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EXPERT SYSTEM TO DIAGNOSE DIGESTIVE DISEASES USING CERTAINTY FACTOR

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Abstract: Tract disorders are disorders caused by abnormalities in the digestive system. This disorder is triggered by food or a person's physical condition. Digestive disorders cannot be diagnosed quickly, but mostly occur in the digestive system. Because the knowledge that will be suspected as a disease is still lacking, it takes experts or doctors to diagnose digestive disorders. The goal is to help produce a diagnosis of the disease experienced by the patient based on the symptoms experienced. The research data is processed based on the symptoms felt by the patient. Patient data using the Certainty Factor method or the value of disease certainty. This Certainty Factor method is a system that is able to run according to needs and produces a high percentage of accuracy results. The system design stage is implemented in the Hypertext Preprocessor programming language and My SQL database. The results of the diagnosis with this method produce a level of confidence in the patient's disease. From the results of the tests carried out, it can produce information about the diagnosis of the disease and help patients and medical personnel in knowing the condition of the disease that is being experienced.

Keywords: certainty factor; digestive tract disorders; expert system,

Abstrak: Gangguan saluran merupakan gangguan yang disebabkan oleh kelainan pada sistem pencernaan. Gangguan ini dipicu oleh makanan atau kondisi fisik seseorang. Gangguan pencernaan ini tidak bisa dilakukan diagnosa dengan cepat, tetapi sebagian besar terjadi pada sistem pencernaan. Dikarenakan pengetahuan yang akan diduga sebagai penyakit masih kurang, maka dibutuhkan tenaga ahli atau dokter untuk mendiagnosis gangguan pencernaan. Tujuannya untuk membantu menghasilkan diagnosa penyakit yang dialami pasien berdasarkan gejala yang dialami. Data penelitian diolah berdasarkan gejala yang dirasakan oleh pasien. Data pasien menggunakan metode Certainty Factor atau nilai kepastian penyakit. Metode Certainty Factor ini merupakan sistem yang mampu berjalan sesuai dengan kebutuha serta menghasilkan persentase akurasi hasil yang tinggi. Tahapan perancangan sistem diimplementasikan ke dalam bahasa pemrograman Hypertext Preprocessor dan database My SQL. Hasil diagnosa dengan metode ini menghasilkan tingkat kepercayaan terhadap penyakit pasien. Dari hasil pengujian yang dilakukan sudah dapat menghasilkan informasi tentang diagnosa penyakit dan membantu pasien serta tenaga medis dalam mengetahui kondisi penyakit yang sedang dialami.

Kata kunci: certainty factor; gangguan saluran pencernaan; sistem pakar

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INTRODUCTION

A disease that most people suffer from is an inner disease [1]. Indigestion is one type of problem that arises in the digestive system of the human body. This disorder of the gastrointestinal tract is caused by abnormalities in the digestive system. Often considered a trifle, although this indigestion is still said to be mild, but if not addressed it can lead to more serious illness [2]. Generally, this disorder is caused by food or a person's physical condition. The large varity and type of food, most of the consumers are not aware of the content of the food they eat, thus adversely affecting the organs of their digestive system.

Indigestion does not directly cause death, but most of the formation of the immune system comes from the digestive tract. Sourced from World *Health Organization* data, diseases caused by the gastrointestinal tract, including bowel cancer, which is also the number 6 disease in the world, causes the most deaths, and another disease that is diarrhea, which is also the number 7 disease in the world that causes death.

The lack of information and knowledge about the symptoms of the disease symptoms that are felt makes the sufferer late to get treatment from a doctor [3]. To detect the disease at the beginning it can be possible to cope apprpriately [4]. Accurately detecting treatment depends on the method used in diagnosing the disease [5]. A system of diagnostic experts can assist in identifying diseases and providing information about the methods of treatment to be carried out, taking into account the user's ability to handle and interact with expert systems easily and clearly [6].

An expert system is a computer-based system whose data uses knowledge, facts, and consideration techniques in solving a problem that usually can only be solved by an expert in his field [7].

A doctor is an expert who can determine and know what type of disease is being suffered based on the symptoms experienced by a patient. Knowledge from a doctor can be applied to an expert system. So that expert systems can help provide information or identify diseases based on perceived symptoms.

To determine the percentage of confidence level in the analysis of a disease based on the different weight of symptoms in an analysis, the Certainty Factor method is needed [8]. In 1975 Shortliffe and Buchanan proposed the Certainty Factor (CF) method to help uncertainty of an expert's thinking. For example, a doctor often analyzes using the word "maybe".

This study resulted in a method for the diagnosis of digestive disorders from the symptoms felt by sufferers. So that it can help in presenting clear information to patients or the public as well as medical personnel [9]. The information obtained is expected to help in its treatment and provide an appropriate way of handling by paying attention to the symptoms felt [10].

METHOD

The research framework in this research methodology aims to facilitate writing and carrying out work steps. This is done so that research can be carried out in a structured manner. Image 1 is the framework used in this study:

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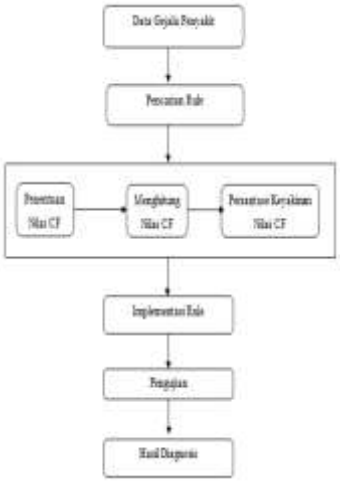

Image 1. Research Framework

Disease Symptom Data

The knowledge base on the expert system is a very important point. All knowledge from experts is stored in the knowledge base. The basis for making decisions in an expert system is the knowledge base. From the previous knowledge already collected and stored, it is used for decision-making related to the process. Not only knowledge from experts, in this study also conduct literature studies so that the research carried out is based on clear and correct theories, which have been put forward by previous experts, sourced from books, journals and various other sources from accountable experts.

Rule Search

In the stage of applying this rule, it can be done in three stages, including the following:

1. Determination of Certainty Factor Value

In this first step the determination of the value

Certainty Factor is by determining the CF value of a symptom in a disease by an expert, followed by determining the CF value of the symptoms needed by the patient.

Table 1. Uncertain Term (UT) Value

Uncertain conditions (UT)	CF
No	0
Don't Know	0.2
Little Sure	0.4
Almost Sure	0.6
Sure	0.8
Very Confident	1

2. Calculating the Certainty Factor Value

After matching the symptoms entered by the patient with the rules on the system, then multiply the expert's CF value by the user's CF value, and then calculate the CF value of the combination of several symptoms on the matching rule.

CF [P AND P] = Min [CF (P),CF (Q)] **** CF[rule]*** ***(1)***

next look for the CF value of the combination

CFgab1 = CF1 + CF2 * (1-CF1) ***(2)***

3. CF Value Confidence Persantase

It further displays the results (disease and confidence percentage based on CF values).

Rule Implementation

In this study, researchers implemented a system using PHP programming language and MySQL database to identify symptoms in gastrointestinal disorders with calculations that include for more than one symptom, because this programming language is right for creating web-based programs and is easy to use by users. The process

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at this stage of identification is carried out by including the fact of the symptoms that occur in disorders of the gastrointestinal tract.

Testing

The testing phase of the system is carried out aimed at checking the accuracy of the results of the implementation and the final results of calculations with data from experts. The next step in this study is to test the accuracy or level of accuracy of the system in producing outputs in the form of disease names and their trust values. Data derived from expert analysis are tested. From the calculations on the system produce recommendation results, validated with the results of analysis from experts.

RESULTS AND DISCUSSION

In this study, the data that was used was data on diseases of the gastrointestinal tract. Data obtained from Padang Eye Center Hospital by dr. Fadian, SpD. Diseases of the gastrointestinal tract disorders that can be seen in table 2.

Table 2. Disease Name

Kode Penyakit	Nama Penyakit
P01	DIARE / GEA (Gastroenteritis akut)
P02	Kanker Kolonrektum
P03	HEPATITIS A

From the knowledge analysis data that has been obtained and then the data is made into the form of a decision tree. Like Image 2.

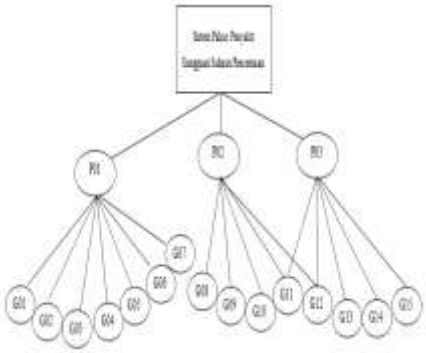

Image 2. Decesion Tree Diagnosis of Gastrointestinal Disorders

From the decision tree above, rules such as Image 3 are obtained based on knowledge from experts.

Tabel 3. Rule

No	*Rule* (Aturan)
1	IF G01 AND G02 AND G03 AND G04 THEN P01 (CF=0.80)
2	IF G02 AND G05 AND G06 AND G07 THEN P01 (CF=0.55)
3	IF G03 AND G04 AND G05 AND G06 THEN P01 (CF=0.50)
4	IF G08 AND G09 AND G10 AND G11 THEN P02 (CF=0.85)
5	IF G09 AND G10 AND G11 AND G12 THEN P02 (CF=0.70)
6	IF G08 AND G10 AND G11 AND G12 THEN P02 (CF=0.75)
7	IF G11 AND G12 AND G13 AND G14 THEN P03 (CF=0.60)
8	IF G13 AND G14 AND G15 AND G16 THEN P03 (CF=0.55)
9	IF G12 AND G13 AND G14 AND G15 THEN P03 (CF=0.65)

Based on table 4, 20 sample test data can be calculated the accuracy level of this digestive tract disorder expert system. The accuracy rate can be calculated by dividing the number of valid data by the number of test data used, then multiplied by 100% as explained.

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Table 4. Table of Test Results

Pasien	Penyakit		Nilai CF		Gejala
	Pakar	Sistem	Manual	Sistem	
1	Hepatitis a	Hepatitis a	34%	34%	G01, G02, G04, G05, G06, G09, G10, G11, G12, G13, G14, G15
2	Diare / gea	Diare / gea	68%	68%	G01, G02, G03, G04, G05, G06, G08, G10, G11, G12, G13
3	Kanker kolon-rektum	Kanker kolon-rektum	50%	50%	G01, G04, G05, G06, G07, G08, G10, G11, G12, G13, G14
4	Hepatitis a	Hepatitis a	41%	41%	G01, G02, G04, G05, G06, G09, G10, G11, G12, G13, G14, G16
5	Kanker kolon-rektum	Kanker kolon-rektum	28%	28%	G01, G02, G04, G05, G06, G09, G10, G11, G12, G13
6	Kanker kolon-rektum	Kanker kolon-rektum	49%	49%	G01, G04, G05, G06, G09, G10, G11, G12, G13, G14
7	Hepatitis A	Hepatitis a	50%	50%	G01, G02, G04, G05, G06, G07, G10, G11, G12, G13, G14
8	Diare/gea	Diare/gea	58%	58%	G01, G02, G03, G04, G05, G06, G07, G09, G10, G11, G12, G13, G14
9	Diare/gea	Diare/gea	76%	76%	G01, G02, G03, G04, G05, G06, G07, G09, G10, G11, G12, G13, G14, G16
10	Kanker kolon-rektum	Kanker kolon-rektum	80%	80%	G01, G02, G03, G04, G05, G06, G07, G08, G09, G10, G11, G12, G13, G14, G15, G16
11	Kanker kolon-rektum	Kanker kolon-rektum	49%	49%	G01, G02, G04, G05, G06, G09, G10, G11, G12, G13, G14
12	Diare/gea	Diare/gea	72%	72%	G01, G02, G03, G04, G05, G06, G07, G09, G10, G11, G12, G13, G14
13	Diare/gea	Diare/gea	52%	52%	G01, G02, G03, G04, G05, G06, G08, G10, G11, G12, G13
14	Diare/gea	Diare/gea	58%	58%	G01, G02, G03, G04, G05, G06, G07, G09, G10, G11, G12, G13, G14
15	Hepatitis a	Hepatitis a	56%	56%	G01, G02, G04, G05, G06, G07, G09, G10, G11, G12, G13, G14, G15, G16
16	Kanker kolon-rektum	Kanker Kolon-rektum	67%	67%	G01, G02, G03, G04, G06, G07, G08, G09, G10, G11, G12, G13, G14, G16
17	Kanker Kolon-rektum	Kanker kolon-rektum	77%	77%	G01, G02, G03, G04, G06, G08, G09, G10, G11, G13, G15, G16
18	Hepatitis A	Hepatitis A	41%	41%	G01, G02, G04, G05, G06, G09, G11, G12, G13, G14
19	Hepatitis A	Diare/Gea	89%	58%	G01, G02, G03, G04, G05, G06, G07, G09, G10, G11, G12, G13, G16
20	Kanker Kolon-rektum	Kanker kolon-rektum	81%	81%	G01, G02, G03, G04, G06, G07, G08, G09, G10, G11, G12, G13, G14

From 20 test data, 14 data were obtained or the results were the same as expert data. Calculations for the accuracy value of this system of infectious disease experts.
Accuracy rate =
Number of correct test data / amount of data * 100% = 14/20 * 100% = 70%

The trial conducted in this study used 20 users, the results of the trial were then compared with the opinion of doctors, then obtained from this system the percentage of accuracy was 70%.

CONCLUSION

This expert system with the CF method can work with incomplete data. The expert system used to diagnose diseases of the gastrointestinal tract disorders has been able to produce information to users about the diagnosis of the

disease suffered based on the symptoms experienced. In addition, the expert system can also help the public to find out the initial symptoms of gastrointestinal disorders.

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