4   = CF[H2,E1] + CF[H2,E4] * (1 - CF[H2,E1]
                       = 0.48 + 0.16 * (1 - 0.48)
                       = 0.5632 old1
CFcombineCF[H,E]old1,6 = CF[H,E]old1 + CF[H2,E6] * (1 - CF[H,E] old1
                       = 0.5632 + 0.6 * (1 - 0.5632)
                       = 0.82528

The results of the CF value of Schizophrenia are:
Confidence percentage = CF * 100%
                       = 0.82528 * 100%
                       = 82.52%

3. To calculate the value of MB in Depression

CF[H3,E1] = CFuser * CFexpert
           = 0.6 * 0.8
           = 0.48
CF[H3,E4] = CFuser * CFexpert
           = 0.4 * 0.4
           = 0.16
CF[H3,E5] = CFuser * CFexpert
           = 0.4 * 0.4
           = 0.16
CF[H3,E6] = CFuser * CFexpert
           = 1 * 0.6
           = 0.6
CF[H3,E7] = CFuser * CFexpert
           = 0.8 * 0.4

$= 0.32$

Combining CF values in Depression

CFcombineCF[H,E]1,4 $\quad = CF[H3,E1] + CF[H3,E4] * (1 - CF[H3,E1]$
$= 0.48 + 0.16 * (1 – 0.48)$
$= 0.5632$ old1

CFcombineCF[H,E]old1,3 $\quad = CF[H,E]old1 + CF[H3,E5] * (1 - CF[H,E] old1$
$= 0.5632 + 0.16 * (1 – 0.5632)$
$= 0.633088$ 0ld2

CFcombineCF[H,E]old2,6 $\quad = CF[H,E]old4 + CF[H3,E6] * (1 - CF[H,E] old4$
$= 0.633088 + 0.6 * (1 - 0.633088)$
$= 0.8532352$ old3

CFcombineCF[H,E]old3,7 $\quad = CF[H,E]old5 + CF[H3,E7] * (1 - CF[H,E] old5$
$= 0.8532352 + 0.32 * (1 - 0.8532352)$
$= 0.9001999$

The results of the CF value of Depression are:
Confidence percentage $\quad = CF * 100\%$
$= 0.9001999 * 100\%$
$= 90.02\%$

4. To calculate the value of MB in PTSD

CF[H4,E1] $\quad = CFuser * CFexpert$
$= 0.6 * 0.8$
$= 0.48$

CF[H4,E6] $\quad = CFuser * CFexpert$
$= 1 * 1.6$
$= 0.6$

Combining CF scores on PTSD
CFcombineCF[H,E]1,6 $\quad = CF[H4,E1] + CF[H4,E6] * (1 - CF[H4,E1]$
$= 0.48 + 0.6 * (1 - 0.48)$
$= 0.792$

The results of the CF value of PTSD are:
Confidence percentage $= CF * 100\%$
$= 0.792 * 100\%$
$= 79.2\%$

4. Results And Discussion

Based on the results of CF calculations, the highest value is found in depression with a confidence value of 0.9001999. From the results obtained, the person suffers from a type of mental illness depression with a value of 90.02%.
Depression treatment solutions:

    a. Regular exercise
    b. Therapy
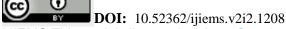   c. Do the freedom emotional technique (EFT) method

5. Conclusion

Based on the results of the analysis that has been carried out by the author, the following conclusions can be drawn:
1. The results of expert diagnostic tests with the system produce diagnoses of the same disease.
2. Minimizing sufferers of mental illness which continues to increase due to the lack of knowledge about mental illness.
3. Based on the results of CF calculations, the highest value is found in depression with a confidence value of 0.9001999. From the results obtained, the person suffers from a type of mental illness depression with a value of 90.02%. With solutions for treating depression, namely regular exercise, therapy and the emotional freedom technique (EFT) method.

References

[1] Adani, MR (2021). Expert System_ Definition, Purpose, Structure, and Methods. In Sekawan Media.
[2] Charlson, F., van Ommeren, M., Flaxman, A., Cornett, J., Whiteford, H., & Saxena, S. (2019). New WHO prevalence estimates of mental disorders in conflict settings: a systematic review and meta-analysis. The Lancet, 394(10194).
[3] Djahir and Pratita. (2015). Definition of Data Dictionary. Definition of Data Dictionary.
[4] Jannah, M., Sarwandi, & Creative, C. (2019). Proficient in PHP Programming Language. In Elex Media Komputindo.
[5] Kadarsih, K., & Andrianto, S. (2022). JTIM : Journal of Informatics Engineering Masterpiece. JTIM: Mahakarya Informatics Engineering Journal, 03(2), 37–44.
[6] Kromann, FM (2018). Beginning PHP and MySQL. In Beginning PHP and MySQL.

[7] Kusumadewi Sri. (2003). Artificial Intelligence (Techniques and Applications). In GRAHA SCIENCE.
[8] Material, a. (2014). Data Dictionary (Data Dictionary). 1–13.
[9] Munawar. (2018). Object Oriented System Design Analysis with UML (Unified Modeling Language). In Bandung: Informatics.
[10] Pakpahan, M., Amruddin, A., Sihombing, RM, Siagian, V., Kuswandi, S., Arifin, R., Mukhoirotin, M., Karwanto, K., Tasrim, IW, Kato, I. , Subakti, H., & Aswan, N. (2022). Research methodology . Our Writing Foundation .

[11] Putri, GVG (2018). An expert system for diagnosing mental illness sichosis using the certainty factor method. Journal of Inovtek Polbeng - Informatics Series, 3(2), 164–168.

[12] Rosaly, R., & Prasetyo, A. (2019). Understanding Flowcharts and the Functions and Symbols of the Most Commonly Used Flowcharts.

[13] Setiawan, G. (2019). Software. Gastronomía Ecuatoriana y Turismo Local., 1(69), 5–24.

[14] Sugiarti, Y. (2013). Analysis and Design of Generated UML (Unified Modeling Language) VB.6 Accompanied by Case Study Examples and Web Interface.

[15] Suhendi, H., & Supriadi, A. (2020). Expert System for Diagnosing Anxiety Disorders Using the Website-Based Certainty Factor Method. Narrative : National Journal of Research, Applications and Informatics Engineering, 2(2), 13–23.

[16] Sukiakhy, KM, Zulfan, Z., & Aulia, O. (2022). APPLICATION OF THE CERTAINTY FACTOR METHOD TO THE WEB-BASED EXPERT SYSTEM FOR THE DIAGNOSIS OF MENTAL DISORDERS IN CHILDREN. Cyberspace: Journal of Information Technology Education, 6(2).

[17] Sutojo, T., Mulyanto, E., & Suhartono, V. (2011). Artificial Intelligence. In Journal of Chemical Information and Modeling.

[18] World Health Organization. (2020). WHO-HealthyAtHome - Mental health. Campaigns.

[19] Yasin. (2019). Understanding MySQL, Functions, and How It Works (Complete). In Niagahoster Blog.

[20] Yusuf, A. (2017). The Stigma of the Indonesian Society regarding Mental Disorders. Nursing Seminar: The Role of Nurses in Facing Trends and Issues in Mental Health, Mental Disorders.

[21] Zulfian Azmi, ST., MK, & Verdi Yasin, S. Kom., MK (2020). Introduction to Expert Systems and Methods. Media Discourse Partners.