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SURVEY ON CROP AND FERTILIZER RECOMMENDATION USING MACHINE LEARNING

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ABSTRACT

India is a predominantly agricultural country. For around 58 percent of India's population, agriculture is the primary source of income. Agriculture contributes 20.2 percent to GDP, according to the first revised estimates of national income for 2020-2021 issued on May 30, 2021. So clearly, the Indian economy is reliant on agricultural yield growth and agro-industrial output. Machine learning is a new research subject in agricultural business. It has become possible to predict crop production and the best fertilizers for crops using machine learning models. In agriculture, crop yield and crop prediction are critical issues. Farmers are constantly interested in knowing how much output they have at the end of the season, which crop they should plant, and which fertilizer is best for their crops. Various attributes, such as location, crop yield data, fertilizer data, and so on, have been studied. The nutrient value of the soil in the region, as well as the amount of rainfall within the region, can be assessed using third-party applications such as APIs for weather and temperature. All this information is analyzed, and machine learning methods such as SVM and Random Forest are used to create models. The system will generate a model that is accurate in forecasting crop output and will provide the user with appropriate recommendations for which crop to plant to increase yield and farmer revenue. It will also suggest the appropriate amount of fertilizer for the crops. The proposed system develops web applications using HTML, CSS, and JavaScript.

KEYWORDS

Support Vector Machine (SVM), Random Forest, Web Application, Agriculture, Fertilizer Recommendation

1. INTRODUCTION

As we all know, agriculture is one of India's most vital yet mainly unorganized sectors, and it is still lagging in terms of technical improvements. Farmers are often unaware of the proper amount of fertilizer to use, as well as the proper understanding or information about which crop to grow under specific conditions and how much yield the crop will produce. This lack of awareness detracts from the organic nature of the crop, and excessive fertilizer can make the crop unhealthy to eat. Hence,

this makes the agricultural sector overall unorganized and less economical Excessive use of fertilizer also makes the land infertile for farming as well as it causes soil pollution. An inadequate quantity of fertilizers majorly affects the overall health of the people consuming these crops and in turn, the health of a region over time degrades. Unduly high concentration or intake of elements and nutrients also harms plant growth. Also, heavy metals tend to bio-accumulate on the soil, and hence the plants can become a source of excess heavy metal intake in human beings if the farmers keep on adding unwanted fertilizer to the crops. Meeting the growing need for food is also a major challenge, for this agricultural land per unit area is required to achieve maximum efficiency. Our project attempts to reduce fertilizer use and only prescribe the type of fertilizer that is required for each crop, to deal with excess fertilizer problems. Here we present an idea to implement a machine learning model which suggests whether the crop should be planted in that area or not along with the yield and fertilizer information for a particular crop and land, basically it benefits the farmers and saves them a lot of trouble, machine learning algorithms like Random Forest.

2. LITERATURE SURVEY

[1](2019) The researcher C.P.Wickramasinghe, P.l.N.Lakshitha, H.P.H.S Hemapriyaa from Sri Lanka Institute of Technology, Malabe, Sri Lanka suggested a crop and fertilizer prediction system that uses sensors to collect soil measurements and an SVM algorithm to develop a list of appropriate crops for the area. They used k-nearest neighbours to simulate daily precipitation and other weather variables, evaluate soil water characteristics, and anticipate climate change, as well as Neural Networks to forecast water resource variables in agriculture. It achieves an accuracy of over 80% after generating the model with the trained data set.

[2](2020) N.Manjunathan, P.Rajesh, E.Thangadurai and A.Suresh of Department of Computer Science and Engineering, R & D Institute of Science and Technology, Chennai, India. Proposed this model, which is focused on crop production and is based on the SVM (support vector machine) Machine Learning algorithm, aims at delivering trustworthy results and supporting farmers in choosing the best crop according to their area and climate. This ML model trained with Support Vector Machine has an **accuracy percentage of 96.5.**

[3](2019) Devadatta A. Bondre, & Mr. Santosh Mahagaonkar, NICT Solutions & Research, Belagavi, Karnataka. This paper provides a method that uses old data to estimate crop production, which is performed by analysing the given agricultural data and then selecting the appropriate fertilizer for each crop using machine learning techniques such as Support Vector Machine and Random Forest. It can be concluded from this study that Random Forest is superior to Support Vector Machine for soil classification, **with an accuracy of 86.35 percent.**

[4](2017) Prof. D.S. Zingade, Omkar Buchade, Nilesh Mehta, Shubham Ghodekar, Chandan Mehta Department of Computer Engineering from All India Shri Shivaji Memorial Society's Institute of Information Technology, this model provides a solution for Smart Agriculture it monitors the agricultural field so that farmers can be assisted to produce maximum yield. Weather forecast data is obtained from Indian Metrological Department mainly temperature, rainfall, and soil parameters repository give information about crops that are fit to be cultivated in a particular area.

[5](2016) Dr.G.M Nasira and MRS.hemageetha (Department of Computer Science, Periyar University, India). Using data mining classification approaches, this paper determines whether the Salem district soil is appropriate or unsuitable for farmed crops depending on pH value. The domain specialists determine the type of crops to be cultivated in a given soil based on the fertility class of the soil, as well as the type of fertilizers to be utilized for the same. To forecast the pH value of soil, the Naive Bayes algorithm is applied. Using the information gathered from the database. From the database collected out of 792 instances of soil samples 701 instances have been considered for the proposed methodology.

[6][2021] Dhruvi Gosai, Chintal Raval, Rikin Nayak, Hardik Jayswal, Axat Patel, Charotar University of Science and Technology, Gujarat, India. The suggested IoT and ML system is capable of soil testing utilizing sensors and is based on the measurement and observation of soil properties. Three aspects are considered in this method: soil features, soil types, and crop yield statistics. This approach offers solutions such as recommending a suitable crop based on soil parameters using a random tree, CHAID, K Nearest Neighbour, and Naive Bayes as the learner with high specific accuracy and efficiency.

[7](2020) Sri Lanka Institute of Information Technology students Pradeepa Bandara, Thilini Weerasooriya, and Ruchirawya T.H. Through this paper a recommendation system is presented based on integrated models for gathering environmental factors using Arduino microcontrollers, some machine learning techniques mainly Naive Bayes (Multinomial)and Support Vector Machine (SVM). Artificial Intelligence employs unsupervised machine learning algorithms like K-Means Clustering and NLP (Sentiment Analysis) to select a crop accurately and efficiently for a given piece of land based on site-specific factors. The proposed system has overall accuracy **greater than 92 percent.**

[8](2018) K. R. Akshatha K. S. Shreedhara, Department of Studies in Computer Science & Engineering, University BDT College of Engineering, India. Through this paper, the researchers propose a recommendation system using Random tree, K-Nearest neighbour, and Naive Bayes to recommend a crop for the site-specific parameters with high precision and efficiency.

[9](2019) Vidyanagar Institute of Technology, Mumbai, India, Department of Computer Engineering, Professor Sachin Deshpande, Miss Vaishali Patil, suggested a system that employs machine learning techniques like the decision tree algorithm and SMA to analyses soil quality and rainfall value to determine the best crop for cultivation and maximum agricultural production.

[10](2015) V.R.Thool, NGCT, M.R. Bendre, R.C. School, this paper discusses how to use a big data technique to uncover extra insights from precision agricultural data.

This study's results, which were predicted using a regression model and huge data handled by MapReduce, suggest that data fusion has a convince able future in the field of crop and water management which is applicable for precision agriculture.

[11](2021) Mr. Mahesh B.L1, Ms. Aditi, Ms. Aisha Reza GD, Mr. Akhil Roy, Mr. Nikhil M from Yenepoya Institute of Technology, Moodbidri.the proposed method is divided into the training and testing phase. data collection and data pre-processing are a part of the training phase. the output of training is given to the k-means algorithm. The pre-processed data will be clustered using the **K-Means algorithm**. Data visualization was done using python matplotlib and Seaborn. This research paper aids in achieving the maximum yield rate of the crops. Also assists in the selection of proper crops for their specific land and selected season. The accuracy may vary with each crop and location.

[12](2019) Devadatta A. Bondre et al, proposed a system for predicting agricultural yield based on historical data. It uses farm datasets to train such as S.V.M and Random Forest, which then propose fertilizer for every crop. Random Forest achieves 86.35 percent accuracy in soil categorization when compared to Support Vector Machine. The Support Vector Machine technique exceeds the Random Forest algorithm by 99.47 percent when it comes to crop yield prediction.

[13][2020] Hemasai Katuru et al proposed that the random forest classification technique and the logistic regression algorithm are used in this model to forecast crop prediction using data from India's agricultural agriculture. It also provided 100 percent model accuracy, which was superior to logistic regression. This is especially useful for all farmers and related businesses, as it will help them plan their operations ahead of time.

[14][2020] Vinay Kumar C & IT Department, Assistant Professor from REVA University Bangalore, India This project will be able to propose which grains and vegetables a farmer should grow to increase profit and productivity. The result will be in the form of a table, with all of the data sets included. The project also forecasts yields depending on several elements such as rainfall, temperature, and so on, and can be recommended to farmers.

(15)[2016] Mr. Khakal V.S. et al. proposed a system whose aim is to design, optimize, and manufacture a realistic agricultural monitor and controlling system. Sensors used for measuring micro parameters i.e., N, P, K, temperature, level detection, motion detection, humidity, soil moisture, and soil pH are used in the proposed system for agricultural environment management.

3. CONCLUSIONS

The conclusion drawn from the literature survey is that the SVM classifier is the most appropriate algorithm to predict crop yield, fertilizer, and crop recommendation. Support Vector Machine is used to classify crops based on characteristics such as location and season in the proposed system, there's also a web application that allows people to engage with the machine learning model and generate predictions based on their inputs. We hope to give a contribution to the agriculture sector through our work and present a farmer-friendly project.

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