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Sensor Based Model for Soil Testing Using Machine Learning

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ABSTRACT: India's population is growing rapidly and nearly 70 % of the population depends on agriculture. Soil is important for human beings on earth because it is the root source for farming, the medical sector and everywhere else. In every new location the soil type is different and their characteristics too. As per availability of minerals from soil we need to grow the different plants as well as increase the income from farming with good quality foods. Good quality food development is a great challenge without using chemical fertilisers. So firstly improve the soil quality and to improve the quality of soil we find the deficiencies from the farms. Then the main challenge becomes to make some sophisticated model to determine the contents and their respective values in a particular area. After finding the values we get the deficiencies then we shall provide the respective organic fertilisers and improve the quality of soil. Also we can provide the air nitrogen for crops which is very much useful for crop growing. Some more organic ways such as crop rotation, no-till farming, growing cover crops, bush fallowing, use of manures and weed control etc. These are some effective organic measures that improves and preserves the soil fertility. Using mulching of soil surface can also preserve the soil fertility. In this paper we have proposed a sensor based model for soil testing using machine learning. The different machine learning algorithms like K-Nearest Neighbour, bagged tree, support vector machine and logistic regression.

KEYWORDS: Soil type, agriculture, machine learning, soil, organic farming

I. INTRODUCTION

A sensor based model is developing for soil testing that helps for agriculture use. We collect the data and use data mining for analysing data sets and according to the result making the classification. Data mining can be used in agriculture for different purposes like soil classification, wasteland management, crop and paste management and many more uses. The data analysed from data mining used to classify soil quality. Also we can use the data like rain, weather, soil type, pesticide and fertilisers which is useful to improve the quality of production. The main aim of agriculture is to grow crops and increase the profit with good types of crops. Crop cultivation is mainly dependent on environmental factors such as rain, weather, soil types, nutrients from soil etc.[1]. All mentioned things can improve the performance of farming and give more and more production. So the management of soil is very important for all living organisms. To do this task we need a soil test that results in showing the deficiencies from soil and how we can overcome them. This test identifies the nutrients, organic factors, different gases and water [2]. With the help of soil tests we can use preventive measures wherever necessary.

We can use machine learning for soil testing. Machine learning has a very huge scope in computer science for the agriculture field. We can make use of different machine learning algorithms for agriculture through which improves the soil results and growing the plants inside farms. Firstly develop the learning model through which data checking is done and validate the data.

II. LITERATURE SURVEY

In a research carried out by N. Saranya predicting soil type and according to that which crop is suitable to relevant soil type. The designed model is implemented with the help of different machine learning algorithms like KNN, SVM and logistic regression. The mentioned algorithm is more accurate than the existing models[1].

In another approach carried out by Zaminur Rahaman the comparative study of different machine learning techniques is mentioned.

The Bangladesh country data comparison is mentioned intheir analysis. They had considered data of six districts and classified them on the basis of geographical features. Use of KNN, Bagged Tree and SVM for comparison

and generated the result for soil to cultivate new crops. Among these three algorithms SVM obtained the average accuracy [4].

The research done by Leisa J. Armstrong on comparative study of data mining algorithms. They had studied and extracted a large dataset from the Australian Department of Agriculture and Food (AGRIC) for research purposes [5].

Next approach discussed by Jay Gholap to classify the soil fertility. They had collected the dataset from soil testing laboratories of Pune District. They had developed an automated system using the WEKA tool for soil fertility [3].

III. DATA MINING PROCESS

Data mining process generally involves the following steps:
1. Data collection
2. Dataset Collection
3. Pre-processing of data
4. Classification of data
5. Prediction
6. Result

1. Data Collection: This phase is used for collection of raw data, in this paper we are collecting different samples of soil and fertility, water content, gaseous contents, minerals and organic contents as input for the algorithm.
2. Dataset Collection: Using above data we are making a data set according to different contents of soil.
3. Pre-processing of data: When we are collecting the data, it contains raw data and also some unformatted data, which needs some modification that is used for this stage.
4. Classification of data: When we are done pre-processing the prototype models are developed and separate classes are made. On the basis of class data is classified.
5. Prediction: After generation of classification phase the results are associated with accuracy and analysis and need some prediction to cultivate the crop for farmers.
6. Result: the final result gives the suggestion to farmers for
7. Cultivating the crop according to soil.

IV. ALGORITHMS FOR CLASSIFICATION

Following algorithms are used to classification:
1. Decision Trees
2. Logistic Regression
3. Naive Bayes Classification
4. K-Nearest Neighbours
5. Support vector Machine

1. Decision Trees: This algorithm is useful to analyse the useful part of the database and make the right decision. We can find a number of solutions and make decisions for the right solution with the help of tree structure.
2. Logistic Regression: It is a statistical method which uses one or more descriptive variables to produce binomial results.
3. Naive Bayes Classification: This is a simple classification algorithm. Using historical data it predicts the classification of new data. It calculates theprobability which already occurs in an existing problem. The spam mail detection is real time application of this type.
4. K-Nearest Neighbours: This is a standard classification algorithm and it works on choice on classification metric. In this we are using the set of data to train the algorithm. The distance between existing data and new data is calculated to evaluate the new data.

5. Support vector Machine: It is a supervised machine learning algorithm used for classification, regression and anomaly detection. It divides the dataset into two different classes. It solves problems like image based gender detection.

V. PROPOSED METHODOLOGY

The mentioned proposed system involves two phases like training and testing phase. It takes two databases as soil and crop with their different features.

VI. RESULT ANALYSIS

Different machine learning algorithms are used to classify the soil to predict the crop using a database of soil and crop. So for particular soil decide which crop is better as a result.

VII. CONCLUSION AND FUTURE WORK

A given model decides the crop according to soil type for a better result. We can test the model using NNN, SVM and Logistic Regression. The accuracy for a given model is greater than the existing model. In future we develop a model for suitable fertilisers which leads to better growth of the cultivated crop.

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