

Application of Forward Chaining and Certainty Factor Methods to Identify Anxiety Disorder Categories

Tio Doli Raharjo✉, Gunadi Widi Nurcahyo, Syafri Arlis

Master of Informatics Engineering, Faculty of Computer Science, Universitas Putra Indonesia YPTK Padang, 25221, Indonesia

tiodoliraharjo@uinib.ac.id

Abstract

Anxiety disorders are a form of mental disorders that often occur and have a significant impact on the quality of life of individuals. However, the process of diagnosing this disorder still faces various challenges, especially limited access to professionals and difficulties in identifying the type of disorder based on varying symptoms. This research aims to design and implement an expert-based system to help the early diagnosis process of anxiety disorders quickly and accurately. The system was developed as a web application that allows users to answer a series of questions related to the symptoms experienced, then provide possible types of disorders based on the calculation of confidence levels. The method used is forward chaining as an inference engine to conduct a rule and certainty factor search to calculate the level of confidence in the identification results of the symptoms experienced by the user. Data collected from the literature and interviews with experts were built into a knowledge base consisting of 8 types of anxiety disorders with a total of 41 symptoms. Each rule in the system is formulated using an if-then structure that combines CF values to represent the level of confidence in the symptoms and the results of logical inference with advanced tracking methods. The system was tested using 32 test data in the form of symptom-based case simulations. The results of the evaluation showed that the system was able to produce an initial diagnosis with an accuracy rate of up to 96.87% based on comparison with manual diagnosis from experts. This system also provides explanatory information in the form of confidence level in each diagnosis result. These findings suggest that the Certainty Factor and Forward Chaining approaches are effective in building expert systems for diagnosing anxiety disorders and have the potential to be further developed as a screening tool in educational or primary health care settings.

Keywords: anxiety disorders, certainty factor, forward chaining, artificial intelligence, expert systems.

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1. Introduction

Anxiety disorders are one of the most common mental health disorders experienced by the public [1]. WHO data shows that in 2019, around 280 million people worldwide experienced depression, including 15.6 million people in Indonesia. This situation shows how important early detection is to reduce the impact of this disorder [2]. The impact of the COVID-19 pandemic has further exacerbated the burden of anxiety disorders [3] [4]. The WHO scientific summary of 2022 reported an increase of about 25% in the prevalence of anxiety and depression in the first year of the pandemic. In Indonesia, Riskesdas 2018 showed that the prevalence of mental emotional disorders reached 9.8% in the population aged ≥ 15 years, with the highest rate in provinces in densely populated urban areas. While specific indicators vary across provinces, these data show that the need for mental health services remains high and requires an affordable and accessible early detection approach.

Individuals with anxiety disorders often experience sleep problems, panic attacks, and excessive worry. Ultimately, this can affect their overall quality of life [5].

The development of artificial intelligence technology continues to develop with messages and is increasingly known by many people [6] [7]. Artificial intelligence is a field of computer science that studies how to make systems capable of mimicking human intelligence in processing information, making decisions, and solving problems [8] [9]. In the context of this study, AI is used to build an expert system capable of making an initial diagnosis of anxiety disorders based on the knowledge base that has been formulated by experts [10] [11]. In particular, expert systems, allowing the development of early diagnosis tools based on expert knowledge [12]. In the past five years, research in this field has applied the Certainty Factor (CF) method to measure the level of confidence in diagnosis [13] and Forward Chaining (FC) to track symptoms towards hypotheses [14]. The Forward Chaining method is suitable for early diagnosis of diseases by tracking the symptoms suffered [15].

Previous studies have developed expert systems for web-based anxiety disorders, for specific populations such as people with disabilities, as well as for depression in college students. Other previous research has implemented the Certainty Factor and Forward Chaining methods in the health sector, especially for the diagnosis of mental illness [16]. Develop a web-based expert system to diagnose anxiety disorders with the Certainty Factor method, which is able to provide a value of confidence level on each diagnosis outcome [17] [18] [19].

Nonetheless, most previous studies have had limitations, such as narrow scope of disorder categories, limited knowledge base, or lack of transparent diagnostic certainty value [20] [21]. This gap opens up research opportunities to develop a multi-classification expert system that contains a broader knowledge base and is able to provide an early diagnosis of anxiety disorder with a level of accountability value [22]. Therefore, this study designed a web-based expert system using a combination of CF and FC to identify eight categories of anxiety disorders with a total of 41 symptoms, validated using test data and comparison with expert diagnoses.

2. Research Methods

This section systematically describes the stages carried out in the development of an expert system to identify anxiety disorders using the Certainty Factor method and the Forward Chaining inference engine as illustrated in Figure 1.

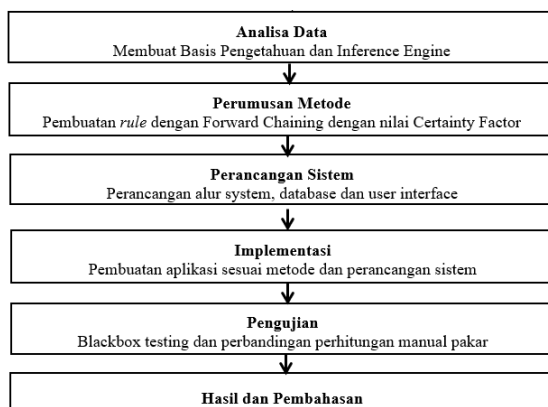


Figure 1. Research Stage Flow Chart

2.1. Data Analysis

Once the data is collected, the next step is to analyze the system requirements. Analysis is to turn the information obtained into a structured knowledge base. This analysis includes the grouping of symptoms and their codes, the grouping of anxiety disorder categories, and the determination of MB and MD values for each symptom related to a specific disorder. At this stage, an inference engine is also designed which will be the core of the system reasoning process, using the Forward Chaining method to trace the symptoms to the conclusion of the

diagnosis. The analysis process is carried out through the following stages:

a. Knowledge Base Analysis

Data obtained both through experts and other literature is processed into a knowledge base. The knowledge base consists of the categories of disorders, symptoms, and relationships between the categories of disorders and symptoms.

b. Analisa Inference Engine

Based on the knowledge base that has been analyzed, rules are formed at the inference engine stage with the Forward Chaining approach.

2.2. Formulation of Methods

The method formulation stage aims to integrate the Forward Chaining technique with the Certainty Factor method to deal with uncertainty in reasoning. Forward Chaining is used to track from facts or symptoms that users enter to a hypothesis in the form of a type of anxiety disorder. Meanwhile, the Certainty Factor is used to calculate the level of confidence in the diagnosis based on a combination of the value of the expert (CF rule) and the value of the user (CF user). Rules are arranged in the form of IF-THEN statements that link one or more symptoms to a specific type of disorder, supplemented by the relevant CF values.

2.3. System Planning Stage

After the stage of formulating methods and inference machines is completed, system design is carried out based on the results of the formulation of methods and rules that have been made. This process includes designing a system flow that describes the process from symptom input to diagnosis output, designing a database to store symptom data, categories, rules, CF values, and diagnostic results, and designing an easy-to-understand user interface. The interface is designed to make it easy for users to enter symptom data and receive diagnostic results with a level of confidence. The next step is to design an application based on the methods and rules obtained in the previous stage.

- a. **System Flow Design:** System flow design is created to provide an overview of the menus, features and flows that will run in the application to be built.
- b. **Database Design:** Database design is created to provide an overview of the tables and relationships on the database needed for the construction of the system.
- c. **Interface Design:** Interface design aims to facilitate communication between users and applications while performing tasks. In designing interfaces, it is important to create a look that is easy for users to understand and use.

2.4. Implementation Stage

The implementation stage is a phase in research where the process of coding or developing applications is carried out in accordance with the design that has been made in the previous stage. In this study, an application will be developed using the PHP programming language with a MySQL database to manage symptom data, disorder categories, rules, and diagnostic results. The Forward Chaining and Certainty Factor algorithms are integrated into the program code so that the system is able to automatically trace rules and calculate confidence levels. In addition, an interactive and responsive user interface is created that makes it easier for users to enter symptoms and obtain diagnostic results quickly and accurately.

2.5. Testing Stage

This test stage is carried out to assess whether the system created with the Forward Chaining and Certainty Factor methods is able to provide accurate identification results. The system will be tested using real case scenarios with inputted symptoms. After the identification results are obtained, a comparison is then made between the identification system and the identification of experts to test the accuracy of the system.

2.6. Outcome Stage and Discussion

The next stage is the results and discussion section, which includes presenting findings from expert system testing based on the Forward Chaining and Certainty Factor methods in identifying anxiety disorders. At this stage, the results of accuracy, confidence level values, and comparisons between system diagnoses and expert diagnoses are displayed as a benchmark for system performance. The discussion was conducted to analyze the factors that affect the results, identify the advantages and limitations of the system, and provide an in-depth interpretation of the effectiveness of the methods used. In addition, this section also contains recommendations for further development so that the system can be optimized for use in various environments, such as primary health facilities or educational platforms.

3. Results and Discussion

The results of the application of the expert system of identification of anxiety disorders and their evaluation are presented in this section. It starts with the knowledge base of anxiety disorders, a list of symptoms, and the Measure of Belief (MB) and Measure of Disbelief (MD) values given by experts who are an important part of the system. The confidence factor (CF) calculation uses this value to calculate the level of confidence in the relationship between symptoms and disorders.

The Forward Chaining method cultivates the knowledge base through an inference engine. This allows the system to make a diagnosis based on the user's

symptoms and their level of confidence. The data on the Anxiety Disorders Category can be seen in table 1.

Table 1. Categories Anxiety Disorders

Code	Categories of Anxiety Disorder
P01	Generalized Anxiety Disorder (GAD)
P02	Panic Disorder
P03	Agoraphobia
P04	Specific Phobias
P05	Social Phobia
P06	Acute Stress Disorder (ASD)
P07	Post-Traumatic Stress Disorder (PTSD)
P08	Obsessive-Compulsive Disorder (OCD)

Symptom data on anxiety disorders can be seen in table 2.

Table 2. Symptom Data

Code	Symptom
G01	Feeling overly worried about things and having difficulty controlling them
G02	Feeling restless, tense, or having trouble relaxing for no apparent reason
G03	Experiencing fatigue, difficulty sleeping, or difficulty concentrating
G04	Experiencing physical symptoms such as tense muscles, heart palpitations, sweating, or indigestion when feeling anxious
G05	Feeling afraid that something bad will happen, even if there is no obvious reason
G06	Experiencing sudden attacks in the form of intense fear or panic for no apparent reason
G07	Experiencing physical symptoms such as heart palpitations, shortness of breath, trembling, or feeling like you are going to die when you panic
G08	Panic attacks occur repeatedly and make fear of having another attack
G09	Avoiding certain places or situations for fear of panic attacks happening there
G10	After a panic attack, feeling extremely anxious for days about the possibility of the next attack
G11	Feeling very scared or anxious when in a public or open place, such as a market, station, or shopping center
G12	Fear of being in a situation where it is difficult to escape or get help if experiencing panic or physical symptoms
G13	Avoiding traveling far from home, especially alone
G14	Anxious when on public transportation such as buses, trains, or cars on long trips
G15	Prefer to be accompanied when leaving the house because they feel safer
G16	Limiting activities outside the home, such as not working, not going to school, or refusing to attend social events
G17	Having an excessive fear of certain objects or situations (such as animals, high places, blood, or narrow spaces)
G18	Feeling anxious when thinking about or looking at images of feared objects or situations
G19	Trying to avoid objects or situations due to intense fear
G20	Realize that fear doesn't make sense, but still find it very difficult to control fear
G21	Experiencing physical symptoms such as heart palpitations, tremors, or shortness of breath when dealing with something that is feared
G22	Feeling very anxious or afraid when you have to speak in public or in a crowd
G23	Feeling nervous or scared when eating, drinking, or writing in front of others for fear of being noticed

G24	Often avoids social situations such as meetings, parties, or job interviews for fear of judgment of others
G25	Very afraid of being criticized, humiliated, or judged badly by others in social situations
G26	Experiencing physical symptoms such as flushed face, sweating, shaking, or heart palpitations while in social situations
G27	Have experienced or witnessed a traumatic life-threatening event, such as a natural disaster, a serious accident, abuse or physical violence
G28	Often experience flashbacks, nightmares, or disturbing memories of traumatic events, as if they happened again
G29	Experiencing dissociative symptoms: difficulty remembering important parts of events, feeling detached from oneself, or the environment feels unreal
G30	Trying hard to avoid places, people, or activities that are reminiscent of trauma
G31	Feeling emotionally numb, having trouble feeling happiness, or withdrawing from others
G32	Often feeling overly alert, easily surprised, or having trouble sleeping and concentrating since the traumatic event
G33	Disproportionate feelings of guilt, shame, or anger arise after trauma
G34	Symptoms are felt within 3-30 days after the traumatic event
G35	Symptoms are felt within more than a month of the traumatic event
G36	Experiencing intrusive, repetitive, and unwanted thoughts (obsessions), such as fear of dirt, doubt, or aggressive thoughts
G37	Feeling compelled to perform certain actions repeatedly (compulsions) to reduce anxiety
G38	Realizing that these thoughts and actions are excessive or unreasonable, but still feeling like you can't stop them
G39	Such repetitive behaviors take a lot of time (e.g. more than 1 hour a day) and interfere with activities
G40	Feeling very anxious or uncomfortable if you don't perform certain rituals or actions
G41	Having repetitive routines such as washing hands, checking doors, counting, arranging things, or repeating certain sentences

The knowledge base of the categories of anxiety disorders and their symptoms was then related by providing the value of expert beliefs and insecurities about the relationship between those symptoms and certain types of anxiety disorders. The CF value is calculated based on formula 1:

$$CF(H,E)=MB(H,E)-MD(H,E) \quad (1)$$

- $CF(H,E)$: *The certainty factor* of hypothesis H is influenced by evidence E.
- MB (Measure of Belief): The level of belief that H is true.
- MD (Measure of Disbelief): The degree of belief that H is wrong.

The MB and MD values are in the range of 0 to 1. An MB value close to 1 indicates high confidence that symptoms are related to a specific disorder, while an MD close to 1 indicates that symptoms are not related to the disorder. The CF values of each symptom can be seen in table 3.

Table.3 Relationship of disorders, symptoms and CF values

Code	Anxiety Disorders	Symptom Code	MB	MD	CF
P01	Generalized Anxiety Disorder (GAD)	G01	0,9	0,25	0,65
		G02	0,7	0,3	0,4
		G03	0,6	0,3	0,3
		G04	0,6	0,3	0,3
		G05	0,8	0,2	0,6
P02	Panic Disorder	G06	0,9	0,1	0,8
		G07	0,9	0,2	0,7
		G08	0,7	0,3	0,4
		G09	0,7	0,3	0,4
		G10	0,7	0,3	0,4
P03	Agoraphobia	G11	0,8	0,1	0,7
		G12	0,9	0,25	0,65
		G13	0,7	0,3	0,4
		G14	0,7	0,3	0,4
		G15	0,6	0,3	0,3
		G16	0,7	0,3	0,4
		G17	0,9	0,05	0,85
P04	Specific Phobias	G18	0,7	0,3	0,4
		G19	0,7	0,3	0,4
		G20	0,9	0,3	0,6
		G21	0,7	0,3	0,4
P05	Social Phobia	G22	0,9	0,3	0,6
		G23	0,7	0,3	0,4
		G24	0,7	0,3	0,4
		G25	0,9	0,25	0,65
		G26	0,6	0,3	0,3
P06	Acute Stress Disorder (ASD)	G27	0,9	0,5	0,4
		G28	0,9	0,05	0,85
		G29	0,8	0,2	0,6
		G30	0,6	0,3	0,3
		G31	0,6	0,3	0,3
		G32	0,6	0,3	0,3
		G33	0,6	0,3	0,3
		G34	0,9	0,25	0,65
P07	Post-Traumatic Stress Disorder (PTSD)	G27	0,9	0,5	0,4
		G28	0,9	0,05	0,85
		G30	0,6	0,3	0,3
		G31	0,6	0,3	0,3
		G32	0,6	0,3	0,3
		G33	0,6	0,3	0,3
		G35	0,9	0,25	0,65
P08	Obsessive-Compulsive Disorder (OCD)	G36	0,9	0,1	0,8
		G37	0,9	0,2	0,7
		G38	0,7	0,3	0,4
		G39	0,7	0,3	0,4
		G40	0,7	0,3	0,4
		G41	0,7	0,3	0,4

Based on the knowledge base that has been analyzed, rules are formed at the inference engine stage with the Forward Chaining approach. *The rules* can be seen in table 4.

Table.4 Rules

Rules	IF	THEN
R01	G01, G02, G03, G04 G05	P01
R02	G06, G07, G08, G09, G10	P02
R03	G11, G12, G13, G14, G15, G16	P03
R04	G17, G18, G19, G20, G21	P04

R05	G22, G23, G24, G25, G26	P05
R06	G27, G28, G29, G30, G31, G32, G33, G34	P06
R07	G27, G28, G30, G31, G32, G33, G35	P07
R08	G36, G37, G38, G39, G40, G41	P08

The test data is fed into the system through the web application interface, the system uses the Forward Chaining method to look for the rules of symptoms that lead to the diagnosis and the Certainty Factor is used to deal with uncertainty in reasoning. Each fact/phenomenon has a belief value (CF_user) given by the user, and each rule has a belief value determined by the expert (CF_rule). The value of user confidence can be seen in table 5.

Table 5. User's degree of confidence.

Code	Value
Very Confident	1
Confident	0.8
Pretty sure	0.6
A Little Confident	0.4
Not Sure	0.2
Very Unsure	0

An example of manually calculating the Certainty Factor according to the user's confidence can be seen in table 6.

Table 6. Case study of patient symptoms

Code	Gejala	User Answer	CF User
G27	Have experienced or witnessed a traumatic life-threatening event, such as a natural disaster, a serious accident, abuse or physical violence	Confident	0.8
G28	Often experience flashbacks, nightmares, or disturbing memories of traumatic events, as if they happened again	Pretty sure	0.6
G30	Trying hard to avoid places, people, or activities that are reminiscent of trauma	Very Confident	1.0
G31	Feeling emotionally numb, having trouble feeling happiness, or withdrawing from others	Pretty sure	0.6
G32	Often feeling overly alert, easily surprised, or having trouble sleeping and concentrating since the traumatic event	A Little Confident	0.4
G33	Disproportionate feelings of guilt, shame, or anger arise after trauma	Confident	0.8
G35	Symptoms are felt within more than a month of the traumatic event	Pretty sure	0.6

Based on the rules in table 4, the *user* is categorized as experiencing Post-Traumatic Stress Disorder (PTSD) (P07). The next step is to calculate the Certainty Factor based on the answers given by the patient using formula 2.

$$CF1 = CF_{user} \times CF_{rule} \quad (2)$$

Tabel 7. Nilai CF User x CF Rule

Code	CF User	CF Rule	CF User x CF Rule
CF1	0.8	0.4	0.32
CF2	0.6	0.85	0.51
CF3	1.0	0.3	0.3
CF4	0.6	0.3	0.18
CF5	0.4	0.3	0.12
CF6	0.8	0.3	0.24
CF7	0.6	0.65	0.39

Since there is more than one symptom relevant to a single disorder, the CF combination is calculated using the formula 3:

$$CF_{combine} = CF_1 + CF_2 (1 - CF_1)$$

(3)

$$\begin{aligned} CF_{combine}CF[H,E]_{1,2} &= CF_1 + CF_2(1 - CF_1) \\ &= 0.32 + 0.51 \times (1 - 0.32) \\ &= 0.32 + 0.51 \times 0.68 \\ &= 0.32 + 0.3648 \\ &= 0.6668 \end{aligned}$$

$$\begin{aligned} CF_{combine}CF[H,E]_{old1,3} &= 0.6668 + 0.30 \times (1 - 0.6668) \\ &= 0.6668 + 0.30 \times 0.3332 \\ &= 0.6668 + 0.9996 \\ &= 0.7667 \end{aligned}$$

$$\begin{aligned} CF_{combine}CF[H,E]_{old2,4} &= 0.7667 + 0.18 \times (1 - 0.7667) \\ &= 0.7667 + 0.18 \times 0.2332 \\ &= 0.7667 + 0.0419 \\ &= 0.8087 \end{aligned}$$

$$\begin{aligned} CF_{combine}CF[H,E]_{old3,5} &= 0.8087 + 0.12 \times (1 - 0.8087) \\ &= 0.8087 + 0.12 \times 0.1912 \\ &= 0.8087 + 0.0229 \\ &= 0.8316 \end{aligned}$$

$$\begin{aligned} CF_{combine}CF[H,E]_{old4,6} &= 0.8316 + 0.24 \times (1 - 0.8316) \\ &= 0.8316 + 0.24 \times 0.1683 \\ &= 0.8316 + 0.0403 \\ &= 0.872 \end{aligned}$$

$$\begin{aligned} CF_{combine}CF[H,E]_{old5,7} &= 0.872 + 0.39 \times (1 - 0.872) \\ &= 0.872 + 0.39 \times 0.1279 \\ &= 0.872 + 0.0498 \\ &= 0.9220 \end{aligned}$$

$$\begin{aligned} \text{Percentage of confidence} &= CF[H,E]_{old5,7} \times 100\% \\ &= 0.9220 \times 100\% \\ &= 92,20\% \end{aligned}$$

Based on these calculations, patients were identified as experiencing Post-Traumatic Stress Disorder (PTSD) with a confidence percentage of 92.20%.

The system interface can be seen in Figure 3.1.

Figure 2. Symptom identification process

Gejala	CF User	CF Expert
127 - Pernah mengalami atau menyaksikan peristiwa traumatis yang mengancam nyawa, seperti bencana alam, kecelakaan berat, pelecehan atau kekerasan fisik	0.8	0.4
128 - Sering mengalami kilas balik, mimpi buruk, atau ingatan yang mengganggu tentang peristiwa traumatis, seolah-olah itu terjadi kembali	0.8	0.85
129 - Bersusah-susah menghindari tempat, orang, atau aktivitas yang mengingatkan pada trauma	1	0.3
131 - Merasa mati rasa secara emosional, susah merasakan kebahagiaan, atau menarik diri dari orang lain	0.8	0.3
132 - Sering merasa waspada berlebihan, mudah terkejut, atau sulit tidur dan berkonsentrasi sejak peristiwa traumatis itu	0.4	0.3
133 - Perasaan bersalah, malu, atau kemarahan yang tidak proporsional muncul setelah trauma	0.8	0.3
135 - Gejala diabaikan dalam waktu lebih dari satu bulan setelah peristiwa traumatis	0.8	0.85

Hasil CP gabungan: 0.9320 (92.20%)

Hasil: Gangguan Stress Posttrauma (PTSD) - Kepercayaan 92.20%

Deskripsi: Post-traumatic Stress Disorder atau Gangguan Stress Posttrauma (PTSD) adalah gangguan kecemasan yang muncul setelah seseorang mengalami peristiwa traumatis dan berlangsung lebih dari satu bulan. Gejala yang dialami sering dengan: Nyeri Stress Disorder (PTSD), seperti rasa cemas berlebihan, kilas balik (flashback), mimpi buruk, serta perasaan seolah-olah trauma terjadi kembali. Namun, berbeda dengan ASD yang berfokus sementara (3 hari hingga 3 bulan), PTSD berlangsung secara menahun selama berbulan-bulan, bertahun-tahun, bahkan bisa hingga puluhan tahun setelah kejadian traumatis.

Figure 3. Identification results

ID	Nama	Pemeriksaan	Tanggal	Aksi
87	HA	Gangguan Stress Posttrauma (PTSD) (92.47%)	02 Sep 2025, 02:04:37	
86	G	Gangguan Stress Posttrauma (PTSD) (92.20%)	02 Sep 2025, 02:03:58	
85	F	Fobia Sosial (FOS) (89.48%)	02 Sep 2025, 02:03:18	
84	E	Gangguan Kecemasan Umum (GK) (PTSD) (90.32%)	02 Sep 2025, 02:03:45	
83	D	Agoraphobia (AG) (89.83%)	02 Sep 2025, 02:02:06	
82	C	Fobia Spetris (FSP) (89.34%)	02 Sep 2025, 02:01:18	
78	B	Gangguan Obsesif Kompulsif (GOK) (PTSD) (87.27%)	02 Sep 2025, 02:03:14	
77	A	Gangguan Stress Posttrauma (PTSD) (92.20%)	02 Sep 2025, 02:03:05	

Figure 4. Identification history

The system test used 32 test data indicating cases of anxiety disorders based on a combination of symptoms identified in the knowledge base. This data is created based on interviews with clinical psychology experts to ensure that the symptoms included correspond to the 8 categories of anxiety disorders that exist in the system. The test results can be seen in table 8.

Table 8. Comparison of System and Specialist Diagnosis Results

No	Patient	Expert Diagnose	System Diagnose	CF (%)	Result
1	A	Post-Traumatic Stress Disorder (PTSD)	Post-Traumatic Stress Disorder (PTSD)	92.20	Matches
2	B	Obsessive-Compulsive Disorder (OCD)	Obsessive-Compulsive Disorder (OCD)	97.27	Matches
3	C	Specific Phobias	Specific Phobias	89.36	Matches
4	D	Agoraphobia	Agoraphobia	83.81	Matches
5	E	Generalized Anxiety Disorder (GAD)	Generalized Anxiety Disorder (GAD)	60.32	Matches
6	F	Post-Traumatic Stress Disorder (PTSD)	Not Identified	-	Not Matches
32	AH	Specific Phobias	Specific Phobias	87.77	Matches

Based on the comparison of the results of the diagnosis system and the expert, the level of accuracy was obtained:

$$Accuracy = \frac{\text{Number of Matches}}{\text{Number of Test Data}} \times 100\%$$

$$= \frac{31}{32} \times 100\% = 96.87\%$$

This accuracy value indicates that the combination of the Certainty Factor and Forward Chaining methods is effective in determining the type of anxiety disorder based on the symptoms indicated. The MB and MD values of the specialist can indicate uncertainty during the diagnosis process, so that the system can provide a realistic value of diagnosis certainty.

4. Conclusion

This research successfully applied an expert system based on the Certainty Factor (CF) and Forward Chaining methods. The knowledge base of the system includes eight types of anxiety disorders with 41 symptoms discovered through literature research and interviews with experts. Testing involving twenty test

data showed that the system was able to provide highly accurate diagnostic results as well as information about the confidence level of each result. This suggests that the combination of CF and Forward Chaining methods is effective in determining different types of anxiety disorders. This system can be used as an initial screening tool that can speed up the detection and treatment of anxiety disorders.

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Biographies of Authors

	Tio Doli Raharjo   Born in Pekanbaru on December 24, 1995, is a Master's student in Computer Science at Universitas Putra Indonesia YPTK Padang, specializing in Intelligent Systems. He can be contacted via email at tiodoliraharjo@uinib.ac.id. Originally from Pekanbaru City, Riau Province, he earned his Bachelor's degree in Information Systems from UIN Sultan Syarif Kasim Riau and is currently employed at UIN Imam Bonjol Padang.
	Gunadi Widi Nurcahyo    Assoc. Prof. Dr. Ir. Gunadi Widi Nurcahyo, M.Sc. was born in Temanggung, 14 March 1969. He was graduated Bachelordegree in Informatics Management at Universitas Putra Indonesia YPTK Padang in 1992.He completed his Master and PhD in Computer Science at Universiti Teknologi Malaysia in2003. Scopus Id is 57200563356. E-mail: gunadiwidi@yahoo.co.id
	Syafri Arlis    Syafri Arlis born in Padang on October 23, 1986. His undergraduate study was completed in 2009 at Universitas Putra Indonesia YPTK. He completed his Masters degree at Putra Indonesia University, YPTK Padang. He currently serves as a lecture in the Informatics Engineering study program at the Universitas Putra Indonesia YPTK Padang. Teaching history that has been carried out starting from 2011 until now, such as database and digital image processing. Published research history places more emphasis on the atificial neural network and digital image processing. He can be contacted at email: syafri_arlis@upiypk.ac.id.