CROP ROTATION AND YIELD ANALYSIS USING NAIVE RATIO CLASSIFICATION

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Abstract

Crop rotation and yield analysis is the methodology of predicting and analyzing what crop can be cultivated during the particular month and the yield of that crop prior to harvest. This will help us to predict the crop yield by suggesting the best crop that can be cultivated to improve the quality and profitability of the agricultural sector by processing the given datasets. The objective of this work is to construct a crop yield predictor for farmers that will give suggestions by analyzing various attributes in the historical dataset that were surveyed across Tamil Nadu. A decision support system has been designed using the predicted results and it works by getting basic inputs from the farmers and system will suggest what type of crops can be cultivated to get better yield.

Keywords—naive ratio; yield; preprocessing; prediction; analysis

I. INTRODUCTION

Agriculture is the backbone of our country, it plays a major role in improving our countries economy. But it has been noticed that due to changes in climatic conditions and other factors, the farmers are not able to predict the yield. They were not able to guess what crops will suit for their land and soil type due to environmental factors. Foremost the farmers are not aware of what type of crop can be cultivated during that particular month. Therefore, efforts should be taken to develop innovative approaches for sustainable crop production. The crop yield prediction framework suggests the farmers, investors and other stack holders for better improvement in the agriculture sector.

1.1. Benefits for farmers

Crop yield analysis depends on some of the complex, interconnected set of attributes or parameters that include different economic, agricultural, management, monitoring and meteorological factors. The set of relevant features are selected for constructing the predictive model. A decision support system is designed using the predicted results and this works by getting basic inputs from the farmers and it will suggest what type of crops can be cultivated to get better yield. It will help Farmers to adjust the harvesting, planting times, available water and nutrients level by irrigating and adding the fertilizer to their cultivating area. This will help the farmers to make smarter decisions by collecting and analyzing simple real time data on land type, soil type, soil texture, and NPK levels.

II. RELATED WORK

The variation due to climate, soil, rainfall, pests and management decisions contribute complexities in growing crops. For making these prediction Bayesian network can be used. Farmers adjust planting and harvesting times, according to

the available water and nutrients by irrigating and adding the fertilizer. Different classifiers like (NB, TAN, and GB) are compared, it shows that NB classifier predicts a multi-modal distribution with largest amount of yields predicted [1]. The pros and cons of Bayesian network especially in the context of environmental modeling and management were analyzed. They provide a method for avoiding over fitting of data they can show good prediction. The Bayesian network is suitable for small and incomplete data sets. The challenge is that Bayesian networks can, however deal with continuous variables in only a limited manner [2]. Using a directed acyclic graph, the relationships between crop diseases and its symptoms had been represented. The meteorological conditions were studied by establishing Bayesian networks to predict the attack on crop and based on that prevention work is done. There is a large number of uncertain knowledge in the diagnosis of crop pests, while Bayesian network has unique advantage in dealing with uncertain factors [4]. The ability of farmers to predict crop productivity under different climatic conditions, can help the farmers in making some important decisions in terms of agronomy related factors and crop choice to get better yield. This paper proposes a decision support system for Maharashtra state, India for the purpose of rice crop yield prediction. A Graphical User Interface (GUI) has been created in Java using Net Beans tool and Microsoft Office Access database for the ease of farmers and decision makers. Some of the constraints are uneven precipitation, climatic conditions, land, labor, fertilizer, herbicides, pesticides, quality of soil etc. Hence by improving the prediction level the better decision support system can be developed [7].

III. RESEARCH METHODS

This section deals with the method used for this implementation and includes the details of the data sets and methodology that were used.

3.1. Dataset Used

The datasets used in this process was sourced from the freely accessible government records of our agricultural sector. A limited number of attributes or parameters which have the most significant effect on improving the crop production range were chosen for the analysis from the available large dataset.

- Soil type: The mostly commonly used soil types were selected they are, red sandy soil and black soil.
- Soil texture: Soil texture is the relative proportions of the sand, clay and silt particles that were present naturally in the soil. The soil texture is classified as, sandy clay loam soil, clay loam soil and loam soil based on these texture the dataset can be classified.
- Land classification: The crop cultivated land can be classified into dry land, garden land and wet land inorder to find the crop type for every month based on land type.
- NPK: It is a major constituent for plant growth but soil often lack these elements either by nature, or as a result of over cultivation of crop to get high yield, the decrease in these levels creates a need to have these building blocks put back into it is really important. NPK fertilizer is composed of three major elements, they are: Nitrogen, Phosphorus, and Potassium, each of these is essential part in supplying nutrition to plants.

- Yield (Tonnes/Acre): Depending on crop cultivated for every year each of the calculated yield was considered for the present research.

IV. METHODOLOGY USED

The phase carries out the following steps

4.1 Dataset Preprocessing:

Dataset preprocessing is the process to extract the needed attributes for the analysis of the crop yield productivity. This preprocessing was done for the extensive extraction of the attributes and the conversion of the text file into the excel format and then into understandable database table format. The attributes include the following:

Soil_type, soil_texture, soil_nitrogen, soil_potassium, soil_phosphorus, fertilizer, month, cropname, landclassification, irrigation_area, cultivationarea, productivity, production.

It classifies the attributes for the selection of particular needed features based on the soil type. And the classified selected dataset is given as the input to the classification, grouping analysis.

4.2. Analysis of the crop yield productivity using the Visual Studio2012:

Microsoft Visual Studio from Microsoft is an integrated development environment. It is used for developing the computer programs for windows platform, as well as it is used to develop web sites, web apps, mobile apps and web services. C# developed by Microsoft is a modern, simple, general purpose and object oriented programming language, built within its .NET initiative. The GUI was designed using .Net framework and the classification, analysis was done by using C# and the data manipulation has been taken by sql. Here the data preprocessing, classification and grouping can be done by using the c#. Access to SQL databases for processing of the results was through the use of c# Database connectivity. The dataset collected was preprocessed, classified and then stored in database in the form of tables.

For the present study naive ratio algorithm has been proposed and executed with selected parameters. The performances of both the classifiers were compared to conclude which classifier performed better for the current dataset which helps farmers to get faster decisions.

4.3. Analyzing the results:

Cross validation, it is also called rotation estimation, is a way to analyze how a predicted data mining model will perform on an unknown dataset. Based on the ranges given on the GUI the NPK calculation has been done and then those results are compared with the stored existing dataset and the final crop yield productivity has been determined. Figure 1 shows the work flow of the model.

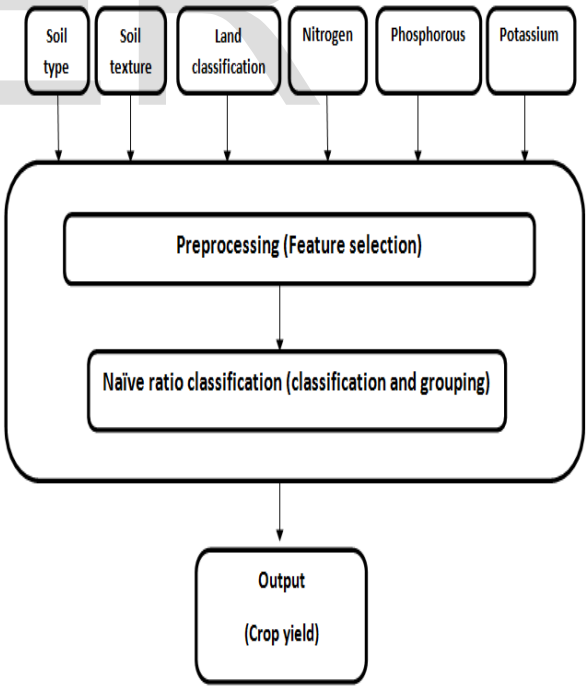

Figure 1 Work flow diagram

4.4. Experimental analysis and performance evaluation:

The performance of all the classifiers was evaluated by based on the query execution time and accuracy. The classifier works based on the formulation and declarations and it is given below,

Declaration:
Soil Type: ST
Land Type: LT
Soil Text: STX
N: Nitrogen
P: Phosphorus
K: Potassium

Initialization has been done to the ST, LT, STX, N, P, K values and based on those range values, crop productivity is analyzed.

Calculate:
ST: N, ST: P, ST: K.
LT: N, LT: P, LT: K
STX: N, STX: P, STX: K
This calculation is done for all the soil type, land type, soil texture separately with that of the N, P, and K.
Finalize (ST: N, P, K: LT: N, P, K: STX: N, P, K)

Based on this finalized result the crop yield productivity is analyzed and the fertility suggestion is given to the farmers. Figure 2 represents the calculation of crop yield productivity using the above algorithm and its values are given in Table 1. Figure 3 represents graphical view of crop yield for better understanding of farmers.

Obtained output:

Result

jan	feb	mar	apr	may	jun	jul	aug	sep	oct	nov	dec	cropname	production
no	yes	yes	no	no	no	no	no	no	no	no	no	cholam	2434
yes	yes	yes	no	no	no	no	no	no	no	no	no	sunflower	75
yes	yes	no	no	no	no	no	no	yes	yes	yes	yes	bajra	265
yes	yes	yes	no	no	no	no	no	no	no	no	no	onion	28900
no	no	no	no	no	no	no	no	yes	yes	no	no	mango	35
no	no	no	no	no	yes	yes	yes	yes	yes	yes	no	mango	1544
yes	yes	no	no	no	no	no	no	no	yes	yes	yes	sunflower	1325
no	yes	yes	no	no	no	no	no	no	no	no	no	bajra	725
no	yes	yes	no	no	no	no	no	no	no	no	no	bajra	1544

Figure 2 Result of crops to be cultivated during particular months and its yield.

Table 1 Shows the crop name and its yield

CROPS	YIELD IN KILOGRAMS
Mango	35
Paddy	180
Bajra	1080
Tomato	280
Cholam	940
Black gram	280
Ragi	340

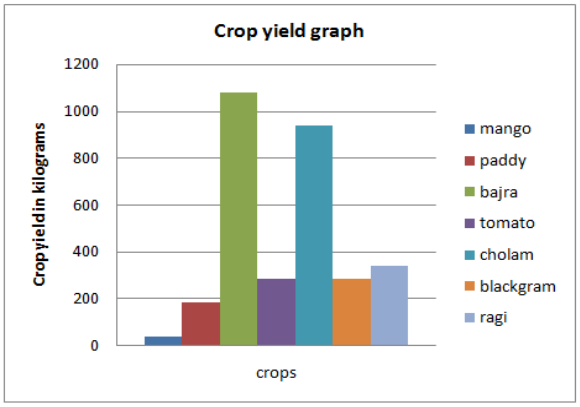

Figure 3 Graphical representation of crop yield

4.5. Performance evaluation:

The performance of the classifier was evaluated based on execution speed. This mainly depends on the query execution speed of the classifier, it has been found that the performance of naive ratio (Figure 4) is better than the naive bayes (Figure 5) and it gives better results. The comparison is shown below:

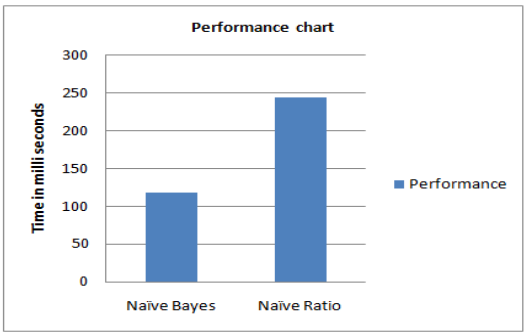

Figure 4 Performance of naïve bayes and naïve ratio algorithm.

V. CONCLUSION

The objective of this paper is to help the farmers to make smart decisions based on their basic knowledge. This also suggest them about what sort of crops can be cultivated based on their nitrogen, phosphorous and potassium levels present in their soil and also give suggestion about fertilizers to be added to enhance the productivity. The will also help them by giving the yield for each crop on cultivating during some particular month based on that the farmers can rotate the crop to earn higher profit. Implementation of this concept would help farmers to produce higher yield. By using the above methodology input factors can be minimized and output can be maximized in precise way. Another benefit of this concept is adjusting the rotation of crop based on the environmental factors. Based on these the farmers can plant right crop at right time and the yield can be predicted for their respective land area in advance. Hence predictive analysis plays a major role, in future agriculture.

VI. REFERENCES

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