Emotion Intelligent Application for Independent Wellbeing Management using Certainty Factor

by Dewi Yanti Liliana

Submission date: 27-Jan-2022 08:04AM (UTC+0700)
Submission ID: 1748924011
File name: 27_62-1570750066-rev.pdf (1.92M)
Word count: 5262
Character count: 24463

2021 4th International Conference on Computer and Informatics Engineering (IC2IE)

Emotion Intelligent Application for Independent Wellbeing Management using Certainty Factor

Dewi Yanti Liliana, Iklima Ermis Ismail, Ayu Rosyida Zain, Siti Sarah Balgis
Department of Computer and Informatics Engineering
Politeknik Negeri Jakarta
Depok, Indonesia
dewiyanti.liliana@tik.pnj.ac.id, iklimaermis.ismail@tik.pnj.ac.id, ayu.rosyidazain@tik.pnj.ac.id, siti.balgis.tik16@mhsw.pnj.ac.id

***Abstract*—According to the Indonesian National Research Master Plan, Indonesia is currently facing strong challenges in the field of public health, particularly mental health. Especially during the Covid-19 pandemic where there are many problems with emotional disorders that can threaten physical and behavioral health. Emotion health during a pandemic need to be maintained. The problem is that the lack of access and restrictions in consulting a psychologist makes it difficult for people to understand and recognize their emotions which will adversely affect their life and their decision making. To overcome this problem, in this study an expert system-based Certainty Factor (CF) method was built to recognize emotions. The method used the belief value and knowledge-based acquired from reference books as well as a psychologist expert. Implemented as a mobile application, made it easier for user to access it through their smart phones. The CF method was able to run in accordance with functional requirements and produced expected results. Based on the test results, the expert system to recognize emotions using the Certainty Factor method has worked with an accuracy rate of 92.31% on the test data.**

Keywords—certainty factor, classification, emotion, expert system, mobile application

I. INTRODUCTION

Emotion is an intense feelings that encourage someone to take an action that can be triggered from within or outside oneself . Young adults aged 18-25 years have a fairly high level of psychological pressure [1]. They tend to find it difficult to understand the emotions they feel. According to Daniel Goleman, author of the book "Emotional Intelligence", intellectual intelligence (IQ) only contributes for 20% of human success. The rest, about 80% depends on the emotional intelligence (EQ) human have. Emotional intelligence is a person's ability to accept, assess, manage, and control the emotions of oneself or others around him [2]. Therefore, intelligence in managing emotions is very important in living a life, especially during the current pandemic so that it does not have any negative impact on mental and physical health. The problem is, conflict can occur because humans do not understand the emotions they experience and how to manage them properly.

Over time, technological developments have touched various fields and can help to meet various needs. Many technologies can help humans to manage their emotions, one of which is in application development for emotion recognition using expert system. By recognizing their emotion, people can manage their response to a situation and leads to a better wellbeing condition. Five studies related to expert systems and specific cases recognition were reviewed before this research was started. First, the research conducted by [3] entitled "An Android-Based Application of an Expert System for Early Diagnosis of Cat Diseases with the Forward Chaining Method". The study explained that humans as cat owners were expected to know the prevention and treatment of diseases in cats. With expert system technology, users can save time and money on going to the doctor. This expert system application used the forward chaining method which produces an accuracy of 85.71%. However, further development can use other methods with more higher accuracy rate.

Second, the research entitled "Expert System for Pulmonary TB Diagnosis Using Fuzzy Logic Method" by [4]. The study explained about tuberculosis which had a wide impact on the quality of life and the economy, and often resulted in death. For this reason, an analysis was carried out using fuzzy logic. Information about pulmonary tuberculosis was obtained from experts by conducting interviews. The accuracy rate was 70.33%. The suggestion was for further application development which can be made in the android version, so that it can be accessed. Third, the research entitled "Application of the Depth First Search (DFS) method in Expert Systems to Diagnose Diseases of the Skin" by [5]. This study described the diagnosis of skin diseases using the DFS method. The test results of the expert system application that was built can be proven by the results of the pre-test and post-test that produced 64% pre-test accuracy rate and 80% post-test accuracy rate so that it can be recommended as an application to replace experts if there was no one in place.

Fourth, the research entitled “Certainty Factor for Early Detection of Children’s Respiratory Disease” by [6] which described that expert system based on Certainty Factor (CF) method can be used to early diagnosed the respiratory diseases in children by providing the certainty degree of diagnosis which was also leveraging the detection trust. Fifth, the research entitled "Expert System for Diagnosing Diseases of Pregnant Women Using the Certainty Factor (CF) Method" by [7]. The study described the disease of pregnant women. Lack of knowledge about the symptoms felt during pregnancy makes pregnant women ignore certain symptoms that can indicate dangerous diseases and become an indirect cause of death of pregnant women. The CF method has a good system performance by producing a high percentage of accuracy in diagnosing pregnant women's diseases with an accuracy rate of 100%. From the comparison of the five studies, it can be concluded that the Certainty Factor method has better results than the Forward Chaining, Fuzzy Logic, and Depth First Search methods in expert system development.

Based on the background that has been explained, this study proposed to solve the problem of diagnosing the emotions felt by a person using an expert system based on Certainty Factor which is a method that has a high accuracy rate. Implemented in a mobile application, users can occupy the application independently and manage their emotions according to suggestions from the system. This study has two contributions which are 1) modeling the knowledge of psychologists and utilizing the degree of confidence in each

978-1-6654-4288-6/21/$31.00 ©2021 IEEE

question items in recognizing user emotions, and 2) developing an android-based intelligent application that can be used on mobile devices for independent emotion recognition. The benefit of this application is that it helps users to manage emotions, especially negative emotions felt so as not to interfere with a person's mental or physical health due to many activity restrictions and isolation during a pandemic.

The rest of the paper is organized as follows; section two discusses emotion recognition methods; section three discusses experiments and results; and the last section draws conclusion of this study.

II. METHODS

A. Emotion Intelligence Application

Emotion intelligence application is based on expert system. An expert system is a computer system intended to emulate all aspects of an expert's decision-making ability. Expert system utilizes specific knowledge like an expert to solve problems [8]. An expert system combines two components; a knowledge base and an inference system. The knowledge base contains knowledge in specific domains provided by one or several experts in a particular field. The inference system is used to perform reasoning and drawing conclusions. The combination of those two components will then be stored in the computer and will be used in the process of drawing conclusions about a particular problems [9].

In this study, emotion knowledge was acquired from psychologist as well as reference book [10], [11]. The knowledge was then modeled into an emotion knowledge base and Certainty Factor method was applied to the calculation of the emotion score. Four types of basic emotion taken from Ekman universal basic emotion were happy, sad, angry and fear [12]. Four emotions were becoming the results of the emotion recognition. Users interacted with the application through a mobile-based application interface. A series of questions were asked to them in order to get the emotion recognition results. The application interface gave questions based on the emotion knowledge base and passed the user answers to the inference engine which resulted the emotion types. Figure 1 depicts the emotion recognition flowchart.

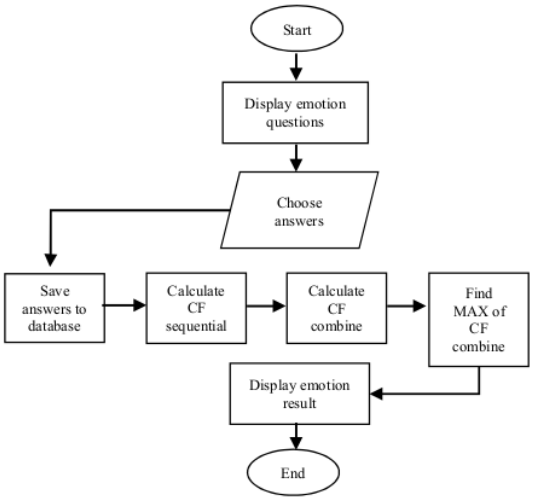

Fig. 1. Emotion Recognition using Certainty Factor

B. Certainty Factor

Certainty Factor (CF) is a method used to express belief in an event based on evidence or expert judgment [13]. The certainty factor method is used when facing a problem for which the answer is uncertain. Two ways to get the confidence level of a rule are through [14]:

1). Net Belief method

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

where *CF(H, E)* is the certainty factor, the magnitude of CF ranges from 0 to 1. A value of 0 indicates absolute distrust, while a value of 1 indicates absolute confidence. MB(H,E) is the measure of belief against hypothesis *H*, if given evidence *E* (between 0 and 1). *MD(H, E)* is the measure of disbelief against hypothesis H, if given evidence of *E* (between 0 and 1). The basic formula as in (1) is used if there is no CF value information from experts.

2). Interviewing an expert

The certainty factor value is obtained from the interpretation of an expert, which is converted into a certain CF value according to Table 1 [15].

TABLE I. EXPERT INTERPRETATION OF CF VALUES

Uncertain Term	CF Value
Definetely Not	-1.0
Almost certainty not	-0.8
Probably not	-0.6
Maybe not	-0.4
Unknown	-0.2 to 0.2
Maybe	0.4
Probably	0.6
Almost certainty	0.8
Definitely Yes	1.0

The combination of certainty factors used to recognize emotions are:

1). Certainty factor for rules with single premise or symptom using (2).

$$\mathrm{CF}_{sequential} = CF_{user} * CF_{rule} \quad (2)$$

2). If there are rules with similar conclusions or more than one item, then the CF is then calculated by using (3).

$$CF_{Combine} = CF_{old} + CF_{symptom} * (1 - CF_{old}) \quad (3)$$

3). Meanwhile, to calculate the percentage of confidence in emotional results is using (4).

$$\mathrm{CF}_{percentage} = \mathrm{CF}_{combine} \times 100 \quad (4)$$

In dealing with a problem, it is often found that the answer does not have full certainty, therefore the certainty factor method is effectively used. The next step to apply CF is by developing an emotion knowledge base.

C. Emotion Knowledge base

The knowledge base contains knowledge for understanding and solving problems obtained from the representation of expert knowledge and related scientific research journals about emotion. In this study, the

psychologist is Nurhuzaifah Amini M.Psi. Furthermore, a knowledge base that contains rules is built. The main components of a rule are premises and conclusions. In terms of emotion recognition, the premise is a description of the symptoms or causes that lead to the occurence of an emotion, while the conclusion is the type of emotion that is recognized. In the emotion knowledge base, there are separate premise and conclusion tables. The conclusion table consists of four types of emotions that are used as a result of recognition as in Table 2.

TABLE II. EMOTION TYPES

Code	Emotion Type
E01	Happy
E02	Sad
E03	Angry
E04	Fear

Based on interviews with psychologist expert, there were 42 questions or statements that became a measuring tool for recognizing or knowing the emotions felt by someone. The answers of these questions are then becoming the rule's premises. Table 3 displays the 42 question items for emotion rule. Rules have been validated by the psychologist.

TABLE III. EMOTION LIST OF QUESTIONS

Code	Question Items
Q01	I'm interested in doing new things
Q02	I feel depressed because too much trouble is happening
Q03	I feel annoyed because there are many annoying things that interfere with my activities aktifitas
Q04	I feel nervous, anxious, or restless
Q05	I feel confident
Q06	I have trouble sleeping or sleeping well
Q07	I feel like I want to explode because various kinds of problems keep popping up
Q08	I can't stop or control my worries
Q09	I'm excited to do anything
Q10	I have no appetite
Q11	I am pressured or forced to do something I don't want others to do
Q12	I have a hard time relaxing
Q13	I actively communicate/close with my family or friends
Q14	I feel I have let myself / family / people closest to me down
Q15	I feel like I'm not being treated fairly by anyone
Q16	I feel as if something bad is going to happen
Q17	I can think positively even in difficult situations
Q18	I have trouble concentrating
Q19	I feel frustrated easily
Q20	I worry too much about different things
Q21	I wake up in the morning with a good mood or fresh
Q22	I feel hopeless
Q23	I'm upset that I didn't get what I wanted
Q24	I feel unsure about the decision I made
Q25	I can fully concentrate on what I'm doing
Q26	I feel tired of the life I live
Q27	I wake up in the morning with a bad mood or a mess
Q28	I can't trust other people
Q29	I can sleep well
Q30	I feel alone or no one cares about me
Q31	I keep thinking negative
Q32	I feel lost in life
Q33	I feel calm and relaxed
Q34	I'm tired because my thoughts and feelings are so messed up
Q35	I feel easily offended
Q36	I feel panic
Q37	I can handle problems well
Q38	I feel uncomfortable in my surroundings
Q39	I can't wait to do something
Q40	I'm not ready to face reality
Q41	I can still think clearly when I have a problem
Q42	I'm satisfied with what I got

The application of the certainty factor method in an expert system requires rules determined by experts to carry out the calculation process to recognize emotions. The combination of these questions will produce four rules, where each rule is for each type of emotion. The combination of these rules is determined by the expert, so do the certainty factor values. The CF value is then applied to each premise in parentheses which implies the user input value will be multiplied by the CF value. This combination forms the emotion rule. Emotion rules are shown in Table 4. In the conclusion column, the code of emotions is based on Table 2.

TABLE IV. EMOTION RULES

No.	Rules	Conclusion	Emotion
1	IF Q01 (0.8) AND Q05 (0.6) AND Q09 (0.8) AND Q13 (0.6) AND Q17 (0.8) AND Q21 (0.6) AND Q25 (0.8) AND Q29 (0.6) AND Q33 (0.2) AND Q37 (0.6) AND Q41 (0.2) AND Q41 (0.2)	E01	Happy
2	IF Q02 (0.8) AND Q06 (0.4) AND Q10 (0.4) AND Q14 (0.6) AND Q15 (0.2) AND Q18 (0.6) AND Q02 (0.8) AND Q26 (0.6) AND Q30 (0.8) AND Q31 (0.4) AND Q34 (0.6) AND Q38 (0.4)	E02	Sad
3	IF Q03 (0.8) AND Q04 (0.2) AND Q07 (0.8) AND Q11 (0.6) AND Q12 (0.2) AND Q15 (0.6) AND Q19 (0.8) AND Q23 (0.6) AND Q27 (0.6) AND Q31 (0.4) AND Q35 (0.6) AND Q39 (0.4)	E03	Angry
4	IF Q04 (0.8) AND Q06 (0.4) AND Q08 (0.8) AND Q12 (0.4) AND Q16 (0.8) AND Q18 (0.2) AND Q20 (0.6) AND Q24 (0.6) AND Q28 (0.4) AND Q32 (0.4) AND Q36 (0.8) AND Q40 (0.4)	E04	Fear

D. Calculating The CF sequential

After the knowledge base is formed, inference can be done by entering input from the user. For each question there are five answer options. Each answer option also has a weighted value, which is strongly agree (0.8), agree (0.6), neutral (0.4), disagree (0.2), and strongly disagree (0). The value of this user's answer will be the input for each rule and will later be multiplied by the CF value in the emotional knowledge base. After getting the user's answer, the user's CF will be multiplied by the expert's CF which will produce a sequential CF value using (2). The multiplication results will produce a sequential CF.

As an illustration of the manual calculation using CF method, let assume that a random user gives answers as in Table 5, column CF user.

TABLE V. SEQUENTIAL CF CALCULATION

Emotion Types	Code	CF rule	CF user	CF sequential	
Happy	Q01	0.8	0.8	CF 1	0.64
	Q05	0.6	0.6	CF 2	0.36
	Q09	0.8	0.6	CF 3	0.48
	Q13	0.6	0.6	CF 4	0.36
	Q17	0.8	0.6	CF 5	0.48
	Q21	0.6	0.4	CF 6	0.24
	Q25	0.8	0.4	CF 7	0.32
	Q29	0.8	0.4	CF 8	0.24
	Q33	0.2	0.4	CF 9	0.08
	Q37	0.6	0.6	CF 10	0.36
	Q41	0.2	0.6	CF 11	0.12
	Q42	0.2	0.4	CF 12	0.08
Sad	Q02	0.8	0	CF 1	0
	Q06	0.4	0	CF 2	0
	Q10	0.4	0	CF 3	0
	Q14	0.6	0	CF 4	0
	Q15	0.2	0	CF 5	0
	Q18	0.6	0	CF 6	0
	Q22	0.8	0	CF 7	0
	Q26	0.6	0	CF 8	0
	Q30	0.8	0	CF 9	0
	Q31	0.4	0	CF 10	0
	Q34	0.6	0	CF 11	0
	Q38	0.4	0	CF 12	0
Angry	Q03	0.8	0	CF 1	0
	Q04	0.2	0	CF 2	0
	Q07	0.8	0	CF 3	0
	Q11	0.6	0.2	CF 4	0.2
	Q12	0.2	0	CF 5	0
	Q15	0.6	0	CF 6	0
	Q19	0.8	0	CF 7	0
	Q23	0.6	0.2	CF 8	0.12
	Q27	0.6	0	CF 9	0
	Q31	0.4	0	CF 10	0
	Q35	0.6	0.2	CF 11	0.12
	Q39	0.4	0.2	CF 12	0.08
Fear	Q04	0.8	0	CF 1	0
	Q06	0.4	0	CF 2	0
	Q08	0.8	0.2	CF 3	0.16
	Q12	0.4	0	CF 4	0
	Q16	0.8	0.2	CF 5	0.16
	Q18	0.2	0	CF 6	0
	Q20	0.6	0	CF 7	0
	Q24	0.6	0.2	CF 8	0.12
	Q28	0.4	0	CF 9	0
	Q32	0.4	0	CF 10	0
	Q36	0.8	0	CF 11	0
	Q40	0.4	0.2	CF 12	0.08

E. Calculating The CF combine

After calculating the *CF sequential*, the next step is to calculate the *CF combine*. This can be done by using the CF sequential value for each rule as in Table 5 using (3). We demonstrate the calculation process of gaining the *CF combine* value for happy emotion using (3), and the same process applied to other types of emotion as well.

CF (A) = CF 1 + CF 2 * (1 – CF 1)
= 0.64 + 0.36 * (1 – 0.64)
= 0.769
CF (B) = CF A + CF 3 * (1 – CF A)
= 0.769 + 0.48 * (1 – 0.769)
= 0.880
CF (C) = CF B + CF 4 * (1 – CF B)
= 0.880 + 0.36 * (1 – 0.880)
= 0.923
CF (D) = CF C + CF 5 * (1 – CF C)
= 0.923 + 0.48 * (1 – 0.923)
= 0.960
CF (E) = CF D + CF 6 * (1 – CF D)
= 0.960 + 0.24 * (1 - 0.960)
= 0.969
CF (F) = CF E + CF 7 * (1 – CF E)
= 0.969 + 0.32 * (1 - 0.969)
= 0.979
CF (G) = CF F + CF 8 * (1 – CF F)
= 0.979 + 0.24 * (1 - 0.979)
= 0.984
CF (H) = CF G + CF 9 * (1 – CF G)
= 0.984 + 0.08 * (1 - 0.984)
= 0.986
CF (I) = CF H + CF 10 * (1 – CF H)
= 0.986+ 0.36 * (1 - 0.986)
= 0.991
CF (J) = CF I + CF 11 * (1 – CF I)
= 0.991 + 0.12 * (1 - 0.991)
= 0.992
CF (K) = CF J + CF 12 * (1 – CF J)
= 0.992 + 0.08 * (1 - 0.992)
= **0.993**

From the calculation of *CF combine* for happy emotion, we got the result of *CF combine value* is 0.993. The same calculation process for other emotions resulting the *CF combine* value for sad is 0, angry is 0.373, and fear is 0.429. The maximum value obtained is the happy emotion with 0.993. So, it can be concluded that the user is feeling happy emotions with a confidence percentage using (4) is 99.3%. There is also emotion leveling which are 0% to 40% for low level; 41% to 70% for medium level; and 71% to 100% for high level of emotions.

F. Application Implementation

After designing the CF methods, we implement it in a mobile-based application using Android Studio. We name it EmoHealth application. First, on the login page, the user presses the sign in with Google button, then selects or enters which email account will be used to login to the application. The personal data information page will only appear the first-time user register to EmoHealth. The personal data information page consists of three items: gender, date of birth, and employment status. Next, on the emotional assessment questionnaire page, there are 42 questions related to the user's current feelings and behavior that must be filled out by the user to recognize the emotion. The user interface of the emotion recognition page can be seen on Fig. 2.

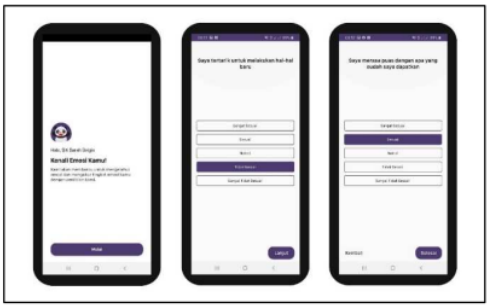

Fig. 2. Emotion Assessment Pages User Interface

Fig. 3 is the user interface of the emotion results page. The emotion results page in Fig. 3(a) displays the results of the user's emotions and their level after filling in the 42 statements given previously. The user can also see the description from

the results of the emotion. After that, on the emotions page there are also two choice buttons, continue to manage emotions or go directly to the home page, as in Fig. 3(b). On the home page, there is information on the type of emotions. This home page also displays 5 button options, namely emotional assessment, my emotional journey, emotion insight, activity recommendations and the chatbot button which is on the bottom right (the panda icon). Fig. 3(c) is an emotion journey user interface. The emotion journey page displays the history of the results of the user's emotions and their level after filling out the assessment questionnaire. Users can see the progress of their emotions every day.

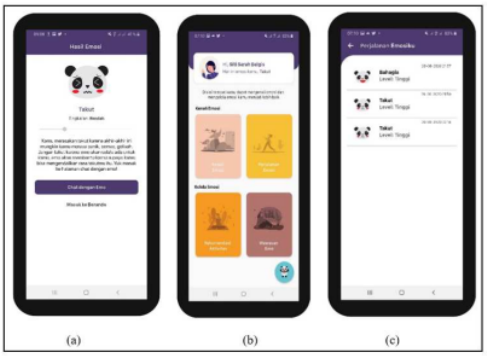

Fig. 3. EmoHealth Results Interface

III. Results and Discussions

Application testing was done by using test data. Test data was emotion data that was taken directly from users who had conducted emotion assessments on the EmoHealth application. 26 respondents from different education background, age, and gender who became user tester were using EmoHealth and reporting their emotion results. The results were being compared with the expert recognition results to confirm its conformity. Moreover, the expert answers became the baseline for the correct emotion recognition. The higher the similarity of the application results with expert recognition, the higher the accuracy of the CF method in recognizing emotion. Furthermore, we also compared the results using CF and without CF to the rules to analyze the effect of adding certainty factor method to the expert system. Table 6 shows the testing results.

TABLE VI. Sequential CF Calculation

User	No-CF Results	CF Results	Baselines
user 1	Happy	Happy	Happy
user 2	Happy	Happy	Happy
user 3	Happy	Happy	Happy
user 4	Sad	Sad	Sad
user 5	Sad	Sad	Sad
user 6	Sad	Sad	Sad
user 7	Angry	Angry	Fear
user 8	Angry	Angry	Angry
user 9	Angry	Angry	Angry
user 10	Sad	Fear	Fear
user 11	Fear	Fear	Fear
user 12	Fear	Fear	Fear
user 13	Fear	Fear	Fear
user 14	Fear	Fear	Fear
user 15	Happy	Happy	Happy
user 16	Happy	Happy	Happy
user 17	Happy	Happy	Happy
user 18	Fear	Fear	Fear
user 19	Sad	Sad	Sad
user 20	Sad	Fear	Fear
user 21	Angry	Angry	Angry
user 22	Fear	Fear	Fear
user 23	Happy	Happy	Happy
user 24	Fear	Fear	Fear
user 25	Sad	Sad	Sad
user 26	Angry	Angry	Fear

Based on the results in Table 6, it can be seen that the emotion recognition using the CF method has inaccuracies in the results for user 7 and user 26, where the emotion results are identified as angry while the baseline identified as fear. This means that from the tests that have been carried out on 26 users, there are 24 that match between expert recognition and system recognition, while the other 2 cases are different. The results between expert identification and the system got an accuracy rate of 92.31%. Meanwhile, the same test using expert system rules without certainty factor gives 4 different recognition results (on user 7, user 10, user 20, and user 26) so that the accuracy rate is 84.61%. The same recognition error as the CF method is fear of being recognized as angry in user 7 and user 26, and another recognition error is fear of being recognized as sad.

Recognition errors occur in emotions with negative valence, such as sad, angry, and fear, but do not occur in emotion with positive valence, like happy. This happens because the symptoms experienced by negative emotions are almost the same; some users also gave the same answers for the symptom questions. Here, the certainty factor value that is justified by the expert acts as an emotion differentiator. For example, the Q04 symptom (I feel nervous, anxious, or restless) which appears simultaneously on the emotions of angry and fear, but different belief values; 0.2 for anger and 0.8 for fear. This also explains why recognition errors can occur because the results of the user's answers are also almost the same. However, the overall application of the CF method provides better accuracy than without the CF method. This indicates that the expert system for recognizing emotions with the certainty factor method can function properly.

In addition, we also conducted beta testing for the EmoHealth mobile application to assess user satisfaction. Beta testing was carried out using a usability scale system for 26 users of the Emo Health application. Based on the SUS test, the result is a score of 75.41. This value is in the good category with a range between 68 – 80.3 according to [16]. This means that the EmoHealth application has good, effective, efficient, and satisfying uses and functions for users.

IV. Conclusion

Mental health is a health domain that is currently becoming a challenge for the people in Indonesia. If it is not prevented earlier, it will affect your physical health. Especially during this pandemic, many symptoms of anxiety and fear are experienced which, if not managed properly, will disrupt individual emotional health. Through an expert system based on the certainty factor method, this research produces a smart application for managing emotions independently for the welfare of life. Based on testing of the respondents, the use of intelligent emotion recognition applications has an accuracy of 92.31% when compared to recognition by psychologists. This shows that the certainty factor method has

been successfully applied with a high level of accuracy. In the future, it is expected to be able to add types of rules to recognize emotions, also add other types of emotions such as surprise, and complex emotions.

ACKNOWLEDGMENT

This research is supported by The Ministry of Education, Culture, Research, and Technology and Directorate of Higher Education through research grant number 252/E4.1/AK.04.PT/2021. Authors would like to express our sincere thanks to all those who involved as well as helped this project.

REFERENCES

[1] R. J. Bonnie, C. Stroud, and H. Breiner, *Investing in the health and well-being of young adults*. Washington (DC): National Academies Press (US), 2015.

[2] D. Goleman, *Emotional intelligence: Why it can matter more than IQ for character*. New York: Bantam Books., 1995.

[3] M. D. Nurmalasari, A. D. Laksito, and K. Kunci, "A*plikasi Sistem Pakar Diagnosa Awal Penyakit Kucing Berbasis Android Dengan Metode Forward Chaining* [The Application of Expert System for Early Diagnose of Cat Diseases Based on Forward Chaining]," *INFOS J.*, vol. 1, no. 2, 2019.

[4] N. Novianti, D. Pribadi, and R. A. Saputra, "*Sistem Pakar Diagnosa Pulmonary TB Menggunakan Metode Fuzzy Logic* [Pulmonary TB Diagnosis Expert System Using Fuzzy Logic Method]," *J. Inform.*, vol. 5, no. 2, pp. 228–236, 2018, doi: 10.31311/ji.v5i2.3927.

[5] G. A. Rianty, S. T. Informatika, S. Pakar, and B. F. Search, "P*enerapan Metode Depth First Search Pada Sistem Pakar Untuk Diagnosa Penyakit* [Application of the Depth First Search Method in the Expert System for Disease Diagnosis]," *Jutisi J. Ilm. Tek. Inform. dan Sist. Inf.*, vol. 7, no. 1, pp. 51–70, 2018.

[6] E. R. Syahputra, A. R. Dewi, and T. Hidayati, "Certainty Factor for Early Detection of Children ' s Respiratory Disease Certainty Factor for Respiratory Disease Early Detection of Children ' s," 2019, doi: 10.1088/1742-6596/1361/1/012071.

[7] A. H. Aji, M. T. Furqon, and A. W. Widodo, "*Sistem Pakar Diagnosa Penyakit Ibu Hamil Menggunakan Metode Certainty Factor (CF)* [Expert System for Diagnosing Diseases of Pregnant Women Using Certainty Factor (CF) Method]," J. Pengemb. Teknol. Inf. dan Ilmu Komput., vol. 3, no. 5, pp. 2127–2134, 2018.

[8] A. Saibene, M. Assale, and M. Giltri, "Expert systems: Definitions, advantages and issues in medical field applications," *Expert Syst. Appl.*, vol. 177, p. 114900, 2021, doi: https://doi.org/10.1016/j.eswa.2021.114900.

[9] K. Muludi, R. Suharjo, A. Syarif, and F. Ramadhani, "Implementation of forward chaining and certainty factor method on android-based expert system of tomato diseases identification," *Int. J. Adv. Comput. Sci. Appl.*, vol. 9, no. 9, pp. 451–456, 2018, doi: 10.14569/ijacsa.2018.090957.

[10] N. Sebe, M. Lew, Y. Sun, and I. Cohen, "Authentic facial expression analysis," *Image Vis. ...*, vol. 25, no. 12, pp. 1856–1863, 2007, doi: 10.1016/j.imavis.2005.12.021.

[11] P. Ekman, *Emotions revealed: recognizing faces and feelings to improve communication and emotional life*, 1st ed. New York: Times Books, 2003.

[12] P. Ekman, *Emotions revealed: Understanding faces and feelings*. Orion, 2003.

[13] K. E. Setyaputri, A. Fadlil, and S. Sunardi, "Comparative Analysis of Certainty Factor Method and Bayes Probability Method on ENT Disease Expert System," *Sci. J. Informatics*, vol. 5, no. 2, pp. 205–212, 2018, doi: 10.15294/sji.v5i2.16151.

[14] E. K. Panggabean, "Comparative Analysis Of Dempster Shafer Method With Certainty Factor Method For Diagnose Stroke Diseases," *Int. J. Artif. Intell. Res.*, vol. 2, no. 1, p. 32, 2018, doi: 10.29099/ijair.v2i1.53.

[15] E. P. Gunawan and R. Wardoyo, "An Expert System Using Certainty Factor for Determining Insomnia Acupoint," *IJCCS (Indonesian J. Comput. Cybern. Syst.*, vol. 12, no. 2, p. 119, 2018, doi: 10.22146/ijccs.26328.

[16] B. Klug, "An Overview of the System Usability Scale in Library Website and System Usability Testing," *Weav. J. Libr. User Exp.*, vol. 1, no. 6, pp. 1–19, 2017, doi: 10.3998/weave.12535642.0001.602.

Emotion Intelligent Application for Independent Wellbeing Management using Certainty Factor

ORIGINALITY REPORT

6%	5%	7%	1%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

MATCH ALL SOURCES (ONLY SELECTED SOURCE PRINTED)

2%

★ jurnal.umt.ac.id

Internet Source

Exclude quotes	On	Exclude matches	< 1%
Exclude bibliography	On		