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Expert System To Diagnose Pregnancy Diseases In Women Using Naive Bayes Method

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ABSTRACT

Expert system is a system that uses human knowledge, where the knowledge is entered into a computer, and then used to solve problems that usually require human expertise or expertise. In this case the expert system is used to diagnose pregnancy diseases in women. Pregnancy disease is a condition in which there is a disturbance in pregnancy or the fetus in the womb. An expert system for diagnosing pregnancy diseases in women is an expert system designed as a tool for diagnosing types of pregnancy diseases. Computer programs are intended to provide aids in solving problems in certain areas of specialization such as pregnancy problems in women. This knowledge is obtained from various sources including books and the internet related to the causes of pregnancy in women. The knowledge base is structured in such a way as to become a database with several disease tables and symptom tables to facilitate system performance in drawing conclusions on this expert system using Naive Bayes. This expert system will display a choice of symptoms that can be selected by the user, where each symptom choice will read the user to the next symptom choice to get the final result.

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1. INTRODUCTION

Pregnancy is a process experienced by some women in the world. In going through the process of pregnancy a woman must get the right management. Because it all affect the morbidity and mortality. With these circumstances provide support and spur to provide the correct management during pregnancy[1].

During pregnancy, mother and fetus are an inseparable unit of function. Even though it looks like a healthy pregnancy, it doesn't mean that the mother and fetus are in good condition. However, the lack of information about pregnancy diseases will cause them to only know about the disease that accompanies their pregnancy[2].

A decision support system (DSS) is a component of a computerized information system that comprises a knowledge-based system or knowledge management and is used to aid decision-making in an organization or enterprise. It is also known as a computer system that converts information into information to make decisions regarding semi-structured situations.[3] Decision Support Systems (DSS) are interactive information systems that present, model, and manipulate data. With the above understanding, it is possible to explain that DSS is not a decision-making tool, but rather a system that assists decision-makers in filling in the information needed by decision-makers, which comes from information that has been processed in relevant ways, and in making decisions about a problem with information. A DSS information system is an interactive computer system that assists decision-makers in solving unstructured problems by utilizing various information models.[4]

In this study, naive bayes will be used for the process of diagnosing diseases during pregnancy by entering the symptoms that appear in pregnant women. Through these symptoms, calculations will be carried out to obtain posterior probability values for each class of disease types discussed in this study. Types of diseases that have a high final probability value will be taken as a result of expert system diagnosis.[5]–[8]

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One of the problems that occur in Koto Palembang is the high mortality rate in pregnant women. This is based on data obtained from the National Ministry of Health of the City of Palembang in 2017 which recorded the number of cases of maternal deaths in Palembang as many as 7 (seven) maternal deaths from 27,876 live births. Of the 7 (seven) maternal deaths, the biggest cause of death was gestational hypertension which had a value of 72% (5 people) and the smallest case was bleeding which had a value of 14% (1 person). While the other causes are Diabetes Mellitus (DM), which amounted to 1 person. For this reason, a tool is needed that can provide information on pregnancy diseases along with their handling and prevention to pregnant women and is expected to also help reduce maternal mortality. The tool is meant in the form of an expert system.

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2. RESEARCH METHOD

Research methodology is a framework and assumptions that exist in conducting research. Methodology can also be referred to as systematic research, scientific research, or research based on an existing theory. Research methodology can be in the form of understanding research methods and understanding research techniques. The research methodology contains knowledge that examines the methods used in research.[4], [9]–[11]

Based on the research methodology used in this study, a research framework activity flow can be made as shown in Figure below:

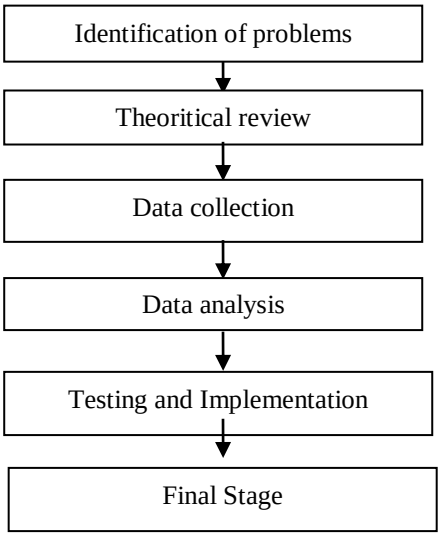

Figure 1. Research Methodology

3. RESULTS AND DISCUSSION

From the symptoms that have been described, the system will carry out the process according to the Bayes theorem method. After the calculation process is complete, it will conclude the disease suffered.

3.1. First define the probability value of each evidence for each hypothesis based on the existing sample data using the Bayesian probability formula.

a. Hipertensi
   G01 = 0,34
   G02 = 0,44
   G03 = 0,44
   G04 = 0,44
   G05 = 0,87
   G06 = 0,40
   G09 = 0,70
   G11 = 0,38
   G12 = 0,80

b. Anemia
   G01 = 0,35
   G03 = 0,45
   G04 = 0,44
   G06 = 0,59
   G11 = 0,49

c. Plasenta Previa

G01 = 0,31
G02 = 0,49

3.2. First define the probability value of each evidence for each hypothesis based on the existing sample data using the Bayesian probability formula.

= P(G01| P01)*P(P01) = 0,34 * 0,34 = 0,1156
= P(G01| P02)*P(P02) = 0,35 * 0,35 = 0,1225
= P(G01| P03)*P(P03) = 0,31 * 0,31 = 0,0961
= P(G02| P01)*P(P01) = 0,44 * 0,34 = 0,1496
= P(G02| P02)*P(P02) = 0 * 0,35 = 0
= P(G02| P03)*P(P03) = 0,49 * 0,31 = 0,1519
= P(G03| P01)*P(P01) = 0,44 * 0,34 = 0,1496
= P(G03| P02)*P(P02) = 0,45 * 0,35 = 0,1575
= P(G03| P03)*P(P03) = 0 * 0,31 = 0
= P(G04| P01)*P(P01) = 0,44* 0,34 = 0,1496
= P(G04| P02)*P(P02) = 0,44 * 0,35 = 0,154
= P(G04| P03)*P(P03) = 0 * 0,31 = 0
= P(G05| P01)*P(P01) = 0,87 * 0,34 = 0,2958
= P(G05| P02)*P(P02) = 0 * 0,35 = 0
= P(G05| P03)*P(P03) = 0 * 0,31 = 0
= P(G06| P01)*P(P01) = 0,40 * 0,34 = 0,136
= P(G06| P02)*P(P02) = 0,59 * 0,35 = 0,2065
= P(G06| P03)*P(P03) = 0 * 0,31 = 0
= P(G09| P01)*P(P01) = 0,70 * 0,34 = 0,238
= P(G09| P02)*P(P02) = 0 * 0,35 = 0
= P(G09| P03)*P(P03) = 0 * 0,31 = 0
= P(G11| P01)*P(P01) = 0,38 * 0,34 = 0,1292
= P(G11| P02)*P(P02) = 0,49 * 0,35 = 0,1715
= P(G11| P03)*P(P03) = 0 * 0,31 = 0
= P(G12| P01)*P(P01) = 0,80 * 0,34 = 0,272
= P(G12| P02)*P(P02) = 0 * 0,35 = 0
= P(G12| P03)*P(P03) = 0 * 0,31 = 0

3.3. Summing up the probability values of each symptom

PG01 = P(G01| P01) * P(P01) + P(G01|P02) * P(P02) + P(G01|P03) * P(P03)
PG01 = 0,1156 + 0,1225 + 0,0961
PG01 = 0,3342
PG02 = P(G02| P01) * P(P01) + P(G02|P02) * P(P02) + P(G02|P03) * P(P03)
PG02 = 0,1496 + 0 + 0,1519
PG02 = 0,3015
PG03 = P(G03| P01) * P(P01) + P(G03|P02) * P(P02) + P(G03|P03) * P(P03)
PG03 = 0,1496 + 0,1575 + 0
PG03 = 0,3071
PG04 = P(G04| P01) * P(P01) + P(G04|P02) * P(P02) + P(G04|P03) * P(P03)
PG04 = 0,1496 + 0,154 + 0
PG04 = 0,3036
PG05 = P(G05| P01) * P(P01) + P(G05|P02) * P(P02) + P(G05|P03) * P(P03)
PG05 = 0,2958 + 0 + 0
PG05 = 0,2958
PG06 = P(G06| P01) * P(P01) + P(G06|P02) * P(P02) + P(G06|P03) * P(P03)
PG06 = 0,136 + 0,2065 + 0
PG06 = 0,3425
PG09 = P(G09| P01) * P(P01) + P(G09|P02) * P(P02) + P(G09|P03) * P(P03)
PG09 = 0,238 + 0 + 0
PG09 = 0,238
PG11 = P(G11| P01) * P(P01) + P(G11|P02) * P(P02) + P(G11|P03) * P(P03)
PG11 = 0,1292 + 0,1715 +0
PG11 = 0,3007

PG12 = P(G12| P01) * P(P01) + P(G12|P02) * P(P02) + P(G12|P03) * P(P03)
PG12 = 0,272 + 0 +0
PG12 = 0,272

3.4. Calculating the probability of disease

a. Hipertensi
P01 = P(G01|P01) / P(P01) + P(G02|P01) / P(P01) + P(G03|P01) / P(P01) + P(G04|P01) / P(P01) + P(G05|P01)/P(P01) + P(G06|P01) / P(P01) + P(G11|P01) / P(P01) + P(G12|P01) / P(P01)
P01 = (0,1156 / 0,3342) + (0,1496 / 0,3015) + (0,1496 / 0,3071) + (0,1496 / 0,3036) + (0,2958 / 0,2958) + (0,136 / 0,3425) + (0,238 / 0,238) + (0,1292 / 0,3007) + (0,272 / 0,272)
P01 = 0,3459 + 0,4961 + 0,4871 + 0,4927 + 1 + 0,3970 + 1 + 0,4296 + 1
P01 = 5,6484

b. Anemia
P02 = P(G01|P02) / P(P02) + P(G03|P02) / P(P02) + P(G04|P02) / P(P02) + P(G06|P02) / P(P02) + P(G11|P02) / P(P02)
P02 = (0,1225 / 0,3342) + (0,1575 / 0,3071) + (0,154 / 0,3036) + (0,2065 / 0,3425) + (0,1715 / 0,3007)
P02 = 0,3665 + 0,5128 + 0,5072 + 0,6029 + 0,5703
P02 = 2,5597

c. Plasenta Previa
P03 = P(G01|P03) / P(P03) + P(G02|P03) / P(P03)
P03 = (0,0961 / 0,3342) + (0,1519 / 0,3015)
P03 = 0,2875 + 0,5038
P03 = 0,7913

3.5. Finding the value of the conclusion of the Bayes theorem by adding up the probability values of the disease.

= 5,6484 + 2,5597 + 0,7913
= 9

3.6. Calculate the percentage of disease

a. Hipertensi
P01 = 5,6484 / 9
P01 = 0,6276
P01 = 0,6276 * 100
P01 = 62,76%

b. Anemia
P02= 2,5597 / 9
P02 = 0,2844
P02 = 0,2844 * 100
P02 = 28,44%

c. Plasenta Previa
P03= 0,7913 / 8
P03 = 0,0879
P03 = 0,0879 * 100
P03 = 8,79%

From the calculation process using the Bayes method above, it can be concluded that the patient suffers from hypertension (P01) with a confidence value of 0.6276 or 62.76%.

4. CONCLUSION

With the results of the expert system application for diagnosis in this patient, several conclusions can be drawn, including the following: Using the Bayes method can provide convenience in determining what disease the patient is suffering from through the symptoms suffered by the patient, this expert system makes it easier for patients to carry out the diagnosis process. This expert system application can help doctors work in examining patients in hospitals, especially regarding pregnancy diseases in women through the symptoms felt by the patient, so with this expert system application even though the doctor is not in the hospital, the patient can still know himself have pregnancy disease in women or not.

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In developing this research, the writer gives some suggestions, namely:
To get a more accurate certainty value, it can be done by applying several other uncertainty handling methods and adding more complete symptoms. It is recommended that the expert system developed can be designed on other platforms, such as mobile so that its application will be wider and can be used by everyone. The design of an expert system for diagnosing pregnancy diseases in women using the Bayes method is built, it needs some improvements both in terms of appearance and content.

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