Expert System Of Syzygium Aqueum Disease Diagnose Using Bayes Method

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Abstract. This research examines how to design an application of an expert system to diagnose Syzygium aqueum (burm.f.alston) plant diseases so that it is easier to detect diseases in the Syzygium aqueum (burm.f.alston) plants. This study uses the Bayes method to be more precise because it is based on the probability value of disease symptoms that arise in Syzygium aqueum (burm.f.alston) plants. In this research, the authors used a web-based application with the Bayes method. The results or outputs from this application provide the probability value of disease certainty and then the hypothesis is chosen with the largest value.

1. Introduction

In farming, several things must be considered, including soil fertility, rainfall, recognition of symptoms that can damage plants, and how to care well and correctly, such as in planting Syzygium aqueum (burm.f.alston). Sometimes Syzygium aqueum (burm.f.alston) plants also cannot bear fruit, all of which can be affected by plant diseases in the form of parasites or pests, which can affect unsatisfactory results so that farmers suffer losses, especially parasites and plant pests can come at any time, the disease that Syzygium aqueum (burm.f.alston) attacks generally a group of fungus such as root rot disease caused by the fungus Armillaria mellea and Phytophthora sp [2].

In general, the expert system is one of the fields of computer science that utilizes computers so that they can behave intelligently like humans [16][18]. Bayes method is an expert system method, Bayes method is useful for determining the probability value of expert hypotheses and the value of the evidence obtained from facts obtained from the object being diagnosed.

The expert system is a branch of artificial intelligence (AI) which is quite old because this system was developed in the mid-1960s [3][16]. The expert system is a system that seeks to adopt human knowledge into computers so that computers can solve problems as is usually done by experts [5][6][7][9][11][12][13][14][15][17]. Part of the expert system consists of 2 main
components, namely the knowledge base that contains knowledge and conclusions that conclude. These conclusions are responses from expert systems or user requests [1][4][8][10].

2. Methods
The framework that will be carried out by researchers to find data and information that will help in making research is as follows:

2.1. Data Collection Method
This research is a quantitative method with direct studies or surveys. This method uses several questions or closed statements with the choice of answers that have been provided.

2.2. Bayes Method
Bayes’ theorem was put forward by a British Presbyterian priest in 1763 named Thomas Bayes and later perfected Laplace. Bayes’ theorem is used to calculate the probability of an event occurring based on the influence obtained from observations [19].

The Bayes method formula is:

\[ P(H|E) = \frac{P(E|H)P(H)}{P(E)} \]  

(1)

2.3. Data Analysis Stage
Analysis of disease data by linking to symptom data. so hopefully the results obtained will be more accurate and describe the condition and the population as a whole. This process consists of:

- Identification of problems
- Purpose: Design and carry out the determination of syzigium(burm.f.alston)
- Literature review
- Data Collections: Observation and interviews
- Data analysis: Bayes method calculation
- System planning with UML
- System implementation

3. Results And Discussion
Analysis of the diagnosis of Syzygium aqueum (burm.f.alston) by Bayes method can be explained as follows:

3.1. Determine the probability value
First, define the probability value of each evidence for each hypothesis based on existing symptom data.

\[ G01 = P( E | H1) = 0.4 \]
\[ G03 = P( E | H3) = 0.4 \]
\[ G07 = P( E | H7) = 0.95 \]
\[ G08 = P( E | H8) = 0.3 \]
\[ G10 = P( E | H10) = 0.5 \]
\[ G11 = P( E | H11) = 0.4 \]
Table 1. Basis for disease value rules.

| Symptom code | Name symptom                          | Value P1 | Value P2 | Value P3 |
|--------------|---------------------------------------|----------|----------|----------|
| G01          | The tips of the leaves are smaller and yellowing | 0.4      | 0        | 0        |
| G02          | Fruit rot and fall                     | 0        | 0.8      | 0        |
| G03          | Young shoots dry up and die            | 0.4      | 0.4      | 0        |
| G04          | Old leaves look brown or black patches | 0        | 0.3      | 0        |
| G05          | The upper leaf surface is covered in a black layer | 0        | 0        | 0.4      |
| G06          | There are aphids                       | 0        | 0        | 0.4      |
| G07          | Root rot                              | 0.95     | 0        | 0        |
| G08          | Bud growth is not healthy             | 0.3      | 0        | 0        |
| G09          | Falling leaves                        | 0        | 0.3      | 0        |
| G10          | There is a wound on the root          | 0.5      | 0        | 0        |
| G11          | Plants wilt, dry and die              | 0.4      | 0        | 0        |

3.2. Determine the value of the universe
Look for the value of the universe by summing the probability of each phenomenon.
Total $P(E|H_i) = P(E|H_1) + P(E|H_2) + \cdots + P(E|H_n)$
- $G01 = P(E|H_1) = 0.4$
- $G03 = P(E|H_3) = 0.4$
- $G07 = P(E|H_7) = 0.95$
- $G08 = P(E|H_8) = 0.3$
- $G10 = P(E|H_{10}) = 0.5$
- $G11 = P(E|H_{11}) = 0.4$
Total $P = 0.4 + 0.4 + 0.95 + 0.3 + 0.5 + 0.4 = 2.95$

3.3. Calculate the probability value of $H$ regardless of any evidence
$$P(H_i) = \frac{P(H_i)}{\sum P(H_i)}$$
- $G01 = P(H_1) = 0.4/2.95 = 0.13$
- $G03 = P(H_3) = 0.4/2.95 = 0.13$
- $G07 = P(H_7) = 0.95/2.95 = 0.32$
- $G08 = P(H_8) = 0.3/2.95 = 0.10$
- $G10 = P(H_{10}) = 0.5/2.95 = 0.16$
- $G11 = P(H_{11}) = 0.4/2.95 = 0.13$

3.4. Calculates the Bayes value of each hypothesis
$$P(H_i|E) = \frac{P(E|H_i) \times P(H_i)}{P(E)}$$

(2)
3.5. Determine Bayes Value

\[ \sum_{n} G_n = (P(E|H_1) \times P(H_1|E_1)) + \ldots + (P(E|H_i) \times P(H_i|E_i)) \]  

\[ (0.4 \times 0.091) + (0.4 \times 0.091) + (0.95 \times 0.533) + (0.3 \times 0.052) + (0.5 \times 0.140) + (0.4 \times 0.091) = 0.699 \]

3.6. Calculate the percentage value of Bayes

0.699 \times 100\% = 69.9\%

From the calculation process using Bayes method above, it can be seen that the Syzygium aqueum (burm.f.alston) has a root rot disease with a confidence value of 0.699 or 69.9%.

Implementation system begins with selecting the disease symptoms in the plant, and the results of prediction with Naive Bayes algorithm will be displayed as in the figure 1, figure 2 and figure 3.

Figure 1. Symptom data in the plant

Figure 2. Rule base
4. Conclusion

Based on the results of the process of designing and manufacturing an expert system in diagnosing diseases in the Syzygium aqueum (burm.f.alston) using the Bayes method, the authors conclude among others are:

a. Problems that occur concerning the symptoms that arise can be solved by applying the Bayes method.

b. By applying the Bayes method to diagnose diseases in the Syzygium aqueum (burm.f.alston) can be adjusted according to symptoms and use weights to be used with these algorithms.

c. A system built with the Web programming language to diagnose the disease Syzygium aqueum (burm.f.alston) quickly and accurately.

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