

INTRODUCTION

Agriculture is the technique of cultivating the soil, growing crops, and raising livestock. It builds the preparation of plant and animal products for people to use and their distribution to markets. Agriculture gives most of the nation's food and fabrics. Agriculture plays a very important role in the global economy. The world population is increasing at a very fast rate and with an increase in population, the need for food is also increasing. Traditional methods used by farmers are not sufficient enough to serve the huge demand and so they have to hamper the soil by using harmful pesticides in an intensified manner. This affects the agriculture practice a lot and in the end, the land remains barren with no fertility. Machine Learning in agriculture is used to improve the product quality of the crops in the agriculture sector. Machine Learning is the scientific field which gives the machine the ability to learn without the intervention of human being.

Problem statement

According to the current surveys and research, it is observed that there is a proliferate increase in suicide rate of farmers over the years. The reasons behind this includes weather conditions, debt, family issues. Most of the times farmers are not aware of the crop which suits their soil quality, soil nutrients and soil composition. There are hardware devices which can check the soil quality. But is there any software to do this? If yes, is it economical? Is it accurate? The answer to all these questions is, the currently booming technology MACHINE LEARNING. This provides a feasible solution to farmers.

AIM

The main aim of this research is to *design, develop and implement the crop yield prediction and soil fertility analysis model using machine learning (supervised) and Artificial neural network model.*

OBJECTIVES

- Collecting the real-time data of soil and crop from the different online repository (Private).
- Assessing the model using the datasets and computing the result. The datasets are divided into two categories training dataset and testing dataset to build the model.

- Applying different Machine learning algorithms to classify the soil, to know whether the soil is fertile or not by using soil micro-nutrients and chemical features.
- Analyzing the crop yield, crop sowing using the ML technique. The algorithm assessed involves SVM, artificial neural network (ANN), decision tree, Naive Bayes, and linear regression which all are available in the machine learning model.

LITERATURE REVIEW

The literature has many reported works in the domain.

[1] Shivnath Ghosh, et al. (2014) In this paper, machine learning system is divided into three steps, first sampling (Different soil with same number of properties with different parameters) second Back Propagation Algorithm and third Weight updating.

[2] P.Vinciya, et al. (2016) This paper mainly focused on the agricultural analysis of organic farming and inorganic farming, time cultivation of the plant, profit and loss of the data and analyzes the real estate business land in a specific area. This work goes for finding reasonable information models that accomplish a high precision and a high consensus as far as yield expectation abilities.

[3] Zhihao Hong, et al. (2016) This paper proposes an information driven approach on structure PA answers for gathering and information demonstrating frameworks. Soil dampness, a key factor in the yield development cycle, is chosen for instance to exhibit the viability of our information driven methodology. On the accumulation side, a responsive remote sensor hub is built up that expects to catch the elements of soil dampness utilizing soil dampness sensor. The prototyped gadget is tried on field soil to show its usefulness and the responsiveness of the sensors. On the information examination side, a one of a kind, site-explicit soil dampness expectation system is based over models produced by the AI procedures Support Vector Machine and Relevance Vector Machine. The structure predicts soil dampness n days ahead dependent on a similar soil and natural characteristics that can be gathered by our sensor hub.

[4] Sabri Arik, et al. (2016) In this paper, we propose a method for predicting functional properties of soil samples from a number of measurable spatial and spectral features of those samples. The method used is based on Savitzky-Golay filter for pre-processing and a relatively recent evolution

of single hidden-layer feed-forward network (SLFN) learning technique called extreme learning machine (ELM) for prediction.

[5] Vaneesbeer Singh, et al. (2017s) This work presents an approach which uses different Machine Learning techniques in order to predict the category of the yield based on macro-nutrients and micro- nutrients status in dataset. The dataset considered for the crop yield prediction was obtained from Krishi Bhawan (Talab-Tillo) Jammu. The parameters present in the data are Macro-Nutrients (ph,Oc,Ec,N,P,K,S) and Micro Nutrients(Zn,Fe,Mn,Cu) present in samples collected from different regions of Jammu District. After analysis, Machine learning algorithms are applied to predict the category of yield. The category, thus predicted will specify the yield of crops. The problem of predicting the crop yield is formulated as Classification where different classifier algorithms are used.

[6] E.Manjula et al.(2017) This paper chooses Nitrogen, Phosphorus, Potassium, Calcium, Magnesium, Sulphur, Iron, Zinc, and so forth, nutrients for investigating the soil supplements utilizing Naïve Bayes, Decision Tree and hybrid approach of Naïve Bayes and Decision Tree. The performance of the classification algorithms is compared based on accuracy and execution time.

[7] Rohit Kumar Rajak et al. (2017) This method is characterized by a soil database collected from the farm, crop provided by agriculture experts, achievement of parameters such as soil through soil testing lab dataset. The data from soil testing lab dataset given to recommendation system it will use the collect data and do ensemble model with majority voting technique using support vector machine and ANN as learners to recommend a crop for a site specific parameter with high accuracy and efficiency.

[8] Akshada Sakhare et al. (2019) This method is implemented using Raspberry Pi as a controller. Here Hardware like moisture sensor and Motor On and off switch are used. In this work the experiments are executed significantly and well admitted grade algorithm KNN (*a type of supervised ML algorithm which can be used for both classification as well as regression predictive problems.*) are enforced to the dataset. In recommended system the farmer will enter his crop name in the system and when system detect the climate or weather change, then System will automatically predict and advise the farmer that which disease will taint to his crop, the system will also give a distinct method to prevention. This project supports to conduct the moisturize level

of soil and it can be used in the Society easily. The percentage of moisture is preserved by sensor which is present inside the soil and the data will store in the database using a mobile application.

Proposed solution

This work proposes to help farmers to check the soil quality depending on the analysis done based on data mining approach. Thus the system focuses on checking the soil quality to predict the crop suitable for cultivation according to their soil type. As the rate of farmers suicides are increasing, we want to help farmers to understand the importance of prior crop prediction, to flourish their basic knowledge about soil quality, understanding location-wise weather constraints, nutrients present in the soil in order to achieve high crop yield through our technology solution. Most of the existing systems are hardware based which makes them expensive and are difficult to maintain. Also they lack to give accurate results. Some systems suggest crop sequence depending on yield rate and market price. The system which we are proposing tries to overcome these drawbacks and predicts crops by analyzing structured data. The idea being “Prediction of soil quality using machine learning” certainly focuses on agricultural aspects. Being a totally software solution, it does not allow maintenance factor to be considered much. Also the accuracy level would be high as compared to hardware based solutions, because components like soil composition, soil type, pH value, weather conditions all come into picture during the prediction process.

The crops selected in this work are based on important crops from selected location. The selected crops are Maize, Wheat, Soybeans, Cotton, Onion, Dry Chili etc. The dataset of crop yield is collected from last 5 years from different sources.

There are two (2) steps in proposed work.

1. Soil classification and nutrients prediction

Firstly, a data set containing parameters like soil type, climatic conditions (maximum temperature, minimum temperature, average rainfall), pH value of soil, previously grown crop should be taken. Also we can consider the amount of sunlight the soil or the land faces. Based on these parameters, we can predict the nutrients present in the soil using machine learning algorithms (Build a model,

train the model and test the model). Then based on the type of nutrients present in the soil, we can predict the crop to be grown.

2. Fertilizer Recommendation

Now once we know the type of crop, we can recommend the suitable fertilizers that can be used for high yield of a crop. To do all of these steps, we require adequate data and as we increase the number of parameters in a data set, accuracy increases.

Proposed Methodology