Online Expert System for Diagnosis Psychological Disorders Using Case-Based Reasoning Method

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Abstract. Expert system of diagnosis of psychological disorders is a system designed to diagnose early symptoms of psychological disorders that may be suffered by individuals, online-based expert systems by applying the method of Case-Based Reasoning allows users to check the psychological condition directly with the results that can be used as a basis for more examination continue. The use of Case-Based Reasoning method facilitates the examination process for each user consultation because the result of past examination data can be used to compare with consultation data, psychological disorder examination with Case-Based Reasoning method can be done well.

1. Introduction

There are many areas outside the computer field that utilize computer technology to facilitate their work, for example, is the field of health, physical infrastructure, psychology, communications, Virtual Reality, Modelling and many other areas[1]. The field of health is one field that has been widely used computer applications to help work efficiency. One of the forms is an expert system [2], [3]. Expert system application is one of the branches of AI (Artificial Intelligence) which can be described as a computer device that has a knowledge base for a particular field that uses inference reasoning resembles an expert in solving a problem [4], [5].

Psychological disorder [6] is a disease that may be experienced by some people due to various factors such as trauma, stress, environmental conditions and hereditary diseases. Depression, Phobia, Bipolar Disorder are some types of psychological disorder that can be suffered by anyone, to know psychological self can be done in consultation with experts in the field of psychology or by using an expert system.

Expert systems are not a substitute for experts in a particular field, but a method used to adopt specialist knowledge into systems that can be accessed through computers, smartphones or other devices [3], [7], [8]. Case-Based Reasoning (CBR) [9]–[11] Method is one method of solving problems by using a solution that has been used previously against similar issues [11], the use of CBR methods on the diagnosis of psychological disorders will facilitate the process of early examination before a direct consultation to a specialist.
2. Methodology

An expert system is a branch of Artificial Intelligence (AI) developed in mid-1960. Expert system first time appeared was General Purpose Problem Solver (BPS). An expert system is a system that uses human knowledge in which knowledge is incorporated into a computer and then used to solve problems that usually require human skills [2], [12].

2.1 Expert System

Expert systems are designed on a specific knowledge area for expertise to approaching human ability in one field [7]. The expert system was trying to find a satisfactory solution as one expert does. Also, expert systems can also explain each step was taken and provide reasons for suggestions or conclusions that have been found [8], [13], [14].

An expert is a person who has expertise in a particular field, an expert who has the knowledge or unique ability that others do not know or are capable of in the area it has [14]. Knowledge[15], [16] in expert systems may be an expert, or knowledge commonly found in books, magazines and people who know a field. In the expert system, the user delivers the facts or information to the system and then accepts the advice of the expert or the expert answer. The inside of the expert system consists of two main components, the knowledge base which contains the knowledge and the inference engine that illustrates the conclusion. The conclusion is the response of the expert system at the request of the user [12], [14].

2.2 Case-Based Reasoning

Case-Based Reasoning [9] method is one of the ways to build expert systems with decision-making from new cases based on solutions from previous cases. There are four process steps in the Case-Based Reasoning method. Retrieve the most similar case, Reuse (using) information and knowledge of the case to solve the problem, Revise (repair) the proposed solution, and Retain (s) part of the experience that might be useful for solving problems in the future [5], [9], [11], see figure 1 for diagram process Case-Based Reasoning.

![Figure 1. Case-Based Reasoning Method](image)

Case-Based Reasoning process can use several techniques, one of which is the Nearest Neighbor method [11], [17] using equations.
The closeness of the case is determined by the value of 0 to 1, because of Nearest Neighbor calculations using the real calculation is between the values (0.1). A value of 0 means that two similar cases are not absolute and the absolute value of 1 case is similar [5], [9], [18].

3. Results And Discussion

Application of Case-Based Reasoning to a diagnosis of psychological disorder requires several data objects such as symptom data, symptom categories, solutions, and diseases, here are the tables of each data used.

### Table 1. Symptom Categories

| No | Code | Name                  |
|----|------|-----------------------|
| 1  | S1   | Emotional Symptom     |
| 2  | S2   | Physical Symptom      |
| 3  | S3   | Mind Symptom          |
| 4  | S4   | Attitude Symptom      |

### Table 2. Symptom Data

| No | ID  | Name                                         |
|----|-----|----------------------------------------------|
| 1  | G01 | Speaking less smoothly                       |
| 2  | G02 | Rigid and inflexible                         |
| 3  | G03 | Selfish                                      |
| 4  | G04 | Unstable emotional disturbance               |
| 5  | G05 | Respiratory disturbances, shortness of breath |
| 6  | G06 | Diet disorders                               |
| 7  | G07 | Mindset disorder                             |
| 8  | G08 | Insomnia                                     |
| 9  | G09 | Want to kill yourself                        |
| 10 | G10 | Loss of memory                               |
| 11 | G11 | Antisocial                                   |
| 12 | G12 | Doing a job/activity over and over again     |
| 13 | G13 | Experiencing convulsions                     |
| 14 | G14 | Maintain excessive hygiene                   |
| 15 | G15 | Indigestion                                  |
| 16 | G16 | Feeling heavy on the limbs                   |
| 17 | G17 | Excessive suspicion                          |
| 18 | G18 | Feeling low self-esteem                      |
| 19 | G19 | Feeling worried about excessive disease       |
| 20 | G20 | Feeling weak and tired easily                |
| 21 | G21 | Feeling suffering from a severe illness       |
| 22 | G22 | Feeling body parts pain                      |
| 23 | G23 | Feeling hopeless                              |
| 24 | G24 | Feel very sinful                             |
| 25 | G25 | Feeling very guilty / very afraid to make mistakes |
| 26 | G26 | Feel very excited                            |
|   |   |
|---|---|
| 27 | G27 Feel very smart in a particular field |
| 28 | G28 Feel very afraid of certain objects/conditions |
| 29 | G29 Excessive sadness |
| 30 | G30 Feel happy after pulling hair |
| 31 | G31 Feel happy to grab an eye-catching object |
| 32 | G32 Fear of excessive |
| 33 | G33 Fearing excessive dirty |
| 34 | G34 Feeling not confident |
| 35 | G35 Feeling never guilty |
| 36 | G36 Easy to sweat cold |
| 37 | G37 Easy to panic |
| 38 | G38 Easily offended |
| 39 | G39 Underwent traumatic / violent |
| 40 | G40 Feeling stressed for one thing |
| 41 | G41 Always think badly |
| 42 | G42 Nice to quarrel, hostile and often screwed up |
| 43 | G43 Nice to interfere in other people's business |
| 44 | G44 Often lie |
| 45 | G45 Often counts in the mind |
| 46 | G46 Often thinking is unrealistic |
| 47 | G47 often being attentive |
| 48 | G48 Frequent delusions |
| 49 | G49 Often shaking |
| 50 | G50 Frequent hallucinations |
| 51 | G51 Often angry / irritable |
| 52 | G52 Often check the body for mild problems |
| 53 | G53 Often crying hysterically |
| 54 | G54 Often pull hair until it fall out |
| 55 | G55 Often experience of loss of physical function, suddenly paralyzed, feeling deaf, blind, numb but only briefly |
| 56 | G56 Often have severe cramps |
| 57 | G57 Often experience significant mood swings, very happy to be very sad / vice versa |
| 58 | G58 Often experience pain / health problems |
| 59 | G59 Often hurt yourself |
| 60 | G60 Often feel neglected and inattentive |
| 61 | G61 Often feel uneasy |
| 62 | G62 Often feel anxious, restless and daydreaming |
| 63 | G63 Often feel heart palpitations |
| 64 | G64 Often feel headache |
| 65 | G65 Often happy, excessively cheerful |
| 66 | G66 Often feel tense and anxious |
| 67 | G67 Often feel depressed with the circumstances |
| 68 | G68 lost consciousness |
| 69 | G69 impatient |
| 70 | G70 difficult to speak normally |
Difficult concentration and decreased memory
Unable to adjust / difficult to adjust
Do not have a sense of humor
Never fear

Table 3. Solution

| No | Code | Name |
|----|------|------|
| 71 | G71  | Difficult concentration and decreased memory |
| 72 | G72  | Unable to adjust / difficult to adjust |
| 73 | G73  | Do not have a sense of humor |
| 74 | G74  | Never fear |

Table 4. Psychological Disorders Disease

| No | Code | Name           |
|----|------|----------------|
|    | P01  | Ansietas Cemas |
|    | P02  | Anorexia Nervosa |
|    | P03  | Bipolar Disorder |
|    | P04  | Conversion Disorder |
|    | P05  | Depresi |
|    | P06  | Enosimania |
|    | P07  | Fobia |
|    | P08  | Hipokondria |
|    | P09  | Hysteria |
|    | P10  | Multiple personality |

A simple case example of using Case-Based Reasoning method can see in table 5.

Table 5. Example Case Based Reasoning

| No | Disease       | Symptom                  | Initial Case |
|----|---------------|--------------------------|--------------|
| 1  | Anorexia Nervosa | [G06] [G32] [G34] [G58] | Anorexia     |
| 2  | Anxiety       | [G15] [G36] [G37] [G40] [G49] [G61] | Anxiety      |
The consultation process obtained symptoms as follows:
1. [G06] Diet disorders
2. [G34] Feeling not confident
3. [G58] Often experience pain/health problems
4. [G15] Indigestion
5. [G49] Often shaking

To obtain a diagnostic result, the system compares the symptoms chosen in consultation with the existing symptoms of the previously stored case.

Table 6. Case-Based Reasoning Process

| No | Diseases       | Case | Weight | Match | Weight |
|----|----------------|------|--------|-------|--------|
| 1  | Anorexia Nervosa | [G06] | 3      | [G06] | 3      |
|    |                 | [G32] | 3      | [G34] | 3      |
|    |                 | [G34] | 3      | [G58] | 3      |
| 2  | Anxiety        | [G15] | 3      | [G15] | 3      |
|    |                | [G36] | 1      | [G49] | 1      |
|    |                | [G37] | 5      |       |        |
|    |                | [G40] | 1      |       |        |
|    |                | [G49] | 1      |       |        |
|    |                | [G61] | 3      |       |        |
|    |                | [G64] | 1      |       |        |

Based on table 6 data, it means the most likely disease experienced is Anorexia Nervosa with a percentage of 75%, from this data an expert can add the case to a new case on a system that can later be reused or change the existing case data (revision).

The use of case-based reasoning methods in Table 6 is completed in an online expert system.
Figure 1 displays information on symptoms, categories of symptoms, diseases, and solutions. The central section also displays the exact amount of data contained in the database; Figure 2 shows another example of the system.

Testing and implementation done by using case-based reasoning method in the expert system can help to know the psychological disorder.

4. Conclusion

Expert system with Case-Based Reasoning method can be applied well for cases of psychological disorders and can also be used for other cases. Development of this method can also be done by combining with other methods or also compare the results with other expert system methods.

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