

AGRICO – Smart Way of Farming

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Abstract

Research related to agriculture is growing rapidly, the challenges that lie ahead is solved with the help of advancement in technology. It is found that it is very beneficial for the economic growth and development of any nation. Especially in India, it requires the need for good research in order to improve agricultural productivity. In order to enhance the growth and solve the problems in the agricultural sector, the scientists use a variety of data mining methods. There are different data mining techniques, like classification or prediction can be used to predict diseases in crops, and losses incurred as a result of these diseases. The diseases can be bacterial, fungal or viral. Some of the common plant diseases are bacterial wilt, black knot, curly top, etc. These diseases are caused by a variety of insects and micro-organisms. Our main focus in this research is on early identification of the diseases and helps the farmers in taking the decision to use the fertilizers that helps to protect the crops so that the diseases are eliminated in the early stage of production and so the farmers can get maximum yield. Ensemble method combines several classifiers to produce one predictive model and it is a very important technique in Machine Learning. In this paper, ensemble methods are used to predict the crop disease and an analyze has been done with the help of different classifiers such as Decision Trees, Naive Bayes Classifier, Random Forests, Support Vector Machine and K- Nearest Neighbor. Ensemble models, improve the performance of the classifiers that are weak.

The proposed machine learning approach aims at predicting the best yielded crop for a particular region by analyzing various atmospheric factors like temperature, rainfall, humidity etc., and land factors like soil type. Finally, our system is expected to predict the best yield based on data we have collected.

Keywords: *Crop yield prediction Decision support system Systematic literature review Machine learning Deep learning*

I. Introduction:

In India, Agriculture plays an important role for the economic development of the country. Crop prediction is a complicated process in agriculture and multiple models have been proposed and tested to this end. In recent times, modern people don't have the complete awareness about the cultivation of the crops in a right season and at a right location. Due to which modern farmers lack the knowledge of proper selection of crops. Selecting a wrong crop for cultivation may lead to loss in achieving high yield rate and also simultaneously leads to shortage of food. These difficulties imply the need of smart farming which can be achieved with various machine learning algorithm.

Machine Learning approaches are used in many fields, ranging from supermarkets to evaluate the behavior of customers to the prediction of customers' phone use. Machine learning is also being used in agriculture for several years. Crop yield prediction is one of the challenging problems in precision agriculture, and there are many models that have been proposed and validated so far. This problem requires the use of several datasets since crop yield depends on many different factors such as climate, weather, soil, use of fertilizer, and seed variety. Indicates that crop yield prediction is not a trivial task, Instead, it consists of several complicated steps. Nowadays, crop yield prediction models can estimate the actual yield reasonably, but a better performance in yield prediction is still desirable.

Machine learning, which is a branch of Artificial Intelligence (AI) focusing on learning, is a practical approach that can provide better yield prediction based on several features. Machine learning (ML) can determine patterns and correlations and discover knowledge from datasets. The models need to be trained using datasets, where the outcomes are represented based on past experience.

II. Related Work:

Pooja Patil, Shivani Turamari [1] describes “Weather Forecast prediction for agriculture”. In this paper, Author said that entire agriculture depends on the Weather forecast for agriculture and terrace gardening. In some of the places upon the weather. It is important to be concerned, to be identified any methods for weather forecasting to predict its changes, which would affect the economy of the country. Nowadays, the weather is making a bad impact, as society is growing more and more, causing much damage, injury, and loss to the life of farmers. By implementing weather forecast prediction the remote areas will be helpful and that were the main motivation. They have done a low-cost solution for weather forecast prediction is present.

Rishi Gupta, Akhilesh Sharma [2] describes “Weather Based Crop Prediction in India Using Big Data Analytics” in which they have focused on collecting and analyzing temperature, rainfall, soil, seed, crop production, humidity and wind speed data (in a few regions), which will help the farmers improve the produce of their crops. Firstly, they have pre-processed the data in a Python environment and then apply the Map Reduce framework, which further analyses and processes the large volume of data. Secondly, k-means clustering is employed on results gained from MapReduce and provides a mean result on the data in terms of accuracy. After that, they have used bar graphs and scatter plots to study the relationship between the crop, rainfall, temperature, soil and seed type of two regions (Ahmednagar, Maharashtra and, Andaman and Nicobar Islands). Further, a self-designed recommender system has been used to predict the crops and display them on a Graphic User Interface designed in a Flask environment. The system design is scalable and can be used to find the recommended crops of other states in a similar manner in the future.

Anamika Chauhan, et.al [3] describes “Smart Real Time Weather Forecasting System”. The future state of the atmosphere could be predicted with the help of current weather analysis. The aim in this project was to depict and a resourceful forecasting system through which uses data collected using sensors stored in cloud to forecast the required parameters remotely using the internet and to project the predictable trend. 4 The framework proposed will portray the smart system which will incorporate the wireless communication technology (Wi-Fi) for communication. Typical weather forecasting systems that are being used presently uses complex machinery. That machinery has various moving parts that require maintenance therefore also require manual and due to this, frequency fluctuations are common. Due to heavy and large sized machinery, it is nearly impossible to install it in remote areas which are deficient of large space. Therefore, in their proposed system, they have created a smart weather forecasting system using concept of IOT which is both simple in implementation and cost effective. The design will be very compact and hence will provide easy installation in remote areas for weather forecasting. The sensors which we have used in our project are also cheaper than the sensors being used in existing weather forecasting systems.

Shubham Madan; Praveen Kumar [4] describes “Prediction of crop and yield in agriculture using machine learning technique”. Agriculture holds a predominant position in the growth of country's prosperity. However, there exists a major threat in the crop yield due to unpredictable and uncontrolled climatic changes, traditional farming methods, and poor irrigation services. Currently, Machine Learning (ML) techniques are being used in multiple fields to accomplish practical and productive solutions. There are various algorithms in ML based on classification, clustering, and neural networks which can be used to predict the crop yield. In which they have proposed a method based on K-Nearest Neighbors (KNN) algorithm which detects the soil quality and predicts the suitable crop for cultivation. suggests the fertilizer based on the crop predicted. The test results show that their method accurately predicts crop and yield in agriculture.

Vaishnavi and Kishore [5] describes “Crop Prediction using Machine Learning”. In general agriculture is the backbone of India and also plays an important role in Indian economy by providing a certain percentage of domestic product to ensure the food security. But now-a-days, food production and prediction are getting depleted due to unnatural climatic changes, which will adversely affect the economy of farmers by getting a poor yield and also help the farmers to remain less familiar in forecasting the future crops. This research was made to help the beginner farmer in such a way to guide them for sowing the reasonable crops by deploying machine learning, one of the advanced technologies in crop prediction. Naive Bayes, a supervised learning algorithm puts forth in the way to achieve it. The seed data of the crops are collected here, with the appropriate parameters like temperature, humidity and moisture content, which helps the crops to achieve a successful growth. In addition, as the software, a mobile application for Android is being developed.

Agila N, Senthil Kumar P, et.al [6] describes “An Efficient Crop Identification Using Deep Learning” the deep neural network is the prominent tool in agricultural industry for providing support to farmers in monitoring crop yield based on the weather conditions. In this paper, the recurrent neural network is utilized for detecting the suitable crop for the observed environmental conditions from the field and also provides the suggestions about the desired crop can be grown in that field or not. The environmental parameters such as humidity, temperature, rain and moisture are obtained through the sensors and fed as input to recurrent neural network. Then, the recurrent neural network identifies the suitable crop by classifying the crop based on the climatic conditions. The experiment was conducted by using the Random Forest classifier, Decision Tree classifier, Logistic Regression, Support Vector Machine classifier (SVM), Multilayer Perceptron (MLP) and Recurrent Neural Network (RNN). The result shows that the recurrent neural network outperforms other methodologies.

Mohammed Ahmed, et.al [7] describes “Car rental and tracking web-based system using GPS” A car rental is a process to allow use car temporarily for a period with a fee renting, with technology customers need to reduce the time and effort in obtaining their needs, and we find that some customers who stay for temporary periods in places other than where they live have a desire to get a car for rent.

Kunal Pahwa, Neha Agarwal [8] describes “Stock Market Analysis using Supervised Machine Learning” Stock market or Share market is one of the most complicated and sophisticated way to do business. Small ownerships, brokerage corporations, banking sector, all depend on this very body to make revenue and divide risks; a very complicated model. However, this paper proposed to use machine learning algorithm to predict the future stock price for exchange by using open-source libraries and pre-existing algorithms to help make this unpredictable format of business a little more predictable. The outcome was completely based on numbers and assumes a lot of axioms that may or may not follow in the real world so as the time of prediction.

Shubham Madan; Praveen Kumar [9] describes “Analysis of Weather Prediction using Machine Learning & Big Data” that whole world is plagued by the dynamical element and their facet, to cut back this facet effects up to some extent there are several techniques and algorithms through which they will predict the weather on the ready reference along with respective context of given information from past years example temperature, dew, humidity air pressure and wind direction. When doing the analysis of existing data from past few years we inculcated the proposed scheme or techniques which have a tendency to conclude that, machine learning paradigm and permits them to research the given set of knowledge and extract the helpful information from the given dataset, thus so as to grasp the unsteady patterns of climatic conditions, a prognosticative model is also persuaded.

Hind Abdalsalam Abdallah Dafallah [10] describes “Design and implementation of an accurate real time GPS tracking system. In this paper they have presented an accurate and reliable real time tracking system using GPS (global positioning system) and GSM (global system for mobile communication) services, which was designed and implemented successfully in university of Khartoum labs. The system permits localization of a portable tracked unit and transmitting the position to the tracking center.

III. Algorithms

A wide range of regression and classification- based prediction algorithms have been utilized to forecast crop yield. In crop yield prediction, linear regression (LR) and multiple linear regression (MLR), k-nearest neighbors (K-NN), support vector machine (SVM) decision tree (DT), random forest (RF), convolution neural network (CNN) have been employed.

1. Machine Learning Algorithms

The LR model represents a relationship between independent and one or more dependent variables. In a machine learning framework, learning can be done by using data and minimizing the loss or error (RMSE or MSE) that are experienced by using regression algorithms. The MLR analysis has been used in several applications in which multi-independent variables was proved to be the most efficient and reliable compared to one independent variable. The learning data is split into sets of adaptive splines with unique slopes. The K-NN is used for classification and regression that provides more weightage to close neighbors in making the prediction so that they relate more to the average than distant ones. SVM is a binary classifier class, which generates a linear separating hyperplane for the classification of data instances.

SVM is a little bit different from SVR where SVR method can be used to solve regression problems. DT is a model of supervised machine learning model which can be applied to both regression and classification. It consists of three nodes, namely root node (no incoming edge), decision node (both incoming and outgoing edges) and leaf node (no outgoing edges). In a decision tree, each attribute is divided by each outgoing node into two or more branches according to the splitting criteria. The most successful methods of DT induction are Classification and Regression Trees (CART) that was developed by Breiman et al. which is supposed to nonparametric and generates binary trees from such data by employing the discrete and continuous features. RF is a powerful tool for the prediction of yield, which has been applied to agricultural research.

It generates a wide range of regression trees that are produced by a large set of decision trees for computing regression. The RF is superior to any other decision tree since it performs more precisely, and the bias is compensated for by the single decision tree due to the randomness [50].

Extremely randomized trees (extra tree) (ERT) are an ensemble model as same as RF, but it utilizes unpruned decision trees. It splits the nodes by randomly chosen cut-points and incorporates the complete learning sample.

The number of trees and the number of variables utilized to divide the nodes are set to be the same as those of RF. An ANN is the most commonly utilized machine learning technique to predict crop yield by which the complex nonlinear relationship between input and output can be modelled. It comprises of three layers, including the input layer, hidden layer and output layer. There are numerous factors that have an impact on the performance of ANN, including the number of nodes in the hidden layer, the learning rate, and the training tolerance. The learning rate determines the amount by which the weights change during a series of iterations to bring the predicted value within an acceptable range of the observed value.

IV. Conclusion:

Using Agrico we can perform crop prediction Weather conditions, Soil condition, Diseases information. Also, we provide Market Price analysis and tractor rental services through GPS service. Agrico centralizes, manages, and optimizes the production activities and operations of farms.

In this Survey we Studied different research paper and different Algorithm for our system we found that for crop prediction KNN algorithm is best suited and for soil prediction Naïve Bayes Theorem is suited. This ML algorithms gives best result for our system algorithm name as KNN, Map Reduce, K-Means, etc.

V. References:

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