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Predicting Crop Yield With pH and Weather Analysis

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ABSTRACT—

A significant economic engine is agriculture. It is essential for a robust biosphere. In reality, people rely on a vast variety of agricultural goods in practically every situation. Farmers must adapt to climatic change while supplying more food with improved nutritional value. The farmer must be aware of the climatic conditions in order to increase agricultural output and growth, and to use those conditions to help decide which crop is best to produce. By monitoring the field in real-time, IoT-based smart farming enhances the overall agricultural system. It provides a crystal clear real-time observation while controlling numerous parameters like humidity, temperature, soil, etc. In the agricultural industry, machine learning is utilised to increase crop quality and productivity. The suggestion of an ideal crop will be aided by the use of relevant algorithms on the detected data.

Keywords—Agriculture, IoT, Machine Learning, Farmers.

INTRODUCTION

Agriculture has been defined as the science and practice of raising plants and livestock. Agriculture became one of the most important trends in the rise of sedentary human civilization.India is ranked 2nd worldwide in farm output.Agriculture and allied sectors like forestry and fisheries accounted for 16.6 percent of the GDP 2009, about 50 percentof the overall workforceThe domestication of plants and animals is documented throughout agricultural history. Agriculture began on its own in many regions of the world. Agriculture's advancement allowed the human population to expand beyond what could be supported by hunting and gathering.

Soil fitness is defined as the capacity to fulfil essential environmental functions such as nutrient cycling, water filtering, and plant and animal habitat supply. Texture, depth, density, water penetration, preserving capacity, amount of natural remember, nutrient maintaining ability (CEC), and respiratory properties are all factors that influence soil fitness. Plants grow in a variety of environments. Air, water, nutrients, light, temperature, and growth space are all essential for plant existence, although the specifics vary greatly. Some flowers thrive in the wild, while others demand a tropical environment. Some plants can withstand harsh winter weather, while others may expire if the temperature goes below a particular level.

Soil is an important source of nutrients for plant development. Nitrogen (N), phosphorus (P), and potassium (K) are the three most important nutrients (K). NPK is the name of the group they form together. Calcium, magnesium, and sulphur are other important nutrients. Plants also require trace amounts of iron, manganese, zinc, copper, boron, and molybdenum, sometimes known as hint elements, because the plant only requires the simplest strains.

LITERATURE REVIEW

Kind of Crops and Small Plants Prediction using IoT with Machine Learning
The hardest difficulty in the agriculture field is predicting what kind of crops will grow. There are several variables that affect the agricultural crop. The growth of agricultural crops is influenced by a variety of factors, including weather, soil properties, soil moisture, and surface temperature. In our work, data on agricultural crop growth are gathered from a variety of sensors placed on the surface of farmland, and extensive exploratory data analysis is conducted. The effectiveness of several regression models, including support vector, multi-linear, and linear, is also examined for crop predictions. Based on the aforementioned factors, our work provides a better prediction for farmers regarding the crops they should plant in their fields to increase productivity.

Smart agriculture by monitoring moisture pH levels in soil In India, agriculture is crucial to both the economy and the survival of the population. Different nations continue to use outdated methods and conventional practices in the agriculture industry. While modern agriculture technology is primarily capital demanding, India's agricultural technology is labour intensive. The development of agricultural technology has substantially improved production efficiency. An innovative design approach to smart farming is created with the assistance of the internet of things, which boosts productivity. IoT will be crucial in addressing this demand. IoT can increase the effective use of inputs like fertilisers, soil, and pesticides when paired with cloud and big data. Additionally, it assists in scanning storage spaces like water tanks, disease prediction related to them, livestock monitoring and ensuring that the crops receive adequate water. In order to increase agricultural production, farmers require a variety of data and services based on the land, crop, climate

conditions, financial resources, irrigation infrastructure, etc. Government and other private organizations have employed cloud computing to store agricultural data. Farmers can communicate with a cloud utilising a variety of services by using any more affordable methods, such as sensors, mobile devices, scanners, etc.

Machine learning approach for forecasting crop yield based on climatic parameters

Authors: S.Veenadhari, Dr. Bharat Misra & Dr. CD Singh. Publication:International Conference on Computer 2014 January; Communication and Informatics (ICCCI-2014).

The purpose of this study was to create a website that would allow users to research the impact of climatic factors on crop output in particular Madhya Pradesh districts. The districts have been chosen based on the area planted with that specific crop. The first five districts with the highest selected crop area were chosen based on this criterion. Based on the prevalent crops in the district chosen for the study, the crops were chosen. Wheat, Maize, Paddy, and Soybean were the crops chosen.

In the case of soybean in the Dewas district, the developed model's prediction accuracy was determined to be 90%, as evidenced by the fact that, out of 20 years of data, 18 were correct and two were incorrect. For the selected crops and districts, the developed model's prediction accuracy ranged from 76 to 90 percent. The developed model's overall prediction accuracy is 82.00% based on these observations. In order to guarantee accurate predictions, this paper focuses on relevance approach analysis. This is accomplished by comparing the information gain of each attribute. However, the analysis of other supervised machine learning algorithms like linear regression and random forest is not included.

Prediction of Crop Yield Using Machine Learning Author: Rushika Ghadge, Juilee Kulkarni, Pooja More, Sachee Nene, Priya R L.

Publication: International Research Journal of Engineering and Technology (IRJET) Volume 05, Issue 02, Feb-2018.

According to this paper, the majority of existing systems are hardware-based, making them costly, difficult to maintain, and unable to provide accurate results. Crop sequence is suggested by some systems based on market price and yield rate. By analyzing structured data, the proposed system in this paper attempts to overcome these limitations and predicts crops. Being an absolutely programming arrangement, it doesn't permit support component to be viewed to such an extent. Additionally, the accuracy would be higher than that of hardware-based solutions due to the inclusion of factors like soil type, pH value, and weather conditions during the prediction process.

It can be accomplished with both unsupervised and supervised learning algorithms like BPN (Back Propagation Network) and Kohonen Self Organizing Map (Kohenon's SOM). Learning networks will then be used to train the dataset. The most accurate outcome will be presented to the end user after it compares the accuracy achieved by various network learning methods. A system that, depending on the quality of the soil, will check the quality of the soil, predict crop yields in accordance with those predictions, and recommend fertilisers if necessary is proposed in this paper. Two controllers process the results after the user enters the pH value and location into the system. A predetermined "nutrients" data store is used to compare the results of controllers 1 and 2. The combination of the aforementioned results and the predefined data set in the crop data store is compared using these compared results that are provided to controller 3. Finally, the accuracy percentage and the results are presented in the form of bar graphs.

Predicting Yield of the Crop Using Machine Learning Algorithm

Author: P.Priya, U.Muthaiah & M.Balamurugan

Publication: International Journal of Engineering Sciences & Research Technology (IJESRT), April, 2018

Machine learning and R programming are used in this paper. R is the most popular software for machine learning, statistics, and data analysis. It's more than just a statistical tool; Because it is a programming language, you are able to make your own packages, functions, and objects. It is free, platform-independent, and compatible with all operating systems. R programs clearly document the steps of our analysis and make it simple to replicate and/or update the analysis, allowing it to quickly test a variety of ideas and/or fix problems. The research derived all of the datasets from the public records of the Indian Government.

The paper concludes that the Results show that we can attain an accurate crop yield prediction using the Random Forest algorithm. The Random Forest algorithm achieves a largest number of crop yield models with the lowest models.

A Survey on Crop Prediction using Machine Learning Approach

Authors: Sriram Rakshith.K, Dr. Deepak.G, Rajesh M, Sudharshan K S, Vasanth S & Harish Kumar

Publications: International Journal for Research in Applied Science & Engineering Technology (IJRASET) Volume 7, Issue IV, Apr 2019

This paper is primarily centered around the strategies and measures taken to work on cultivating by teaching the specialized information and improvements to make the rural area more dependable and simple for the ranchers by anticipating the reasonable harvest by utilizing AI procedures by detecting boundaries like- - soil, climate and market patterns. PH, soil nitrogen-phosphate-potassium content, temperature, rainfall, and humidity are all taken into account. They take into account information fuzzy networks, artificial neural networks, and other methods for data mining.

According to the paper's conclusion, crop forecasting can be accomplished using a variety of approaches, as previously mentioned. Additionally, we can say that ANNs provide us with more reliable predictions. As a result, we are able to construct a model with the workflow shown above that can accurately predict the crop yield suitable for a specific region by utilizing the soil, weather, and market prices. Utilizing an Artificial Neural Network (ANN), these are carried out. For more precise outcomes, this paper employs data mining and machine learning algorithms in combination. KNN, Linear Regression, and SVM, among other machine learning algorithms, are not examined..

Heuristic Prediction of Crop Yield using Machine Learning Technique

Author: S. Pavani, Augusta Sophy Beulet P.

Publications: International Journal of Engineering and According to the article published in Advanced Technology (IJEAT) Volume 9, December 2019, numerous attempts have been made to implement machine learning in agricultural settings. Increasing farm production while simultaneously delivering high-quality goods at the best possible prices is a major challenge in agriculture. Due to wastage and high prices, it was discovered that at least 50% of

farm produce never reaches the final consumer. This work discusses machine learning-based solutions that farmers developed to solve their problems. The constant natural boundaries of Telangana Region like soil dampness, temperature, precipitation, stickiness are gathered and crop yield is being anticipated utilizing KNN Calculation.In this paper, the data sets of different districts of the Telangana state are collected from Telangana State Development Planning Society. The important factors that determine the cropyield are temperature, humidity, soil moisture and rainfall. These samples were taken for the month of May 2019. Among the data set available maximum of the data was used for training and the remaining data was used for testing. The machine learning technique KNN algorithm

was used for prediction of crop yield.The paper concludes that a model of machine learning to predict plant yield is proposed and gives reasonable crop yield suggestions for particular districts in Telangana. The research has been done on soil moisture, temperature, humidity and rainfall datasets of all the districts of Telangana State. By applying machine learning algorithms the model has been tested. K-NN suggests suitable accuracy in crop yield prediction. The well- constructed data set and the machine learning algorithm supports the proposed model. In future, providing other factors that greatly influence the crop yield is our concern, also more data of all these parameters of different seasons in the state will be added to make this model more accurate and efficient. This paper includes a comparative study of the KNN, SVM and Linear Regression giving KNN as the most appropriate one with maximum accuracy. The climatic as well as soil properties are analysed to predict the yield. This paper does not include recommendation of fertilizers or crops based on the soil, climate and location.

OBJECTIVES

This study's primary objectives are:

- Predicting the crop yield at a particular pH condition and thereby recommending suitable crops for that field.
- Collect the pH data, crop yield data, soil type data and the rainfall data and merge these datasets in a structured form.
- Perform Exploratory Data Analysis (EDA) that helps in analyzing the complete dataset and summarizing the main characteristics. It is used to discover patterns, spot anomalies and to get graphical representations of various attributes. Most importantly, it tells us the importance of each attribute, the dependence of each attribute on the class attribute and other crucial information.
- Divide the analyzed crop data into training and testing sets and train the model using the training data to predict the crop yield for given inputs.
- Compare various Algorithms by passing the analyzed dataset through them and calculating the error rate and accuracy for each. Choose the algorithm with the highest accuracy and lowest error rate.

PROPOSED METHODOLOGY

Soils are affected by human activities, such as industrial, municipal and agriculture, that often result in soil degradation and loss or reduction in soil functions. In order to prevent soil degradation and to rehabilitate the potentials of degraded soils, reliable soil data are the most important prerequisite for the design of appropriate land- use systems and soil management practices as well as for a better understanding ofthe environment.

Location, moisture, temperature is detected using the sensors.

Here, pH sensor will be used for collecting pH value from the soil, once the data has been collected . These data will be given as input to the application which will give the prediction of the crop that can be grown in the soil along with crop prediction it also provides the scheme available for the farmers with its information and applicability link.

The system aims to help farmers for smart decision while predicting the crops. To increase the accuracy along with live data, historic data for temperature and humidity from government website is also collected and stored. Also historic rainfall data is collected and stored.

Crop production is completely dependent upon geographical factors such as soil chemical composition, rainfall, terrain, soil type, temperature etc. These factors play a major role in increasing crop yield. Also, market conditions affect the crop(s) to be grown to gain maximum benefit. We need to consider all the factors altogether to predict the yield.

Hence, using Machine Learning techniques in the agricultural field, we build a system that uses machine learning to make predictions of the production of crops by studying the factors such as rainfall, temperature, area, season, etc.

The system uses machine learning to make predictions of the crop and Python as the programming language since Python has been accepted widely as a language for experimenting in the machine learning area. Machine learning uses historical data and information to gain experiences and generate a trained model by training it with the data. This model then makes output predictions. The better the collection of dataset, the better will be the accuracy of the classifier. It has beenobserved that machine learning methods such as regression and classification perform better than various statistical models

CONCLUSIONS

It is proposed that this system be implemented to address the rising suicide rate among farmers and support their financial development. The Crop Recommender system assists farmers in predicting a crop's yield and deciding which crop to cultivate. In addition, it tells the user when to apply the fertilizer.

Utilizing machine learning tools, appropriate datasets were gathered, studied, and trained on. Based on the user's location, the system retrieves the necessary data from the backend. As a result, the user must provide limited information, such as the area and type of soil.

The industry of agriculture benefits from this system. One of the system's most significant and novel contributions is advising users when to apply fertilizer by predicting the weather for the next 14 days. Additionally, the system provides a list of crops and their productions in relation to the climate.

The future work is centered around giving the succession of harvests to be developed relying upon the dirt and atmospheric conditions and to refresh the datasets time to time to create exact forecasts. The Future Work envisions a similar fully automated system. The provision of the appropriate fertilizer for the selected crop and location is another functionality that we are attempting to implement. It is necessary to investigate fertilizers and their relationship to soil and climate in order to put this into practice. We also want to be able to foresee crises in advance, like the recent increase in onion prices.
Thus, this settles on the ranchers to take right choice in choosing the harvest for development with the end goal that agrarian area will be created by imaginative thought.

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