Improve Agricultural Production by Making the Right Decisions for Crop Diseases

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Abstract: **Infectious plant diseases can cause infections, infections, and infections. Infection and Infection. Small organisms infect plants and lose nutrients. Bacteria Insects. Many types of application domains are essential to identify measurement types. This is probably the most important part of a proper diagnostic system. Decisions about crop diseases must be made by the Proposed Decision Support System (DSS). It is a unified computing device which allows decision makers to communicate directly with computers. This system proposes a decision-support system for separating crops using Bayesian Analysis. A key feature of the proposed system is to provide an integrated tool for diagnostic applications. This paper is making the right decisions for crop diseases to improve agricultural production. Therefore, a careful review of the symptoms reported may help with symptoms. The main purpose of this system is to give people information about the diseases they want to know.**

Keywords: **Agricultural Production, Crop Diseases, Bayesian Classification, Classifier accuracy, Naïve Bayesian Classification.**

I. INTRODUCTION

A crop disease may involve a dangerous deviation or change from a normal physiological process. As a result, diseased plants interfere with normal life processes and their vital functions.

The simple knowledge is that if the decision support data is not fine agreed, we can usage the computing power of computers to help us discover patterns in the data. Decision Support System (DSS) supports users help make decisions. It is built in a range of techniques to categorize data.

The background of the system starts with the collection of features during their lifetime. The knowledge gained represents the development of the Decision Support System (DSS) based on Bayesian Classifiers. The system stores records of human experts' knowledge and past events.

Based on stored knowledge, the system uses Bayesian Analysis to determine patterns based on the characteristics of plants. An example is the possibility of a student, especially a class. There are advantages, including simple classification and calculation methods. Comparison with other types The Bayesian classifier is simple and efficient. First, it's easy and easy to calculate. Second, it is easy to combine multi temporal data.[3]

Understanding the disease and development process is the first step towards successful disease management. There are a few special conditions that support disease development. First, some diseases may be caused by certain diseases. Second, weather conditions weaken the factory. Therefore, the plant is weak to combat disease. So the disease acts like a cherry on top. All of these factors come together (potentially crop, abiotic stress, infection) and cause disease at the same time. It is called the Industrial Pyramid. Figure 1 shows the plant disease pyramid. [10]

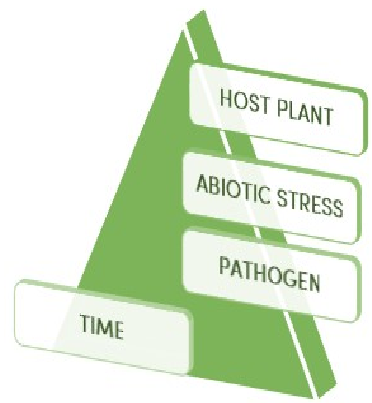

Figure 1: Plant Disease Pyramid [10]

II. RELATED WORK

In any agricultural production system, accumulation and integration of related knowledge and information from many diverse sources play important role. Agriculture specialists and previous experiences are the common sources to provide information that the different stakeholders require for decision making to improve agricultural production.

Agricultural specialists' assistance is not always available when the need arises for their help. Such system is especially useful for those farmers who are not getting the agricultural specialists for their help to control problems in their crop diseases. At present there are many more classification algorithms for example classification based on decision tree, Neural Networks, Genetic algorithms, Bayesian classification etc [7].

Bayesian classification is one of the classification methods successfully applied to the diagnostic problems. An advantage of the naïve Bayes classifier is that it requires a minor quantity of training data to guess the factors basic for classification. For the reason that autonomous variables are expected, only the alterations of the variables for each class need to be determine [9].

The procedure in this system has several benefits. This system supports users in classifying crop diseases based on the symptoms of the plants. The users easily test by inputting the symptom data. Thus system can support to help in decision the user in crop diseases. So the users get treatment early-before it spreads. Early detection is the best action to reduce disease spread and avoid losses.

The purpose of this system is to demonstrate the suitability and ability of the Naïve Bayes methodology in classification problem. The classification results were consistent with some of the highest results obtained from other classifiers.

III. BACKGROUND THEORY

The essence of the Bayesian approach is to present mathematical rules. Your new evidence explains how you can change your current beliefs. In other words, it allows scientists to combine their current knowledge or skills and information. By using a training database, Bayesian categorization uses a method based on Bayes' Theorem to determine the probability of associating certain classes in some cases, which represent the values of the predicted variables.

The information is manipulated, analyzed, and interpreted through comparison with available expert knowledge as part of the decision process. The information is processed to produce a 'decision support' instead of a decision. The choice that one is the duty of the user. Rather than substituting the decision maker, the DSS helps the decision maker select among available actions by providing additional information. A decision effects in an action to be performed within the crop situation. After the action is implemented, the environment is again monitored to instigate a new sequence of data flow. [11]

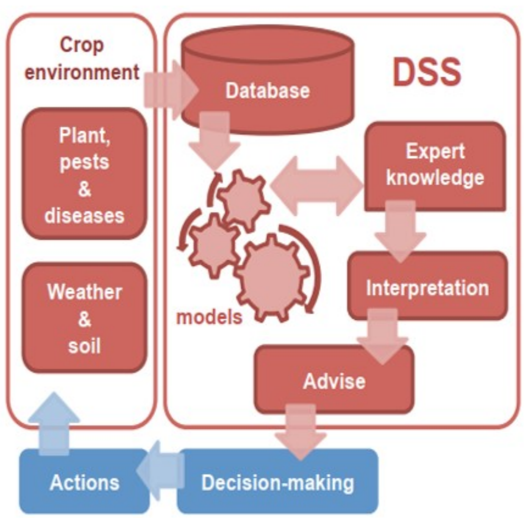

Figure 2: Scheme of an innovative Decision Support System (DSS) for plant disease management [11]

Naive Bayes can provide an exact example. Because the attribute is not related to the class. Although this concept of independent property does not reflect reality in many areas, this approach is effective and effective. The Naïve Bayes method is particularly suitable for large volumes (inputs). Despite its simplicity, the Na Bayve Bayes mark surpasses sophisticated algorithms in many specific areas.

Bayesian classifier is founded by Bayes' theorem.

$$P\,(Ci/\,X) = \frac{P(X/H)P(H)}{P(X)} \qquad \text{------- (1)}$$

Let X be a data tuple, X is considered "evidence". X belongs to the specified class of C.

P (X/H) is the posterior probability, or *a* posteriori probability, of X conditioned on H.

A posterior probability is a probability value that has been studied by using extra information that is future obtained P (H) is the prior possibility, or *a* priori probability, of H.

A previous possibility is an early probability value initially achieved before any additional is obtained.

3.1. Naïve Bayesian classifier

Bayesian classifier is created on Bayes' theorem. Let D be a training set of tuples and their related class labels. As usual, each tuple is represented by an n-dimensional attribute vector X=(x1, x2,x3, …..,xn), depicting measurements made on the tuple from n attribute respectively, (A1 , A2 , A3 , ….., An).

Support that there are m classes C1, C2… Cm. Given a tuples, X, the classifier will predict that X belongs to the class having the highest posterior probability, trained on X. The Naive Bayesian classifier forecasts that tuple X belongs to the class C if and only if

P (Ci / X) > (Cj / X)

For i<= j <= m, j! = i . --- (2)

Thus we maximize P (Ci/ X). The class Ci for which P(Ci/ X) is maximized is called the maximum posteriori hypothesis.

By Bayes' theorem

$$P\,(Ci/\,X) = \frac{P(X/Ci)P(Ci)}{P(X)} \qquad \text{---- (3)}$$

As P(X) is constant for all classes, only P(X/Ci) P (Ci) need be maximized. The class prior probabilities may be assessed by

$$P\,(Ci) = \frac{Si}{S} \qquad \text{------ (4)}$$

Where Si is the number of training example of class Ci and S is the total number of training models.

To compute $P(X/Ci) = \prod_{k=1}^{n} P(xk/Ci)$ ------- (5)

The probabilities P(x1/Ci), P(x2/Ci)….P (xn/Ci) can be estimated from the training samples.P (x) this can be computed from the identity,

$$P(X) = \sum_{i=1}^{n} P(x/Ci)P(Ci), \quad \text{-------- (6)}$$

where the sum is over all classes.

3.2. Classifier Accuracy

Two main metrics for the Na Bayve Bayes classifier were calculated using the correct classification rate (%) at both training and testing levels to assess the accuracy of classification. 100% Vulnerability means that the test recognizes the bad crop. Therefore, high sensitivity testing is used to exclude disease. The accuracy of 100% is that the test recognizes healthy crops. Therefore, positive results are used in a highly specific test to confirm the disease.[4]

By training data come a classifier or forecaster and then to guess the accuracy of the resulting erudite model can outcome in deceptive overoptimistic approximations due to overspecialization of the learning algorithm to the data. The correctness of a classifier on a known test set is the percentage of test settuples that are correctly classified by the classifier.

$$\text{Sensitivity} = \frac{t-pos}{pos} \quad \text{----------- (7)}$$

$$\text{Specificity} = \frac{t-neg}{neg} \quad \text{----------- (8)}$$

$$\text{Précision} = \frac{t-pos}{(t-pos+f-pos)} \quad \text{-----------(9)}$$

Where, t_pos is the number of true positive

- pos is the number of positive
- t_neg is the number of true negative
- neg is the number of negative
- f_pos is the number of false positive

Display that accuracy is a function of sensitivity and specificity:

$$\text{Accuracy} = \text{sensitivity} \frac{pos}{(pos+neg)} + \text{specificity} \frac{neg}{pos+neg} \quad \text{--------- (10)}$$

The true positives, true negatives and false positives are also valuable in measuring the cost and benefits associated with a classification model of this classification have been computed in addition, to give a deeper insight of the automatic diagnosis.

IV. OVERVIEW OF THE SYSTEM

The system uses the Bayesian classification of crop diseases to use train information. Bayesian classification statistics. They can foresee the likelihood of a member of the class as a given example, especially of a class. When applying to large databases, Bayesian categorizers exhibit a high degree of accuracy and speed.

4.1. System Design

The user enters symptoms of the plant characteristic as input to the system. Using the Bayesian Analysis decide the probability based on the input symptoms of the plant characteristic. The system displays the resulted decision for disease and suggestion for treatment. Thus system displays the accuracy result. It uses Bayesian classifier to classify the disease.

4.2 Implementation of the System

Bayesian Classification is used to obtain the training data. The decision for crop disease classification is supported by 21 values and 5 different markings (insects, fungi, viruses, bacteria, etc.) that support this decision. We use this Bayesian analysis as an example to estimate the accuracy of this system. The training data set has records.When we fill out the information required for the system, we can see the result of the factory. Figure 3 shows typical training information is provided on the test table. And the system gives you suggestions for treatments.

@attribute plant name	{Bean, Rice, Sesamum}
@attribute period	{Jan, Feb, Mar, Apr, May, Jun, Jul, Aug, Sep, Nov, Dec}
@attribute parts of plant	{fruit, leaf, stem, root, stalk, ear of rice, plumule, seed, sheath, flower}
@attribute location	{top, bottom, upper, lower, inner, no}
@attribute shape	{spot, round, circle, rod, rectangle, ellipse, line, knot, scratch, concave, bore, pod bore, cell, shuttle, no}
@attribute color	{yellow, green, white, black, brown, red, straw, orange, grey, brick, rust, violet, no}
@attribute color level	{light, median, strong, dim, no}
@attribute wilt	{yes, no}
@attribute stunt	{yes, no}
@attribute drop ground	{yes, no}
@attribute dry	{yes, no}
@attribute cutting	{yes, no}
@attribute burn	{yes, no}
@attribute blast	{yes, no}
@attribute roller	{yes, no}
@attribute binder	{yes, no}
@attribute rot	{yes, no}
@attribute powder	{yes, no}
@attribute faces	{yes, no}
@attribute life object	{larval, adult, no}
@attribute egg	{yes, no}
@attribute result	{insect, bacteria, virus, fungicide, no}

Figure 3: Training Information

This system intends to implement the decision support system for classifying crops diseases and help in diagnosing it. It uses Bayesian classifier to classify the disease. Expert knowledge is collected from the agriculture experts, plant pathologists and literature and the system also learns from the past experiences. It will prepare the training data using the expert knowledge stored. When the new case (crop) arrives, the system will check the symptoms and find the probabilities of each class based on the attributes (symptoms). For example, the probability Attribute plant name, to become the class insect is 0.2. Then it calculates with multiple attributes and finds the best probability and classifies the disease.Figure 4 shows sample train data for classification.

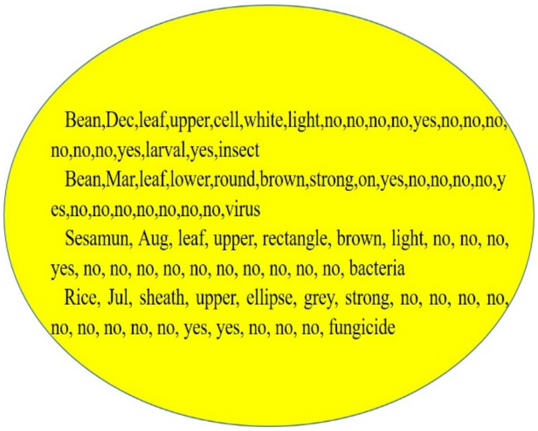

Figure 4: Sample Training Data

V. LIMITATION AND FURTHER EXTENSION

This system uses only Bayesian categorization. Future work will extend Bayesian analysis to work on other classification methods for accurate classification. Further investigation is expected to be a useful treatment for the crop.

VI. CONCLUSION

Classification is to search for data classes or concepts and to identify patterns. Bayesian classification is based on the Bayes theory. Naive Bayesian categorization focuses on the Bayesian formula to calculate the likelihood of each class assigning the values of all attributes. This system can help to identify other diseases from the crop. This paper may assist the Department of Agriculture Research. This document provides accuracy when there is a lot of information available. By using this system, the computer will be able to make the best decisions. This means more accurate and effective diagnosis for crop diseases. Currently, information search is a powerful technology in the computer field.

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