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A COMPREHENSIVE SURVEY ON AGRICULTURE ADVISORY SYSTEM

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Abstract - *Agriculture has a major role in the country's social and economic development and progress. Farmers' failure to select the appropriate crop for cultivation is a major source of crop productivity loss. There is currently no mechanism to advise farmers on which crops to plant. Predicting the appropriate crops to produce and suggesting proper fertilizers to improve crop output well before the harvest. The prediction method is appropriate for data science applications since it incorporates a large number of databases. Using data science, we extract insights from vast volumes of data. The system gives a research paper on the various machine learning algorithms for forecasting the best crops and fertilizer recommendations. The accuracy with which features have been extracted also with efficient classifiers being used are the critical factors in any crop prediction system's performance.*

Key Words: **Data science, GDP, Naïve Bayes algorithm, KNN, Random Forest, GUI, Crop prediction, Data Mining**

1. INTRODUCTION

Agriculture is India's primary source of income and it is indeed an example of a sector that generates only about 14% of GDP yet has a significant impact on the Indian economy. Better practices are required to increase the yield of the crop as well as the living of farmers as well. Agriculture has evolved as a result of globalization, adopting the latest technologies and practices for a higher level of living. Precision agriculture is one of the newer technologies and approaches in the world of agriculture. Precision agriculture is primarily concerned with farming on a site-by-site basis. Crop and fertilizer recommendations are one of the most important aspects of precision agriculture. Crop suggestion is based on several factors, and precision agriculture technologies aid in detecting these factors, allowing for improved crop selection. A systematic evaluation of enormous volumes of data being gathered from various variables including the parameters like soil quality, temperature, pH, N, urea, P, K, humidity, and so on is required to predict a crop in advance.

Understanding the relative contribution of climate elements to agricultural output could give farmers useful knowledge on crop planting and management in the face of climate change. Machine learning approaches can predict appropriateness levels based on input and training data using a variety of methods. These machine learning models, as well as the performance of each method, are compared to the hybrid technique. We predict crops and offer the necessary fertilizers to improve agricultural output in the proposed work. For crop production estimation and fertilizer recommendations, we employ a variety of agriculture characteristics. Supervised learning algorithms are used for the recommendations such as either "Bayesian classifier" or "K nearest neighbour" or "Random Forest" algorithm. These algorithms are preferred as they work efficiently, generate faster results, and also work for all formats of data also, few survey papers suggest these algorithms are efficient and good for agriculture data-sets.

2. LITERATURE REVIEW

1. Developing innovative applications in agriculture using data mining was offered by Sally Jo Cunningham and Geoffrey Holmes. The methods involved in this are Weka classifiers: ZeroR, OneR, Naïve Byes, Decision Table, Ibk, J48, SMO, Linear Regression, M5Prime, LWR, Decision Stump and association rule include apriori algorithm and also it includes the EM clustering algorithm for the purpose of clustering. This produces a classifier, which is frequently in the decision tree form or a collection of guidelines that can be used in predicting the categorization of newer data instances. This approach recognises that machine learning technology is still expanding and improving, with learning algorithms that must be delivered to the peoples system who deal with the data and are also familiar with the application domain from which it originates. Weka is a huge step forward in bringing machine learning into the workplace.

2. D Ramesh, and B Vishnu Vardhan detailed Data Mining Techniques and Applications to Agricultural Yield Data. The KNN and K-Means Algorithms are used in this. The system can anticipate the average yield production by examining the cluster to which the forecasted rainfall belongs in this procedure, given the rainfall in a specific year. It also mentions that the K-Means algorithm can split samples into clusters, but no consideration is given to the substances that cause this partition. This type of information can be obtained using bi-clustering.

3. Monali Paul, at el. Described the Analysis of soil Behaviour and Prediction of Crop Yield using the Data Mining Approach

in the year 2015. For its system to work, it employs the KNN and the Naïve Bayes Algorithm. This demonstrates that the category with the highest confidence value is projected to be the category of that specific soil. It also suggests that this research can assist soil analysts and farmers in determining which land to seed on in order to maximise agricultural yield.

4. Ami Mistry and Vinita Shah described the Brief Survey of data mining Techniques Applied to applications of Agriculture in the year 2016. This system employs a variety of approaches, including Linear Regression, KNN, Regression Tree, and SVM for classification. K-means clustering, Self-organized maps, Density-based clustering, and Weight-based clustering are examples of clustering techniques. The results indicate that rice production variability is influenced by sunshine hours and daily temperature variation in the current research area. According to this, farmers might plant different crops in different regions based on basic forecasts produced by this research, and if that happens, every farmer would have a chance to boost the country's overall productivity.

5. Yogesh Gandge, and Sandhya described A Study on Various Data Mining Techniques for Crop Yield Prediction in the year 2017. This system uses a Classification Algorithm. The agricultural yield prediction per acre is the outcome, along with some recommendations. It is noted that the method used by most experts does not employ a unified approach in which all elements impacting crop production can be used simultaneously for crop yield prediction.

6. Md. Tahmid Shakoor, et al. described Agricultural Production Output Prediction Using Supervised Machine Learning Techniques in the year 2017. This system uses the KNN algorithm, Decision Tree algorithm, and ID3 (Iterative Dichotomis) algorithm. Without eliminating the dataset's outliers, the Decision Tree Learning- ID3 approach produces a lower percentage error value than the KNN technique. Though the study is confined to a single set of data, more data will be added in the future, which will be analyzed using more machine learning algorithms to provide more precise crop predictions.

7. Umid Kumar Dey et al. described the Rice Yield Prediction Model Using Data Mining in the year 2017. This system uses the k-means algorithm, Linear Regression, SVM Regression, and Modified Non-linear Regression. This system has been found to be quite good at predicting yields, with SVM regression providing the best performance. The modified Non-linear regression equation is found to perform better than the other three predefined models. It also establishes that the MNR equation is the most appropriate.

8. Kuljit Kaur and Kanwalpreet Singh Attwal proposed "Effect of Temperature and rainfall on Paddy yield using Data Mining in the year 2017. They used the Apriori Algorithm for their study, which gave the result that predicts the growth of the paddy yield. This depended on various parameters like Rainfall and Temperature. In the end, they concluded that with the increase in rainfall the paddy yields also increased. During the reproductive phase, the rainfall and temperature did not influence, and also during the maturation phase, the yield was better expected at the lower temperature and worse at a higher temperature.

S.No.	Title	Author	Method used	Results
1.	Developing innovative applications in agriculture using data mining.	Sally Jo Cunningham and Geoffrey Holmes	Weka classifier: ZeroR, OneR, Naive Bayes, Decision- Table, Ibk, J48, SMO, Linear Regression. Association Rules: Apriori Algorithm Clustering: EM Clustering Algorithm.	The end result is a classifier, which is typically in the shape of a decision tree or guidelines that can be used to anticipate how fresh data examples will be classified.
2.	Data Mining Techniques and Applications to Agricultural Yield Data.	D Ramesh, B Vishnu Vardhan	KNN, K-Means algorithm.	By examining the cluster in which the projected rainfalls, the system can predict the average yield production based on the rainfall in a certain year.
3.	Analysis of Soil Behavior and Prediction of Crop Yield using Data Mining Approach.	Monali Paul, Santosh K. Vishwakar- ma, Ashok Verma.	KNN and Naive Bayes.	We can see from the results that the category with the highest confidence value is expected to be the soil category for that specific soil.
4.	Brief Survey of data mining Techniques Applied to applications of Agriculture	Ami Mistry, Vinita Shah	Classification technique: Linear Regression, K - nearest neighbor Clustering Technique: K- means clustering, Self-organized maps, Density-based clustering.	The results indicate that in the current study area, sunlight hours and the range of daily temperature have important roles in rice yield variations.
5.	A Study on Various Data Mining Techniques for Crop Yield Prediction	Yogesh Gande and Sandhya.	Classification Algorithm.	The output is a projection of agricultural yield per acre along with some suggestions.
6.	Agricultural Production Output Prediction Using Supervised Machine Learning Techniques	Md. Tahmid Shakoor and others.	KNN, Decision Tree algorithm, ID3(Iterative Dichotomis) algorithm	The result reveals that without eliminating the dataset's outliers, the Decision Tree Learning- ID3 approach delivers a lower percentage error value than the KNN technique.
7.	Rice Yield Prediction Model Using Data Mining	Umid Kumar Dey and others.	K-Means, Multiple Linear Regression, Modified Nonlinear regression.	It can be observed that it predicts yields well, with SVM as best result.

Table-1: Literature Review

3. METHODOLOGY

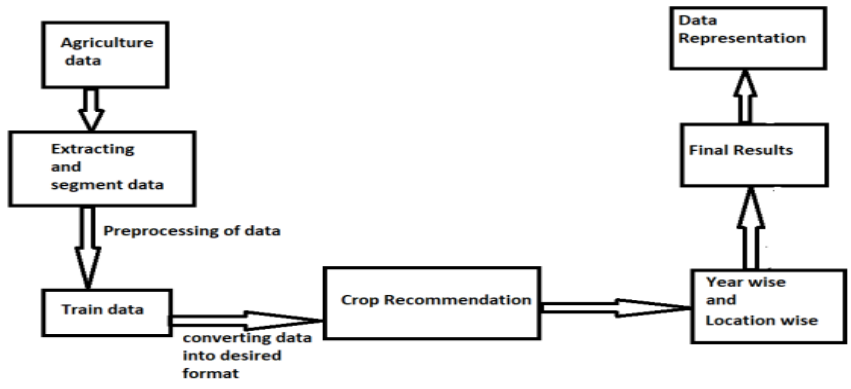

Fig -1:

Step 1: Raw data and Weather Statistics

This is the first step in the crop recommendation process where we collect agriculture data. Agriculture data were collected from the region "Mysore" which contains agriculture parameters, crop details, farmer's details, and yield details. Agriculture parameters include rainfall, temperature, and soil features such as PH, nitrogen, potassium, iron, etc.…

Step 2: Extract and Segment Data (Data Pre-processing)

Here agriculture data is analyzed and only relevant data is extracted. The data required for processing is extracted and segmented according to the different regions. Required data extraction is done because entire agriculture data is not required for processing and if we input all data, it requires too much time for processing, so data processing is done.

Step 3: Train Data

Once required data is extracted and segmented, we need to train the data, train means converting the data into the required format such as numerical values or binary or string, etc. conversion depends on the algorithm type.

Step 4: Supervised Learning

The field of machine learning is concerned with the design and research of data-learning systems. In an e-mail message, for example, ML may be used to learn how to identify between spam and inbox messages.

Supervised learning is a type of machine learning that employs training data that includes predicted responses.

Naive Bayes Algorithm is used for crop recommendation because of the following reasons:

- efficient classifier
- works fine for a smaller number of parameters as well as a greater number of parameters.
- Works fine for small and big data-set.
- More accurate results.

Step 5: Crop Recommendation (Priority wise)

Here suitable crops are recommended for the farmers which may yield high profits. The naive2 Bayes algorithm generates outputs (crop recommendations) based on priority wise.

Step 6: Location and Year Based

The crop recommendation is done based the region-wise as well as year-wise.

Step 7: Results

Advising suitable and high-profit crops to farmers is done in priority order. Here high probability crops are extracted and sorted and the top 3 crops are recommended for the farmers.

Step 8: Visual Representation

Crops are recommended for the farmers on GUI. When users get to log in, the application system recommends suitable and high-profit crops for the farmers on a GUI.

4. CONCLUSIONS

In this paper, we discussed existing techniques for crop and soil prediction. We also briefed on some methods used to analyzes soil behavior and predict crop yields that have already been attempted by some researchers.

We've seen how techniques like data mining and machine learning algorithms can enable us to analyze data and recommend the most appropriate fertilizer and crops for a given piece of land.

The recommendations are made using a supervised learning algorithm, such as the "Bayesian classifier," "K nearest neighbour," or "Random Forest" algorithm. These algorithms are preferred because they work efficiently, provide faster results, and are compatible with all data formats.

The system makes use of data gathered by the agriculture department. However, the proposed system is a real-world application aimed at agriculture departments, assisting farmers in cultivating suitable crops and reaping high profits.

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