JOURNAL OF ALGEBRAIC STATISTICS
Volume 13, No. 1, 2022, p. 426-430
https://publishoa.com
ISSN: 1309-3452

A Machine Learning Based Crop Recommendation System: A Survey

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Abstract – Agriculture and related industries are the most important sources of employment and income in rural Areas. The agricultural industry in the country also makes a significant contribution. Productivity as a percentage of GDP (GDP). The agricultural industry is a huge source of wealth for the country. However, when compared to other agricultural products, the yield per hectare is disappointing. Standards that are accepted all over the world. There are numerous reasons why marginal farmers in India have a higher suicide rate. This is a study paper. Farmers are recommended an effective and user-friendly yield prediction system. The proposed system connects Farmers through a smartphone app. GPS technology aid in user identification and location. The user specifies the area and type of soil in which they want to work, and machine learning algorithms enable the selection of the most profitable user-selected crop yield prediction or crop list. Support Vector Machine (SVM), Artificial Neural Network (ANN), Random Forest (RF), Multivariate Linear Network (MLN), and a combination of regression and KNN are used to estimate crop yields. The Random Forest produced the best results of the three. The rate of accuracy is 95%. Aside from that, the system recommends the best options available. It's time to start using chemical fertilizer to boost output.

Keywords- Agriculture, Crop Recommendation, Machine Learning

INTRODUCTION-

In India, there is a wide range of both physical and cultural diversity. Nearly everyone in India is reliant on agricultural and agriculture-related jobs. Agriculture is benefiting greatly from the Internet of Things (IoT). Farmers from a variety of issues and allow them to concentrate on other relevant careers [1]. I believe that precision farming is one of the greatest innovations ever made. When it comes to illness prevention and early disease detection, it's doing all it can loss and crop recommendations, as well as information on weather conditions, are supplied in addition to this. Exporting his goods and assisting in the preservation of the field His actions are controlled by sensors and actuators tasks like irrigation and pesticide application should be scaled appropriately. By using all of these methods, he may maximise his profits. Keep a close eye on his area of expertise [3].

Over half of the people in this country make their living via agriculture [14,15]. According to the Economic Survey for 2016-17, Farmers in 17 states earn an average monthly wage of $1,050. Farmer suicides and diversion of Rs. 1700/-of farmland for non-farming use [4][5]. In addition, 48% of farmers said they don't want their next generation to instead of taking care of their farm, the next generation should urban locations are where I wish to live. As to why the reason for this is because farmers are notoriously inept. Crop selection [9] is an example of this picking a crop that will not provide a significant amount of income planting at the incorrect season, specific soil, and so on. It's possible that the farmer bought the property from those who have never made a choice like this before Possibly taken away from me. If you choose the wrong crop, you'll result in a lower return on investment If the family is in good health, they will be happy [8]. if you rely on this revenue, it's quite tough to make ends meet. Correct and timely information are both readily available and easily accessible. The lack of access to current knowledge deters would-be researchers due to my experience with case studies focusing on poor countries [6][7]. A mechanism has been put in place using the resources available to us. Presented a solution to this issue that will provide insights into the long-term viability of crops machine learning models are used to make suggestions taught with environmental and social considerations in mind monetary factors.

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MOTIVATION-

Agriculture is critical to India's economy. In recent years, as a result of industrialisation and the widespread use of pesticides, the soil's strength has deteriorated. Numerous agricultural practises are insufficient to boost output. The typical challenge faced by Indian farmers is a lack of knowledge on the appropriate crop depending on their location. Due to their soil needs, this has an effect on production. Indian farmers confront several obstacles while deciding which agricultural technology to use and which crop to plant be chosen according to the climate [10][11]. The prevalent issue among Indian farmers is that they do not choose the correct crops in order to maximise their yields. Maximise yields depending on topographic and economic factors. Maximizing crop yields in agriculture [12]. The purpose of manufacturing is to keep costs down.

LITERATURE SURVEY-

These systems take into consideration a wide range of characteristics, including meteorological conditions, soil type, terrain, temperature and rainfall, crop market price, and crop length when making recommendations for agricultural crops. According to our findings, the following papers were used as sources for our investigation and analysis.

Users may make better decisions on what crops to plant according to a strategy presented by Professor Rakesh Shirsath and his co-authors in their research [1]. Each user's personal information is stored in a subscription-based system. Registration has been completed for a farmer. The system includes a module that gathers data on previous crops grown and recommends a suitable crop for planting based on this knowledge. With the help of artificial neutrals networks, we complete the whole process. As a final step, the developer has included a method for receiving input from the farmer so that any issues with the system's functioning may be corrected as soon as possible.

There is a lot of data in knowledge databases, according to Ji-chun Zhao and JianxinGuo [2]. Modules such as knowledge engineer, domain expert, HMI, inference engine, and knowledge base are all instances of users. An effective knowledge foundation for problem resolution is built via the decision system's data collection mechanism. The article uses a number of Hadoop modules to extract characteristics. This is a NoSQL, Hive, and Mahout-based system that uses unstructured data and HDFS storage. Wheat and other crops yield numbers were recently released.

Crops were not given any consideration. A location detection module, data collecting, and analysis are all part of RSF, according to the research [3]. Database for agricultural cultivation, database for physiographic data, and module for analysis and storage. As part of the application's location-based mapping feature, a user's present location is compared to a list of similar places and the crops that grow there. A similarity matrix is used to provide recommendations for the user. The location detecting module uses Google Maps API services to get the user's current location so that it can find similar locations. The system, on the other hand, does not ask for human feedback to improve the process.

Majority Voting Technique (MVT) is an ensemble strategy suggested by S.Pudumalar and co-authors in paper [4]. Many models are used to increase forecast accuracy in this method. Using ensemble methods such as Nave Bayes and Random Trees, KNN, and CHAID, it is possible to assure that no matter how bad one approach performs, the others will still be accurate. The majority vote procedure guarantees that the final prediction is correct since models are more likely to give accurate predictions.

Prediction relies heavily on the use of if-then logic. The 88 percent model ensemble accuracy is achieved with the use of Several agricultural algorithms and their accuracy are examined in Yogesh's [5] review study. Gandge and Sandhya. For predicting rice production, Multiple Linear Regression was shown to be 90-95% accurate. The ID3 algorithm was used to analyse and provide recommendations for the soybean crop decision-making tree. The third algorithm was SVM. A high degree of accuracy was achieved while using minimum computational resources for all crops. In order to achieve 95% accuracy, we used a neural network trained on corn data. Additionally, Bayes, naïve, utilised KNN, C4.5, K-means, J48, and LAD Tree. The conclusion was that further work is needed to improve the accuracy of the algorithms.

Data from Kaggle.com was used in the paper "Use of Data Mining in Crop Yield Prediction" [6]. Analysis of the data was carried out using WEKA, which is owned by the author. To measure precision, we used sensitivity, specificity, accuracy and root-mean-square

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error. For each classifier, a confusion matrix was utilised to assess its performance. All of the relevant occurrences. It was shown to be possible to acquire higher accuracy via pruning.

Seven machine learning strategies were advocated by Rakesh Kumar, J.P. Singh, and Prabhat Kumar in a study [7]. ANN, SVM, KNN, Decision Tree, Random Forest, GBDT, and Regularized Gradient Forest are among the crop selection techniques used. All seeded crops and their development phases at a certain time of year are intended to be recovered using this approach. As a result, the best yielding crops are selected for planting. Moreover, the approach advises planting a succession of crops in order to maximise output [17].

COMPARATIVE STUDY:

On the topic of "Agriculture Decision Support System Using Data Mining," Prof. Rakesh Shirsath worked in 2017 [1]. A subscription-based system, an Android app, and personalised content were all included in this paper's proposal. The author of this article also focused on previously planted crops that the system was aware of in an Android app with a login module. Crop maintenance and user feedback mechanisms.

Researchers Ji-chun Zhao and Jian-xinGuo [2] collaborated on the paper titled "Big Data Analysis Technology Application in Agricultural Intelligence Decision System". In this study, he presented an Inference engine, Domain expertise, Knowledge engineering, Knowledge acquisition module, and a knowledge base for recommendation system usage. A vast database of crops, which was processed using Hadoop, was also examined by the author in this work. Expertise, as well as experiences from the past Future Scope: Using Hadoop and Artificial Neural Networks for Feature Selection in HDFS. RSF:

A Recommendation System for Farmers" was the work of Miftahul Jannat Mokarrama in 2017 [3]. In this study, he presented a location detection, data analysis, and storage, similar location detection, and recommendation generating module. Aside from these considerations, this research also addressed a number of other aspects of crops, such as the physiographic and temperature conditions in which crops grow and the pace at which they produce, as well as the crop database.

Precise Agriculture Crop Recommendation System [4] was developed by S. Pudumalar and E. Ramanujam in 2016. Random tree, CHAID, KNN, Naive Bayes, and WEKA were utilised in this study. Other aspects of this study include pre-processing the data, dealing with missing and out-of-range values; feature extraction; an ensemble model to improve accuracy; and rule development.

"A Study on Various Data Mining Techniques for Crop Yield Prediction," by Yogesh Gandge, Sandhya, 2017 [5]. A decision tree using ID3, SVM, neural networks, and K-means and KNN, as well as multiple linear regression and attribute selection, are some of the methods he outlines in this study. In addition, according to the author's findings, selecting an agricultural area, selecting a crop that has already been planted, receiving input from the user, preprocessing, selecting attribute values, and running a classification algorithm on the data are all encouraged in this study. She is Shruti Mishra.

"Use of Data Mining in Crop Yield Prediction" by Priyanka Paygude was published in 2018 [6]. J48, LAD tree, LWL, and IBK algorithms were proposed in this study. It has been discovered that errors may be avoided by trimming trees in WEKA's LAD tree, whereas IBK was seen to have a greater level of accuracy.

SYSTEM ARCHITECTURE-

Figure 1. System Architecture.

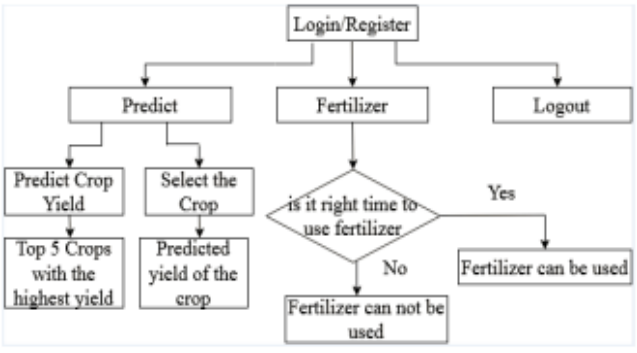

Figure 1 illustrates the flow chart of the system. It describes the whole process starting with the registration and various services provided by the mobile application [16][17].

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PROPOSED MODEL-

Thus, looking upon all these issues that the current Agro industry is facing, the proposed system helps in determining the best crop yield and suitable fertilizers to be used. Also, it helps to determine the diseases that plants are affected with. The proposed system is divided into 3 parts:

1. Crop Recommendation System

a. Best suitable crop that can be grown

b. Top 5 crops as per suitable conditions

2. Fertilizer Recommendation System

a. As per soil content and crop give soil quality

b. Based on soil quality give suggestions and recommendations to improve it

3. Plant Disease Detection

a. Based on image of the plant classify as Diseased or Healthy and give crop name

b. As per output of disease, give:

i. Cause of the disease

ii. Methods to prevent

CONCLUSION-

We concluded from the analysis in this article that more research is necessary in the agricultural industry to improve accuracy. Using ensemble approaches helps assure the system's correctness. Additionally, if we want to evaluate just one algorithm for the recommendation system, we may utilise SVM since its computing needs are minimal. Future study in this topic might include geospatial analysis that incorporates and utilises all available seasonal, soil, weather, and temperature data. Topography, agricultural production, and farmer economic conditions into a single model in order to produce a stable and unified system. System accessible to the user. The research shown, in particular, that for previously suggested recommendation systems, elements such as the user's investment in agriculture, the number of workers required for upkeep, and the amount of cultivable land available were not taken into account. These criteria also have a significant impact on the farmer's profitability, which is the primary reason for a farmer would make crop recommendations using a crop recommendation system.

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