CROP AND YIELD PREDICTION WITH FERTILIZER ESTIMATION

MEGHANA S[1]

Dept. of Master of Computer Applications

Dr Ambedkar Institute of Technology

Bangalore, 560056, India

Dharani N V [2]

Dept. of Master of Computer Applications

Dr Ambedkar Institute of Technology

Bangalore, 560056, India

Abstract— Soil is an important ingredient of agriculture. There are several kinds of soil. Each sort of soil can have different sorts of features and different sorts of crops grow on differing types of soils. We need to know the features and characteristics of varied soil types to understand which crops grow better in certain soil types. Machine learning techniques are often helpful during this case. In recent years, it's progressed tons. Machine learning remains an emerging and challenging research field in agricultural data analysis. In this paper, we've proposed a model which will predict soil series with land type and consistent with prediction, it can suggest suitable crops. Machine learning algorithms such as Random Forest and Support Vector Machines (SVM) are used for soil classification and Crop Yield Prediction.

The main goal of our project is to create a onestop solution to various problems in the domain of agriculture. Nowadays Machine Learning is getting more popular as it is the technique of teaching machines to make decisions by the provided data. This stream of computer Science helps a lot in achieving our goals Predicting the Suitable Crop based on the condition of the cultivation land, Estimating the number of Fertilizers to be used for better yield, and predicting the yield based on the weather condition and various practices taken. This Project eliminates the manual and inaccurate approach practiced by the farmers and helps them to make the right decisions for a better Yield.

Keywords: Crop Prediction, Yield Prediction, Machine learning, Support Vector Machine(SVM), Random Forest.

I. INTRODUCTION

Data mining means identifying hidden patterns from large datasets and establishing a relationship among them to solve the problem through data analysis. The introduction of data mining in the agricultural field has made benefits in the research field. Classification is extremely important in any field of science to determine the basics. It can help to find the diversity between the objects and concepts. It also provides necessary information through which research can be made systematically. Soil is one of the key components in the agricultural field for yielding crops.

In India, farming is done by the traditional method, farmers plant crops traditionally without knowing the content of soil and quality of that soil. As a result, farmers will not gain sufficient profit from their farming. The existing method of soil testing is the manual method which starts by taking soil samples and then sends them to laboratories for testing. This manual process is time-consuming and not so feasible. Due to human intervention, there are chances of human errors so farmers may receive the incorrect report. So there is a need for an automated process for soil testing and prediction of the crop, yield prediction, and fertilizer estimation. Testing of soil is vital because soil testing helps to work out the fertility of the soil and thus crop prediction are often done. So we proposed a system that will have a handheld device that gives pH value and we will estimate Nitrogen (N), Phosphorus (P), and Potassium (K) from the pH, temperature, moisture, and electrical conductivity of that soil.

India is one of the agricultural based countries in which 50% workforce is involved in agricultural activities. India accounts for 7.68% of total global agricultural output. The contribution of the agriculture sector to the Indian economy is much higher than the world average(6.1%). But traditional farms in India still have some of the lowest per capita productivity and farmer incomes. This sector also requires a lot of human efforts to do different kinds of tasks like watering crops, cultivating crops and spreading pesticides, etc. Soil analysis is an important methodology as it gives nutrients present in the soil such as NPK, temperature, moisture, and electrical conductivity values. An automated soil testing human efforts will be reduced by monitoring the quality of soil using sensors. This paper aims to enhance the yield of the crop in several ways and recommends fertilizer suitable for each particular crop.

II. LITERATURE SURVEY

Machine learning (ML) is that the study of computer algorithms that improve automatically through experience and by the utilization of knowledge. it's seen as a neighbourhood of AI. Machine learning algorithms build a model supported sample data, mentioned as "training data", to form predictions or decisions without being explicitly programmed to undertake to to so. Machine learning algorithms are utilized during an honest quite applications, like in medicine, email filtering, and computer vision, where it's difficult or unfeasible to develop conventional algorithms to perform the needed tasks.

Machine Learning (ML) deals with problems where the connection between input and output variables isn't known or hard to urge . The "learning" term here denotes the automated acquisition of structural descriptions from samples of what's being described. Unlike traditional statistical methods, ML doesn't make assumptions about the right structure of the info model, which describes the info . This characteristic is extremely useful to model complex nonlinear behaviours, quite a function for crop yield prediction. ML techniques were most successfully applied to Crop Yield Prediction (CYP).

- Title: Farm management systems and thus the long run Internet era.

  Authors: Alexandros Kaloxylos, Robert Eigenmann, Frederick Teye, September 2012.

  Summary: This paper gives us information regarding introducing advanced technologies within the world of agriculture like IoT devices and Sensors

- Title: Cloud Computing for Agricultural Information Management in India

  Authors: Jayde, K. G., Gaikwad, C. J, Vol 7, Issue 3, December 2012.

  Summary: This paper explains how best we'll use the cloud computing concepts within the agriculture field to store an enormous set of agriculture data.

- Title: Cloud Computing and Agricultural Development of China

  Authors: Yanxin Zhu, Di Wu, and Sujian Li, IJCSI Issues, Vol 10, Issue 1, No 1, January 2013.
  Summary: During this paper, the author is trying to put in new cloud computing frameworks to Process an enormous amount of knowledge.

- Title: Application of Cloud Computing in Agricultural Development of Rural India.
  Authors: Rakesh Patel, Mili. Patel, Lecturer, Department of data, Kirodimal Institute of Technology Raigarh, Vol. 4 (6), 2013.
  Summary: How rural farming are often developed by current trends like modernizing agriculture with highend IoT devices especially in rural areas.

- Title: Automated Soil Testing Device.

  Authors: D S Suresh, Jyothi Prakash K V & Rajendra (ITSITEEE)23208945, Volume 1, Issue 5,2013.
  Summary: This paper concentrates on automating the agriculture sector and this paper explains how best we'll reduce manpower and incorporates automated systems for the timesaving purpose.

- Title: Automatic Control of Drip Irrigation System & Monitoring of Soil by Wireless.
  Authors: Aniket H. Hade, Dr. M.K. Sengupta, (IOSRJAVS) EISSN: 23192380, P ISSN: 23192372. Volume 7, Issue 4 Ver. Iii (Apr. 2014).
  Summary: To introduce wireless sensor devices within the agriculture field and to contribute more to the drip irrigation quite agriculture.

3.2 SYSTEM OVERVIEW

The system uses the soil series data obtained by Soil Resources Development Institute. The group of soils that are formed from an equivalent quite parent materials and remain under similar conditions of drainage, vegetation time, and climate forms the soil series. It also has an equivalent patterns of soil horizons with differentiating properties. Each soil series were named supported its locality. the most purpose of this technique is to make an appropriate model for classifying various sorts of soil series data along side crop yield prediction and suggesting suitable fertilizer. the tactic involved two phases: the training phase and therefore the testing phase. The machine learning methods were wont to find the soil class and for crop yield prediction.

Two different methods used were: Random Forest and Support Vector Machine(SVM).

3.1 Support Vector Machine

SVM develops a hyperplane or set of hyperplanes during a highor boundless dimensional space, which may be utilized for characterization, relapse, or different errands. Naturally, an excellent partition is accomplished by the hyperplane that has the most important separation to the closest preparing information purpose of any class, since by and enormous the larger the sting the lower the speculation blunder of the classifier. The computational burden has got to be reasonable, the mappings are utilized by the SVM decide to guarantee the small items are going to be figured as far because the variable within the degree, for that a touch capacity k(x, y) chose to urge the perfect computational time.

Advantages:

1) SVM calculation features a regularization parameter, which stays faraway from overfitting.

2) SVM calculation utilizes the portion trap, so you'll construct master learning about the difficulty.

3.2 Random Forest

Random forest may be a supervised machine learning algorithm supported ensemble learning. Ensemble learning may be a sort of learning where you join differing types of algorithms or an equivalent algorithm multiple times to make a more powerful prediction model. The random forest algorithm combines multiple

algorithms of an equivalent type. Random Forest algorithms are often used for classification and regression problems.

Advantages:

1) The random forest algorithm isn't biased, since, there are multiple trees and every tree is trained on a subset of knowledge.

2) Random Forest algorithm is stable if a replacement datum is introduced within the dataset the general algorithm isn't affected.

Data Pre-Processing:

It is a knowledge mining technique that transforms data into a clear format. Raw data(real world data) is usually incomplete which data can't be sent through a model. that might cause certain errors. That's why we'd like to pre-process data before sending it through a model.

Steps in Data Pre-processing

1) Import Libraries
2) Read Data
3) Checking for Missing Values
4) Checking for Categorical Variable
5) Standardized the info

VII. PROBLEM DEFINATION

The existing method of soil testing is that the manual method which starts by taking soil samples then sends them to laboratories for testing. This manual process is time consuming and not so feasible. Thanks to human intervention, there are chances of human errors so farmers may receive the wrong report. Soil, yield prediction, and fertilizer estimation has become a worldwide issue and is a neighbourhood of concern. All farmers won't be having much knowledge regarding how much soil prediction and fertilizer estimator using sensors with data mining techniques can be produced in their plot with certain soil and soil quality condition for growing crops.

V. METHODOLOGY

The system “Analysis of soil behaviour through sensor devices for the crop, yield prediction, and fertilizer estimation" works on IoT devices and data mining techniques. The data mining techniques used here are Naive Bayes, KNneighbors (KNN), Random Forest algorithm. Data mining comes up with a set of tools and techniques and when applied to processed data.

Provides knowledge to crop prediction tasks and professionals can make appropriate decisions by enhancing the performance of crop predictions.

Admin with similar crop soil health range issues and do a comparison with the master dataset and further does the task of prediction using algorithm techniques such as backpropagation, support vector machine, and random forest.

VI. PROPOSED WORK

The main aim of our System is to Automate the current manual soil testing procedure. In our system, we are building a handheld device using a pH meter which will give the pH value of soil. pH is the negative log of hydronium ion mole per liter pH = - log [H3O+].[9] With help of this pH value, we will estimate NPK, temperature, moisture, and electrical conductivity of that soil, which are necessary Macronutrients of soil. Nutrients present at a particular pH value. These will decide the fertility of the soil. For our software model, we will be training a crop database and we will classify that particular soil sample into a particular class using a classification algorithm. Depending on the class determined by our system we will give a list of crops suitable for that particular soil sample.

Our System consists of a handheld device that is build using temperature, moisture, and electrical conductivity, and depending on these values we decide the fertility level of soil and find the values and manually we enter the PH and NKP value of the particular soil

Advantages of Proposed Work

- ✓ Useful to agriculture department to predict suitable crop.
- ✓ Useful for farmers to know which crop to grow.
- ✓ We use data mining techniques for accurate results.
- ✓ No need to analyze manually.
- ✓ All records will be systematically stored so can be easily accessed.

V. EXPERIMENTAL RESULTS:

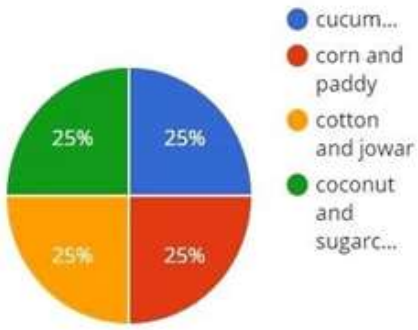

Fig.1 Graphical Representation of Crop Data Prediction

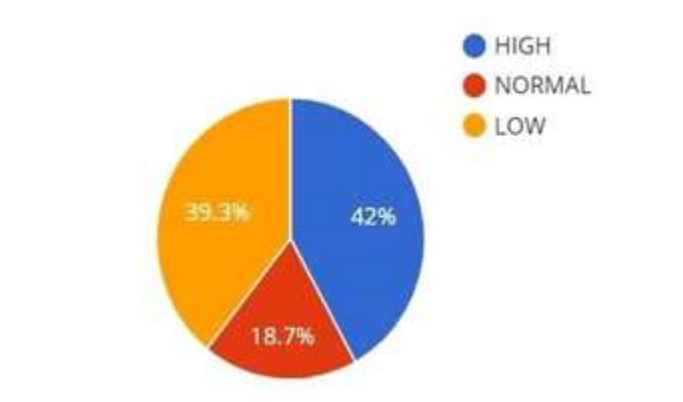

Fig.2 Graphical Representation of Crop Yield Prediction Data

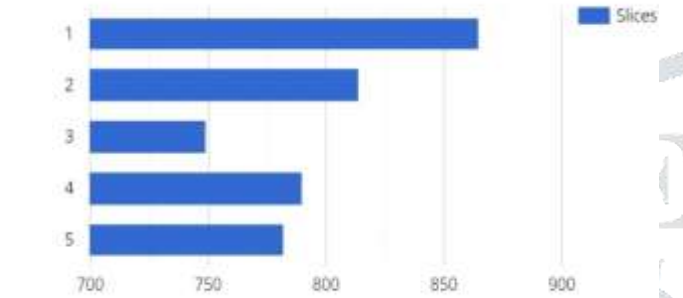

Fig.3 Fertilizer Estimation Data

Fig.4 Accuracy of Crop Prediction Dataset

Fig.5 Accuracy of Fertilizer Estimastion Prediction Dataset

VIII. CONCLUSION

The system "Analysis of soil behaviour around Mysuru region for crop prediction through sensor devices" is developed and tested successfully and satisfies all the requirements of the User.

The goals that are achieved by the developed system are:

- Simplified and reduced the manual work.
- Large volumes of data can be stored.
- It provides a smooth workflow.

It is accomplished by applying Backpropagation, Support Vector Machine(SVM), and Random Forest classification algorithm techniques. These classification techniques come under data mining technology. This algorithm takes Ph and NPK values as input and predicts the crop based on particular soil and land /area using an IoT device and which is compared with master data.

IX. REFERENCES

1. Title: Farm management systems and the Future Internet era.

   Authors: Alexandros Kaloxylos, Robert Eigenmann, Frederick Teye, September 2012.

   Summary: This paper gives us information regarding introducing advanced technologies in the field of agriculture such as IoT devices and Sensors.

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