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Application of Bayes Method to Predicting Vertigo Disease

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Abstract

Health is very important in life. However, sometimes awareness of a healthy lifestyle and regular diet is still neglected. Many diseases and symptoms arise due to irregular lifestyle and diet, one of which is vertigo. Vertigo is a different type of headache from regular headaches and migraines. It involves a sensation of movement or a feeling of motion of the body or surrounding environment, caused by a disturbance of the body's balance. Symptoms include a feeling of spinning, a swaying sensation, or a spinning environment, often accompanied by nausea, vomiting, cold sweat, and the urge to lie down to feel better. From the Bayes method calculation process in this study, it can be seen that the patient suffers from Vertigo disease, namely Vertigo Central (P02) with a value of 0, 7212 or 72.12%.

Keywords: *application of bayes method, vertigo, expert system*

1. Introduction

With the development of technology, the needs of each individual are increasing in various fields, one of which is in the health sector. With the development of technology today, everyone can communicate and obtain and convey the various information needed. Health is very important in life. However, sometimes awareness of a healthy lifestyle and regular diet is still neglected. Many diseases and symptoms arise due to irregular lifestyle and diet, one of which is vertigo [1], [2].

Vertigo is a different type of headache from regular headaches and migraines. It involves a sensation of movement or a feeling of motion of the body or surrounding environment, caused by a disturbance of the body's balance. Symptoms include a feeling of spinning, a swaying sensation, or a spinning environment, often accompanied by nausea, vomiting, cold sweat, and the urge to lie down to feel better [3], [4].

Vertigo disease is still a disease that is suffered by many people, the more patients who experience vertigo disease, of course, the more doctors are needed to predict patients. Artificial intelligence is one of the solutions and helps doctors in supporting decision making for certain diseases which will be managed using the PHP (Hypertext preprocessor) system.

2. Literature Review

2.1. Expert System

In general, an expert system is a system that seeks to adopt human knowledge into computers so that computers can solve problems as experts can do, and a good expert system is designed to be able to solve a particular problem by imitating the performance of experts. The expert referred to here is a person who has special expertise that can solve problems that cannot be solved by ordinary people.

According to [1] An expert system is a computer program capable of storing knowledge and rules from a specific expert domain. with the help of an expert system a layman or non-expert in a particular field will be able to answer questions, solve problems and make decisions that are usually made by an expert. As the name implies, an “Expert System” will be highly dependent on knowledge (knowledge) obtained from experts who contribute their expertise and experience [5], [6].

2.2. Teorema Bayes

Bayes' theorem is a theorem with two different interpretations. In the Bayes interpretation, the theorem states how much a person's subjective beliefs should rationally change when new clues or information are presented.

The Bayes' Theorem method is a theorem with two different interpretations. In the Bayes interpretation, it states the degree to which subjective beliefs should change rationally when new clues or cases are obtained that are compared to older cases. Bayes probability is one way to overcome data uncertainty by using the Bayes formula [2].

2.3. Learning Achievement

Achievement reflects the achievements obtained after carrying out learning activities. To understand the extent of success in the learning process, measurement or evaluation of learning is carried out. The results of this evaluation indicate the achievements that have been achieved in participating in a special learning process. Learning achievement is defined as the result of an assessment of knowledge, skills, and attitudes expressed in the form of grades [7].

3. Research Methods

3.1. Research Methods

On the basis of the research methodology that will be used in this study, a flow of research work method activities can be made as follows:

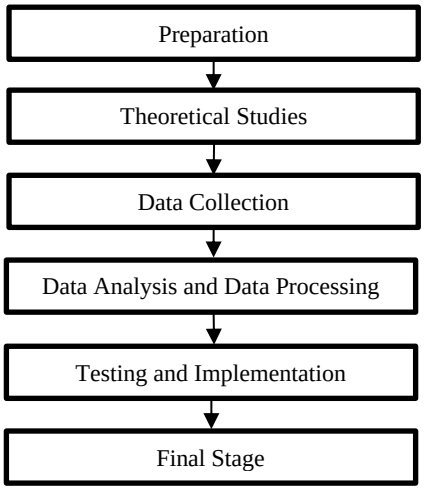

Fig.1: Research Workflow

Based on the table above, it can be explained that there are several stages used in the research, namely as follows [8], [9].

1. Preparation
   This stage is the beginning of the research process to be carried out
2. Theoretical study
   At this stage a theoretical study of the existing problem is carried out. The study is carried out to determine the concepts that will be used in research, especially about expert systems, bayes method, vertigo disease, PHP programming, MYSQL database, and other supporting theories.
3. Data Collection
   This stage is intended to collect supporting data obtained from Dr. Djoelham Hospital, Binjai City to internal medicine specialist Dr. Destika, Sp. N by means of direct interviews about vertigo disease data.
4. Data Analysis
   At this stage, supporting data will be analyzed, there are 100 data taken, namely data on symptoms, vertigo disease that has been obtained previously, with the application of the Bayes method to predict vertigo disease as a problem-solving method. Data analysis is needed to get a solution to the research problem that is being done.
5. Testing and Implementation
   At this stage testing of data variables and implementation using the PHP program will be carried out. as well as the preparation of the system program.
6. Final Stage
   This stage is the stage of taking conclusions and suggestions that can be done in the preparation of the thesis. With the conclusion, the results of the entire thesis will be known and it is hoped that with suggestions there will be improvements and benefits for further researchers. Conclusion is to answer what is the formulation of the problem based on the analysis that has been done in the previous stages [10], [11].

4. Results and Discussion

4.1. Results

In a study, data is needed that can support the success of a study. Research data is used as an analysis process to get results or a conclusion. In this study, the data used to predict vertigo disease using the bayes method is such as symptom data, disease data obtained from Dr. Djoelham Hospital Binjai City which handles vertigo disease. This data is obtained based on direct observation and interviews with experts. These data will be used to test the accuracy of vertigo disease diagnosis using Bayes method. The types of vertigo disease that will be researched are as follows.

Table 1: Vertigo Disease Type Data

No	Kode	Jenis Penyakit
1.	P01	Vertigo Central
2.	P02	Vertigo Perifer

Furthermore, the symptom data of each type of vertigo disease is as follows.

Table 2: Vertigo Symptom Data

No	Symptom Name
1.	Dark vision
2.	Tiredness and decreased stamina
3.	Heart palpitations
4.	Loss of balance
5.	Inability to concentrate
6.	Feeling like you're drunk
7.	Muscle pain
8.	Decreased memory and thinking power
9.	Sensitive to bright light and sound
10.	Sweating
11.	Double vision
12.	Difficulty swallowing
13	Paralysis of facial muscles
14	Severe headache
15	Impaired consciousness
16	Speechlessness
17	Loss of motor coordination
18	Nausea and vomiting
19	Body weakness

From the above symptom data, a table of disease symptoms based on the type of vertigo and central disease is made as shown in the table below.

Table 3: Vertigo Disease Symptom Data

Kode	Nama Gejala	Kode Jenis Penyakit	
		P01	P02
G01	Dark vision	√	
G02	Tiredness and decreased stamina	√	
G03	Heart palpitations	√	√
G04	Loss of balance	√	
G05	Inability to concentrate	√	
G06	Feeling like you're drunk	√	
G07	Muscle pain	√	√
G08	Decreased memory and thinking power	√	
G09	Sensitive to bright light and sound	√	
G10	Sweating	√	√
G11	Double vision		√
G12	Difficulty swallowing		√
G13	Paralysis of facial muscles		√
G14	Severe headache		√
G15	Impaired consciousness		√
G16	Speechlessness		√
G17	Loss of motor coordination		√
G18	Nausea and vomiting		√
G19	Body weakness		√

Table 4: Probability Value of Vertigo Disease

Kode Penyakit	Nama Penyakit	Jumlah data	Nilai Probabilitas
P01	Vertigo Central	41	41/100 = 0,41
P02	Vertigo Perifer	59	59/100 = 0,59
Total		**100**	**100**

Next is to find the probability value for each symptom of Vertigo disease. The amount of symptom data for each Vertigo disease can be seen in the table 5 below.

Table 5: Probability Value of Disease Symptoms

Kode Gejala	Kode Penyakit	
	P01	P02
G01	4	41
G02	4	41

G03	9	41
G04	9	42
G05	0	50
G06	0	50
G07	13	42
G08	5	42
G09	5	42
G10	17	41
G11	18	2
G12	23	0
G13	36	0
G14	32	36
G15	32	0
G16	36	2
G17	36	1
G18	23	26
G19	18	2

The number of data for symptom G01 dark vision of 4 data in disease P01 is obtained from the Vertigo disease data table. By looking for symptoms in G01 in P01 disease. Based on the probability value that has been calculated above, the probability value for each Vertigo disease based on symptoms is as shown in the table 6 below.

Table 6: Probability Value of Symptoms Based on Disease

Kode	Nama Gejala	Kode Jenis Penyakit	
		P01	P02
G01	Dark vision	0.10	0.71
G02	Tiredness and decreased stamina	0.90	0.27
G03	Heart palpitations	0.27	0.73
G04	Loss of balance	0.29	0.71
G05	Inability to concentrate	0.95	0.14
G06	Feeling like you're drunk	0.95	0.14
G07	Muscle pain	0.34	0.75
G08	Decreased memory and thinking power	0.15	0.73
G09	Sensitive to bright light and sound	0.93	0.17
G10	Sweating	0.12	0.78
G11	Double vision	0.85	0.07
G12	Difficulty swallowing	0.15	0.93
G13	Paralysis of facial muscles	0.12	0.37
G14	Severe headache	0.44	0.39
G15	Impaired consciousness	0.27	0.31
G16	Speechlessness	0.32	0.36
G17	Loss of motor coordination	0.20	0.17
G18	Nausea and vomiting	0.27	0.36
G19	Body weakness	0.46	0.14

4.2 Application of Bayes Method

A patient experiences the following symptoms of vertigo.

1. G01 = Yes
2. G02 = No
3. G03 = Yes
4. G04 = Yes
5. G05 = No
6. G06 = No
7. G07 = yes
8. G08 = Yes
9. G09 = No
10. G10 = Yes
11. G11 = Yes
12. G12 = No
13. G13 = Yes
14. G14 = No
15. G15 = Yes
16. G16 = Yes
17. G17 = No
18. G18 = Yes
19. G19 = No

From the symptoms that have been described, the system will carry out the process according to the application of the bayes method. after the calculation process is complete, it will conclude the diagnosis of the disease experienced by the patient.

1. Find the probability value of the disease symptom
   a. Vertigo Central Disease
      P(G01|P01)*P(P01) = 0,10 * 0,41 = 0,041
      P(G03|P01)*P(P01) = 0,27 * 0,41 = 0,110
      P(G04|P01)*P(P01) = 0,29 * 0,41 = 0,118
      P(G07|P01)*P(P01) = 0,34 * 0,41 = 0,394
      P(G08|P01)*P(P01) = 0,15 * 0,41 = 0,061
      P(G10|P01)*P(P01) = 0,12 * 0,41 = 0,049
      P(G11|P01)*P(P01) = 0,85 * 0,41 = 0,348
      P(G18|P01)*P(P01) = 0,27 * 0,41 = 0,110
   b. Peripheral vertigo
      P(G01|P02)*P(P02) = 0,71 * 0,59 = 0,418
      P(G03|P02)*P(P02) = 0,73 * 0,59 = 0,430
      P(G04|P02)*P(P02) = 0,71 * 0,59 = 0,418
      P(G07|P02)*P(P02) = 0,75 * 0,59 = 0,442
      P(G08|P02)*P(P02) = 0,73 * 0,59 = 0,430
      P(G10|P02)*P(P02) = 0,78 * 0,59 = 0,460
      P(G11|P02)*P(P02) = 0,07 * 0,59 = 0,041
      P(G15|P02)*P(P02) = 0,27 * 0,59 = 0,078
      P(G16|P02)*P(P02) = 0,32 * 0,59 = 0,188
      P(G18|P02)*P(P02) = 0,27 * 0,59 = 0,078
2. Summing up the probability value of each symptom
   P(G01) = P(G01|P01)*P(P01) + P(G01|P02)*P(P02)P(G01) = 0,041 + 0,418
   P(G01) = 0,459

   P(G03) = P(G03|P01)*P(P01) + P(G03|P02)*P(P02)P(G03) = 0,110 + 0,430
   P(G03) = 0,54

   P(G04) = P(G04|P01)*P(P01) + P(G04|P02)*P(P02)P(G04) = 0,118 + 0,41

   P(G04) = 0,536

   P(G07) = P(G07|P01)*P(P01) + P(G07|P02)*P(P02)P(G07) = 0,394 + 0,442
   P(G07) = 0,836

   P(G08) = P(G08|P01)*P(P01) + P(G08|P02)*P(P02)P(G08) = 0,061 + 0,430
   P(G08) = 0,491

   P(G10) = P(G10|P01)*P(P01) + P(G10|P02)*P(P02)P(G10) = 0,049 + 0,460
   P(G10) = 0,509

   P(G11) = P(G11|P01)*P(P01) + P(G11|P02)*P(P02)P(G11) = 0,348 + 0,041
   P(G11) = 0,389

   P(G15) = P(G15|P01)*P(P01) + P(G15|P02)*P(P02)P(G15) = 0,078 + 0,031
   P(G15) = 0,109

   P(G16) = P(G16|P01)*P(P01) + P(G16|P02)*P(P02)P(G16) = 0,188 + 0,071
   P(G16) = 0,259

   P(G18) = P(G18|P01)*P(P01) + P(G18|P02)*P(P02)P(G18) = 0,110 + 0,078
   P(G18) = 0,188

3. Calculating the probability value of the disease
   a. Vertigo Central Disease
      P01=P(G01|P01)/P(P01)+P(G03|P01)/P(P01)+P(G04|P01)/P(P01)+P(G07|
      P01)/P(P01)+P(G08|P01)/P(P01)+P(G10|P01)/P(P01)+P(G11|P01)/P(P01)
      P01=(0,41/0,459)+(0,110/0,54)+(0,118/0,536)+(0,394/0,836)+(0,061/0,491)+
      (0,049/0,509)+(0,348/0,389)+(0,110/0,188) P01=0,893+0,203+0,220+0,471+0,124+0,096+0,894+0,585
      P01=2,675

   b. Peripheral Vertigo
      P02=P(G01|P02)/P(P02)+P(G03|P02)/P(P02)+P(G04|P02)/P(P02)+P(G07|

      P02)/P(P02)+P(G08|P02)/P(P02)+P(G10|P02)/P(P02)+P(G11|P02)/P(P02)

      P02=(0,418/0,459)+(0,430/0,54)+(0,418/0,536)+(0,442/0,836)+(0,430/0,4

      9)+(0,460/0,509)+)+(0,041/0,389)+(0,078/0,109)+(0,188/0,259)

      + (0,110/0,188) P02=0,910+0,796+0,779+0,528+0,875+0,903+0,105+0,715+0,725+0,585

P02=6,921

4. Find the Bayes value by summing the probability value of the disease.

∑_gn^n⁒ 〖=P01+P02〗

= 2,675 + 6,921

= 9,596

Calculating disease presentation

a. Vertigo Central

P01= 2,675/ 9,596P01= 0,2787
P01= 0, 2787* 100%
P01= 27,87%

b. Peripheral Vertigo

P02= 6,921/ 9,596P02= 0,7212
P02= 0,7212 * 100%
P02= 72,12%

From the Bayes method calculation process above, it can be seen that the patient suffers from Vertigo disease, namely Vertigo Central (P02) with a value of 0, 7212 or 72.12%.

5. Conclusions and Suggestions

5.1. Conclusions

With the results of the application of the Bayes Method to predicting Vertigo Disease, then the author can take some conclusions, namely conclusions are as follows:

1. In accordance with the formulation of the problem that the author made, the resulting application In accordance with the formulation of the problem that the author made, the resulting application can answer what is the problem in the research, namely, the application of the expert system application can complete the prediction of vertigo disease. Expert system this expert system can also be easily understood by both users or new users.
2. The construction of this expert system as a tool to help find out the disease vertigo quickly and deal with the disease according to the handling what diseases are diagnosed in the system.
3. From the calculation process of the bayes method, it can be seen that the patient one with the inputted symptoms suffers from Vertigo disease, namely Vertigo Central (P02) with a value of 0. Central (P02) with a value of 0.6279 or 62.79%.

5.2. Suggestions

From the results of this vertigo disease diagnosis expert system research, the author provides suggestions, among others:

1. The vertigo disease diagnosis expert system created is still a simple program, which can still be developed to achieve a simple diagnosis.
2. Program, which can still be developed again to achieve an accurate data.
3. Accuracy of the data.
4. This vertigo disease diagnosis expert system discusses 2 vertigo diseases disease that often occurs in patients and can still be developed further with 76 adding some diseases or symptoms through research directed by the original expert.

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