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Gastric Disease Diagnosis Expert System With Bayes Method

Nopriansyah[1], Bosker Sinaga[2]

[1.2]Informatics Engineering Program,
STMIK Pelita Nusantara, Jl. St. Iskandar Muda 1 Medan, Nort Sumatera, Indonesia

E-mail: nopriansya123@yahoo.com

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ABSTRACT

Helped develop information technology in line with the development of human civilization. In the health field, also developed a technology that is able to process and think like humans ie Artificial Intelligence technology. Artificial intelligence is divided into several areas of science, one of which is the expert system. expert systems can help people in gaining the desired information, khususnta information about diseases of the stomach. The stomach is an important organ in the body because it is one of the organs of digestion of food and beverages consumed by humans. To help people in making the diagnosis of diseases of the stomach, it would require an expert system that can diagnose diseases of the stomach in order to determine the type of the illness, symptoms dialamin and how treatment solutions. In this study, researchers made a gastric disease diagnosis expert system using Bayes methods. The data used is the type of disease, symptoms, and treatment solutions. This system will produce the output of information type of disease diagnosis and treatment of the disease.

1. Introduction

Helped develop information technology in line with the development of human civilization. Developments in information technology include the development of infrastructure, such as hardware, software, data storage technologies (storage), and technology. Currently, the development of information technology has penetrated into various sectors including health (Munawarah R, 2016).

In the health field, also developed a technology that is able to process and think like humans ie Artificial Intelligence technology. Artificial intelligence is divided into several areas of science, one of which is the expert system. An expert system is a science field of artificial intelligence section containing insights and experiences submitted by one or more experts into a machine or software so that the machine is able to solve problems that require expertise or human expertise. So with the expert system to assist the community in gaining the desired information, khususnta information about diseases of the stomach (Samsudin & Indriani R., 2018).

Stomach disease is a disease of the stomach. As for the various diseases of the stomach, namely: (1). Gastritis is an acute inflammation of the mucosa of chronic laposan (lender) lambng wall caused by germs; (2). Disease dyspepsia is a collection of complaints / clinical symptoms consist of discomfort / pain, full flavor and heat in the upper abdomen that persist or relapse complaints of pain and heartburn; (3). Disease GERD (Gastroesophageal Reflux Disease) is a condition characterized by watery feces issued or large waste with greater frequency than normal (Samsudin & Indriani R., 2018).

In this study, researchers will conduct research to create a gastric disease diagnosis expert system with Bayes method. In this study, researchers conducted research in Sari Mutiara Hospital Lubukpakam. Problems identified after researching is a stomach disease is a disease that is often experienced by the public and a public health problem that is serious, the lack of specialists in diseases of the stomach,

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working time expert or doctor are limited in dealing with diseases of the stomach and the cost of consulting a doctor expensive

This study was conducted in order to calculate how to diagnose diseases of the stomach using Bayesian methods, to build an expert system to diagnose diseases of the stomach to implement Bayesian methods and benefits are generating the application how to diagnose diseases of the stomach using Bayesian methods, to produce applications or expert system to be implemented using Bayesian methods.

2. Bayesian methods

Bayesian decision theory is a fundamental statistical approach to pattern recognition (pattern recognition). This approach is based quantification of trade-offs between various classification decisions using probability and expenses incurred in these decisions. Bayes methods is also a good method in machine learning based on training data, using the conditional probability as the basis. Probability Bayes is one way to address the reliability of the data by using Bayes formula stated (Nur Aini Hutagalung, 2017).

Steps diagnosis of disease with Bayes method is as follows:

1. Determining the value of the probability of each evidence-based hypotheses.

$$P(H|E) = \frac{P(E|H)\ .\ P(H)}{P(E)}$$

2. Determining the value of the universe of diseases.

$$P(Hi) = \frac{P(Hi)}{\sum_{Gn}^{n}}$$

3. Determining the value of the probability of the hypothesis regardless of evidence.

$$\sum_{Gn}^{n}(P(Hi) * P(E|Hi))$$

4. Calculate the value of P (Hi | E) or a probability value Hi correctly when given evidence E.

$$P(Hi) = \frac{P(Hi) * P(E|Hi)}{\sum_{Gn}^{n}}$$

5. Determining the value of Bayes.

$$\sum_{Gn}^{n} = (P(E|H1) * P(H1|E1))$$

Information :
P (H | E) : The probability of a hypothesis H if known evidence E.
P (E | H) : The probability of the emergence of evidence E if known hypothesis H.
P (H) : The probability of the hypothesis H.
P (E) : Probability of evidence E.
Gn : N Disease Symptoms

From Bayes' theorem can be developed if performed testing of the hypothesis appears more of an evidence, then persamaanya be (Anwar and Anas, 2018):

$$P(H|E,e) = \frac{P(H|E).P(e|E,H)}{P(e|E)}$$

Information:
e : Old evidence
E : New evidence
P (H | E, e) : the probability of a hypothesis, if new evidence of evidence-old E e
P (e | E, H) : The probability of a link between E and E if the hypothesis H true
P (e | E) : The probability of a link between E and E regardless of any hypothesis.
P (E | H) : The probability of the emergence of evidence E if known hypothesis H

3. Analysis

The results of research that has been done, the data obtained gastric diseases such as the following:

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1) gastritis
2) Gastric
3) gastroenteritis
4) dyspepsia
5) Esophageal cancer
6) Gastric Malignant Neoplasms

While the symptoms of gastric diseases are signs of stomach disease.

Table 1.
Gastric Disease Symptoms

Code	Symptoms name
G01	Stomach area (efigastrium) pain, tenderness, or can also be burned
G02	The full flavor of the area of the stomach / abdomen area
G03	Bad taste stomach area (abdomen)
G04	Taste Stomach Bloating
G05	Decreased appetite (anorexia).
G06	Fatigue often
G07	Nausea and vomiting.
G08	Pain in the liver uluh
G09	Discomfort in the abdomen or stomach
G10	Chest tightness
G11	bowel sounds were loud (borborigmi).
G12	At dinner feels pain
G13	Constipation
G14	Diarrhea
G15	abdominal cramps
G16	Sometimes a mild fever or chills,
G17	Watery bowel movements or diarrhea
G18	Restless or cranky
G19	Eyes look sunken,
G20	Thirsty and wanted to drink a lot
G21	The patient looked very lethargic until unconscious,
G22	Pain in duodenal ulcer
G23	Pain in the stomach ulcers after eating
G24	Weight loss is not accidental
G25	Heartburn (burning sensation in the chest)
G26	Difficulty in swallowing food
G27	Often choked while eating
G28	Cough or hoarse
G29	Full quickly when eating
G30	Vomiting blood
G31	Black stools or blood in the stool are
G32	Swelling in the abdomen due to accumulation of fluid
G33	Burp

Knowledge of the system is represented by a set of rules in the form of IF-THEN. Base rules used in represtasi knowledge between the types of diseases with symptoms that lead to the disease are as follows

Table 2.
Basis Rules

P / G	P1	P2	P3	P4	P5	P6
G1	0.9					
G2	0.8					
G3	0.4					
G4	0.3					0.8
G5	0.4	0.6		0.4		0.9
G6					0.6	
G7	0.7	0.8	0.6			0.7
G8	0.5	0.7		0.4		
G9				0.8		
G10				0.9		
G11				0.7		
G12				0.6		
G13				0.8		
G14			0.7			
G15			0.8			

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P / G	P1	P2	P3	P4	P5	P6
G16			0.6			
G17			0.9			
G18			0.4			
G19			0.7			
G20		0.5	0.3			
G21			0.8			
G22		0.6				
G23		0.9				
G24					0.8	
G25					0.9	
G26					0.4	0.6
G27					0.5	
G28					0.8	
G29						0.5
G30						0.4
G31						0.6
G32						0.6
G33			0.6	0.6		0.7

Case

A case of gastritis gastric disease, where symptoms of the disease and answer as follows:

[G01] Regional stomach pain, stinging or burning
[G02] The taste full area of the stomach / abdomen area
[G04] Rasa Stomach Bloating
[G05] Decreased appetite
[G06] Frequently Fatigue
[G07] Nausea and vomiting
[G08] Pain in the liver uluh
[G14] Diarrhea

Calculation Method Using Bayes

1. Determining the value of Probability

Define in advance the probability value of each evidence for each hypothesis based on the available sample data using Bayes probability formula.

[P1] =	[G01] = P (E |	H1) = 0.9
	[G02] = P (E |	H2) = 0.8
	[G04] = P (E |	H3) = 0.3
	[G05] = P (E |	H4) = 0.4
	[G07] = P (E |	H5) = 0.7
	[G08] = P (E |	H6) = 0.5
[P2] =	[G05] = P (E |	H7) = 0.6
	[G07] = P (E |	H8) = 0.8
	[G08] = P (E |	H9) = 0.7
[P3] =	[G07] = P (E |	H10) = 0.6
	[G14] = P (E |	H11) = 0.7
[P4] =	[G05] = P (E |	H12) = 0.4
	[G08] = P (E |	H13) = 0.4
[P5] =	[G06] = P (E |	H14) = 0.6
[P6] =	[G04] = P (E |	H15) = 0.8
	[G05] = P (E |	H16) = 0.9
	[G07] = P (E |	H17) = 0.7

2. Determining the value of probability P (Hi)

Once the value of P (Hi) is known, the value of the probability of the hypothesis H regardless of any evidence.

$$\sum_{Gn}^{n} (P\ (\ E\ |H1\ ) * (P\ (\ E\ |Hi\ )))$$

For P1 diseases (gastritis)

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$$\sum_{Gn}^{n}(0.9) * (0.8) * (0.3) * (0.4) * (0.7) * (0.5) = 0.03024$$

For P2 disease (Gastric)

$$\sum_{Gn}^{n}(0.6) * (0.8) * (0.7) = 0.336$$

For P3 disease (gastroenteritis)

$$\sum_{Gn}^{n}(0.6) * (0.7) = 0.42$$

For P4 disease (dyspepsia)

$$\sum_{Gn}^{n}(0.4) * (0.4) = 0.16$$

For P5 disease (Esophageal Cancer)

$$\sum_{Gn}^{n}(0.6) = 0.6$$

For P6 disease (GERD)

$$\sum_{Gn}^{n}(0.8) * (0.9) * (0.7) = 0.504$$

3. Determining the value of the Universe

Looking universe by summing the values of probability values P (Hi)

$$\sum_{Gn}^{n}\left(\mathrm{P(H|P1)} + (\mathrm{P(H|P2)} + \mathrm{P(H|P3)} + \mathrm{P(H|P4)} + \mathrm{P(H|P5)} + \mathrm{P(H|P6)}\right)$$

Then the value of the entire universe of probability values for all diseases are as follows:

$$\sum_{Gn}^{n}(0.03024 + 0.336 + 0.42 + 0.16 + 0.6 + 0.504) = 2.05024$$

4. Determining the value of P (Hi | E)

Finding the value of P (Hi | E) or the probability of the hypothesis Hi is true if given evidence E.

$$P(Hi) = \frac{P(Hi)}{\sum_{Gn}^{n}}$$

Then the value (Hi | E) for P1 diseases (gastritis)

P (H1 | E) = $\frac{0.03024}{2.05024} = 0.014749$

For P2 disease (Gastric)

P (H2 | E) = $\frac{0.336}{2.05024} = 0.163883$

For P3 disease (gastroenteritis)

P (H3 | E) = $\frac{0.42}{2.05024} = 0.204854$

For P4 disease (dyspepsia)

P (H4 | E) = $\frac{0.16}{2.05024} = 0.07804$

For P5 disease (Esophageal Cancer)

P (H5 | E) = $\frac{0.6}{2.05024} = 0.292649$

For P6 disease (GERD)

P (H6 | E) = $\frac{0.504}{2.05024} = 0.245825$

5. Determining the value of Bayes

The last step is to determine the value of ranking the value of Bayes for each disease as follows:

P1 = 0.014749 * 100% = 14.74%
P2 = 0.163883 * 100% = 16:38%
P3 = 0.204854 * 100% = 20:48%
P4 = 0.07804 * 100% = 7.80%

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P5 = 0.292649 * 100% = 29.26%
P6 = 0.245825 * 100% = 24.58%

Of the calculation process using Bayesian methods above, it can be concluded that the patient had gastric diseases Esophagus Cancer with confidence value of 29.26%.

4. System planning

Use case diagrams Use case diagrams used to describe and analyze the interaction between the user and the system so that it can be understood more easily. Here is a use case diagram of gastric disease diagnosis expert system using Bayesian methods.

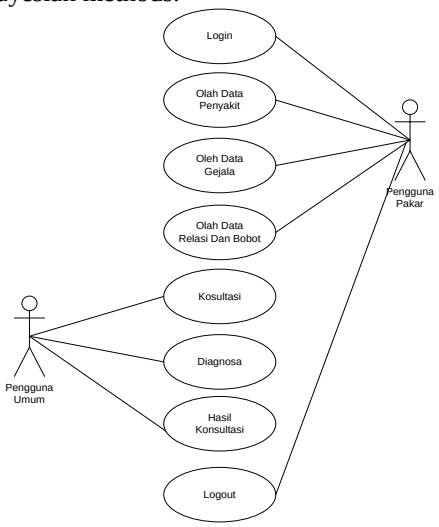

Figure 1 Use Case Diagam

The design of the database with the entity relationship diagram of the expert system can be seen as shown below:

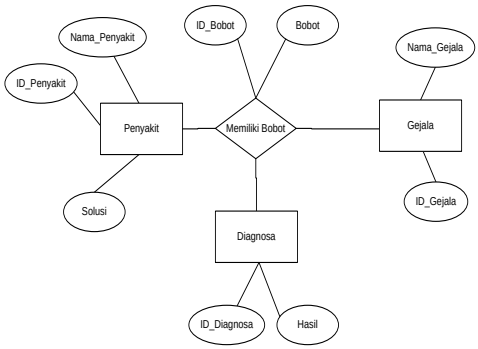

Figure 2 Entity Relationship Diagram

5. System implementation

Implementation of gastric disease diagnosis expert system using Bayes method is as follows:

a. Main Page General User

This page is the first page that appears when the system is run or accessed by public users. On this page the user can perform activities such as:

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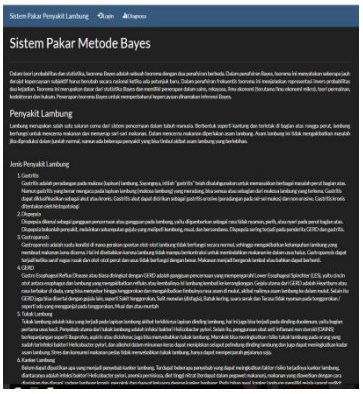


Figure 3 Main Page General User

b. Diagnosis page
On this page will be displayed symptoms of gastric disease. To do diangosa, the end will choose experienced symptoms associated with gastric disease. And the end result is a diagnosis of the analysis of the stomach with Bayes method.

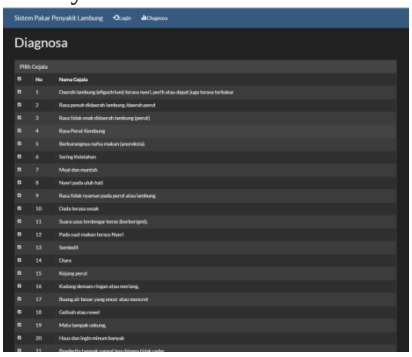
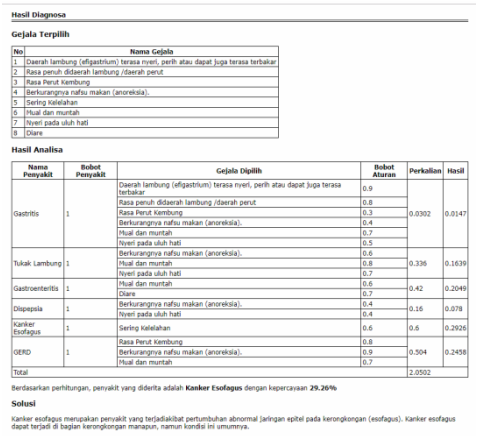


Figure 4 Page Diagnosis

c. Diagnosis Results Page
If the end is already finished selecting the symptoms experienced, then the expert system will display the results of diagnosis using Bayes methods that contain the selected symptoms, the value of Bayes every disease and gastric diseases suffered equipped with penogobatannya solution.



Hasil Diagnosa

Gejala Terpilih

No	Nama Gejala
1	Daerah lambung (efigastrium) terasa nyeri, perih atau dapat juga terasa terbakar
2	Rasa penuh didaerah lambung /daerah perut
3	Rasa Perut Kembung
4	Berkuranginya nafsu makan (anoreksia).
5	Sering Kelelahan
6	Mual dan muntah
7	Nyeri pada uluh hati
8	Diare

Hasil Analisa

Nama Penyakit	Bobot Penyakit	Gejala Dipilih	Bobot Aturan	Perkalian	Hasil
Gastritis	1	Daerah lambung (efigastrium) terasa nyeri, perih atau dapat juga terasa terbakar	0.9	0.0302	0.0147
		Rasa penuh didaerah lambung /daerah perut	0.8		
		Rasa Perut Kembung	0.3		
		Berkuranginya nafsu makan (anoreksia).	0.4		
		Mual dan muntah	0.7		
		Nyeri pada uluh hati	0.5		
Tukak Lambung	1	Berkuranginya nafsu makan (anoreksia).	0.6	0.336	0.1639
		Mual dan muntah	0.8		
		Nyeri pada uluh hati	0.7		
Gastroenteritis	1	Mual dan muntah	0.6	0.42	0.2049
		Diare	0.7		
Dispepsia	1	Berkuranginya nafsu makan (anoreksia).	0.4	0.16	0.078
		Nyeri pada uluh hati	0.4		
Kanker Esofagus	1	Sering Kelelahan	0.6	0.5	0.2926
GERD	1	Rasa Perut Kembung	0.8	0.504	0.2458
		Berkuranginya nafsu makan (anoreksia).	0.9		
		Mual dan muntah	0.7		
Total				2.0502	

Berdasarkan perhitungan, penyakit yang diderita adalah **Kanker Esofagus** dengan kepercayaan **29.26%**

Solusi

Kanker esofagus merupakan penyakit yang terjadiakibat pertumbuhan abnormal jaringan epitel pada kerongkongan (esofagus). Kanker esofagus dapat terjadi di bagian kerongkongan manapun, namun kondisi ini umumnya.

Figure 5 Diagnosis Results Page

6. Conclusion

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Based on research conducted by the researchers, it can be concluded as follows:

1. With the expert system to diagnose diseases of the stomach, then help people to be able to know experienced gastric diseases.
2. An expert system to diagnose diseases of the stomach successfully implemented using Bayes methods.
3. Implemented expert system can be used as a means to diagnose diseases of the stomach.

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