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Machine Learning-Driven Crop Recommendation System through a Web Interface

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ABSTRACT: India's economy is mostly based on its agriculture industry. Agriculture directly supports 70% of India's population. A typical issue for young farmers in India is selecting the appropriate crop depending on the needs of the land. Their output thus suffers greatly as a result. By the analysis of many soil factors, we offer to assist farmers in determining the quality of their soil and to suggest crops based on the findings of data mining. To increase the Crop Recommendation System's effectiveness, the system employs the classification algorithm of Support Vector Machines. The technology analyses soil and crop data to anticipate a list of crops that will grow well on the soil and also offers details on the nutrients that the soil is deficient in for a certain crop. Therefore, the user can decide on the crop to be planted. Thus, the system helps to provide information to amateur farmers.

KEYWORDS: Support vector machine, Crop prediction, Machine learning, Agriculture

I. INTRODUCTION

India's economy relies heavily on agriculture. Food is a need for survival; hence the agricultural sector needs to be given top priority in terms of growth. 50 percent of the workforce in India is employed in the agriculture sector, which contributes 18 percent of the country's agricultural GDP. The primary justification for considering the agriculture sector is that it is so important to the growth of the nation's economy. As crop selection is the first and most crucial step in the process of agricultural growth and the success of this step ensures the outcome of output, the suggested system employs crop selection as the field of research. With the aid of diverse agricultural resources, agriculture development aids crop growers. As a result, it provides high productivity with low consumption of resources. A major problem in agriculture is yield prediction. Each farmer is curious to know what amount of crop he may produce. Examine the different factors that are associated, such as the location and the pH level used to calculate the soil's alkalinity. Together with that, the amount of nutrients such as nitrogen (N), phosphorus (P), and potassium (K), the kind of soil in a certain location, and the nutritional value of the soil in that area may all be identified. To create a model, all these data properties will be examined, and the data will be trained using a variety of useful machine learning methods. The system includes a model to provide the end user with accurate suggestions about the appropriate fertiliser ratio based on atmospheric and soil data of the field, which enhance to boost crop production and raise farmer income. The kind of soil has a significant impact on crop productivity. Advising farmers to utilise fertilisers might assist them in making the optimal choice for their farming condition. We can advise the farmer to plant a better crop for a higher yield by thoroughly analysing the prior data. Crop yield forecasting is an essential piece of science that contributes to food security. With the use of machine learning algorithms, we must analyse vast amounts of data in order to better understand agricultural yields and advise farmers on how to improve their crops. Pesticides are the most crucial component of farming. Without pesticides, crops would suffer greatly from insects and other pests, which would cause a sharp decline in agricultural productivity. Moreover, too many pesticides may harm the crop, whereas too little may be ineffective. Hence, the quantity of pesticides needed by the crop is a crucial factor. The primary justification for considering the agriculture sector is that it is so important to the growth of the nation's economy.

II. RELATED WORK

[1] A survey on Data Mining Techniques for crop Yield Prediction

Authors: Ramesh, Vijay

This paper presents the various crop yield prediction methods using data mining techniques. Agricultural system is very complex since it deals with large data situation which comes from a number of factors. Crop yield prediction has been a topic of interest for producers, consultants, and agricultural related organizations. In this paper the authors focus on the applications of data mining techniques in agricultural field. Different Data Mining techniques such as K-Means, K-Nearest Neighbour (KNN), Artificial Neural Networks (ANN) and Support Vector Machines (SVM) for very recent applications of data mining techniques in agriculture field. Data mining technology has received a great progress with the rapid development of computer science, artificial intelligence. Data Mining is an emerging research field in agriculture crop yield analysis. Data Mining is the process of identifying the hidden patterns from large amount of data. Yield prediction is a very important agricultural problem that remains to be solved based on the available data. The problem of yield prediction can be solved by employing data mining techniques

[2] Applying Data Mining Techniques to Predict Annual Yield of Major Crops and Recommend Planting Different Crops in Different Districts in India

Authors: Rajshekhar Borate, 2Rahul Ombale, 3Sagar Ahire, 4Manoj Dhawade, 5Mrs. Prof. R. P. Karande

In India there are different agriculture crops production and those crops depends on the various kind of factors such as biology, economy and also the geographical factors. And this several factors have the huge different impact on crops, which can be quantified using appropriate statistical methodologies. Applying such methodologies and techniques on historical yield of different crops, it is possible to obtain information or knowledge which can be helpful to farmers and government organizations for making better decisions and for make better policies which help to increased production. In this paper, the authors focus on application of data mining techniques which is use to extract knowledge from the agricultural data to estimate better crop yield for major crops in major districts of India.

[3] Analysis of crop yield prediction using data mining technique to predict annual yield of major crops

Author: B. Devika¹, B. Ananthi

India is generally an agricultural country. Agriculture is the single most important provider to the Indian economy. Agriculture crop production depends on the season, organic, and monetary cause. The prognostication of agricultural yield is challenging and pleasing task for every nation. Nowadays, Farmers are hostile to produce the yield because of erratic climatic changes and scarcity of water resource. The main objective is collecting agricultural data which can be stored and analysed for useful crop yield forecasting. To predict the crop yield with the help of data mining technique, advanced methods can be introduced to predict crop yield and it also helps the farmer to choose the most suitable crop, thereby improving the value and gain of the farming area.

[4] Random Forests for Global and Regional Crop Yield Predictions

Author: Jig Han Jeong, Jonathan P. Resop, Nathaniel D. Mueller, Kyungdahm Yun, Ethan E. Butler

Accurate predictions of crop yield are critical for developing effective agricultural and food policies at the regional and global scales. We evaluated a machine-learning method, Random Forests (RF), for its ability to predict crop yield responses to climate and biophysical variables at global and regional scales in wheat, maize, and potato in comparison with multiple linear regressions (MLR) serving as a benchmark. We used crop yield data from various sources and regions for model training and testing: 1) gridded global wheat grain yield, 2) maize grain yield from US counties over thirty years, and 3) potato tuber and maize silage yield from the north-eastern seaboard region. RF was found highly capable of predicting crop yields and outperformed MLR benchmarks in all performance statistics that were compared. For example, the root mean square errors (RMSE) ranged between 6 and 14% of the average observed yield with RF models in all test cases whereas these values ranged from 14% to 49% for MLR models. Our results show that RF is an effective and versatile machine-learning method for crop yield predictions at regional and global scales for its high accuracy and precision, ease of use, and utility in data analysis. RF may result in a loss of accuracy when predicting the extreme ends or responses beyond the boundaries of the training data.

[5] Agriculture Price Prediction Using Data Mining

Author: Veeresh Kadlimatti, S V Saboji

Agriculture is the main source and backbone of Indian Economy and plays a vital role in individual life. In the total Gross Domestic Product (GDP) agriculture nearly contributes sixteen percent and for increasing foreign exchange it



contributes nearly ten percent to the total country exports. As the population continuously increasing and to manage the livelihood of the country there’s requires a proper utilization and management of agriculture products. Data mining is a better technique and best choice in predicting the accurate prices of the agriculture based on previous data. In this work various data mining algorithms are applied on the dataset to predict the future prices of the agriculture products.

III. PROPOSED SYSTEM

The proposed system obtains the soil and crop parameters and maps those to list the suitable crops. It passes the various inputs to the controller which uses the Support Vector Machine Algorithm for classification. The proposed system provides easy accessibility to the users. They are also easy to use and understand by the dilettante farmers. It improves the visualization and understandability.

Advantages of proposed system

It delivers the end user with proper recommendations about required fertilizer. It increases the crop yield and farmer revenue. It provides accurate prediction for recommending the crop.

IV. PROPOSED SYSTEM METHADODOLOGY

Prediction of the crop using machine learning algorithm and suggest how much quantity of fertilizer should be used to get the proper yield for the crop.

A. Data Set Description

This is the sample dataset used in this project. Table 1 is data used to predict the crop for every location based on the nutrition contents such as nitrogen (N), phosphorous (P) and potassium (K) in that region. By this data we can create a machine learning model and train the model and we can predict the crops. From Table 2 we can predict the amount of fertilizer should be used to get the proper yield and the output is the amount of the respective fertilizer should be used.

TABLE 1

SAMPLE DATASET OF LOCATION DATA

Location	Latitude	Longitude	N	P	K	pH
Yercaud	11.7748	78.2097	104	23	106	6.98
Vellore	12.9165	79.1325	95	9	198	5.26
Salem	10.7905	78.7047	109	19	103	6.8
Coimbatore	11.0168	76.9558	76	11	113	7.72
Vilupuram	11.9408	79.4861	103	20	170	7.54

TABLE 2

SAMPLE DATASET FOR CROP DATA

Crop	N	P	K	pH
Rice	80	40	40	5.5
Maize	80	40	20	5.5
Barley	70	40	45	5.5
Green Peas	40	35	55	6
Sunflower	50	60	30	5.5

B. Architecture

The Fig.1 shown below represents the architecture diagram

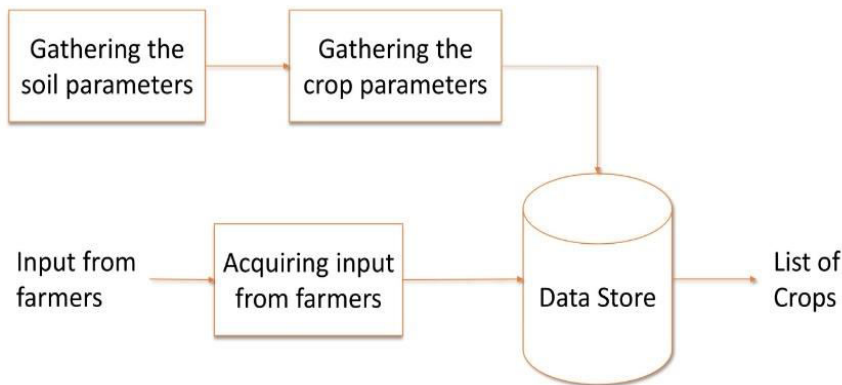


Fig.1 Architecture diagram

C. Data pre-processing

Data pre-processing is a technique that is used to convert the raw data into clean dataset. Here the crop and location datasets are gathered in raw format which is not feasible for the analysis. So, the raw data in the datasets are cleaned. For example, if the dataset contains a total of 103 records, where 6 records are with some missing values. Those 6 records have been removed from the dataset and the remaining 97 records are used in pre-processing.

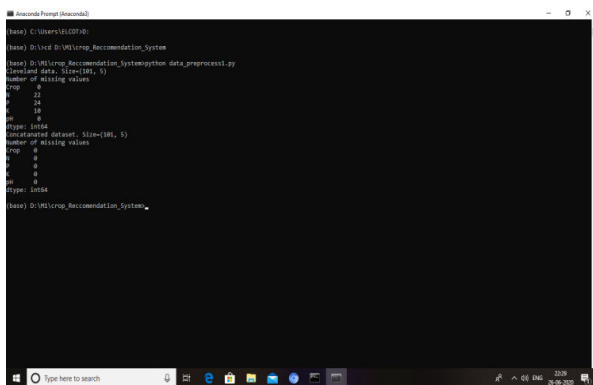


Fig.2 Data pre-processing of crop dataset

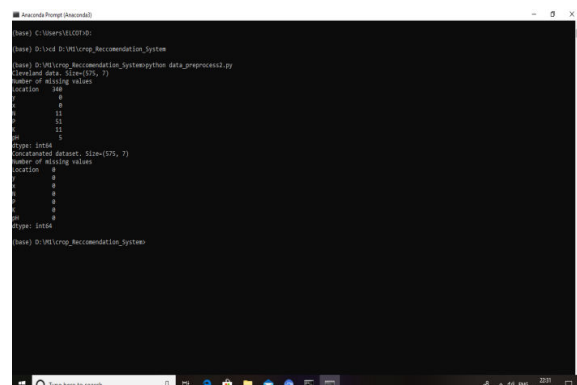


Fig.3 Data pre-processing of location dataset

In Fig.2 and Fig.3, there are some missing values in both datasets and after data pre-processing, the datasets became clean datasets without any missing values.



D. Applying machine learning algorithm:

Machine learning is one of the most influential and powerful technologies in today’s world. Machine learning is a tool for turning information into knowledge. Machine learning facilitates computers in building models from sample data in order to automate decision making processes based on data inputs.

The Recommendation System requires Classification and Clustering Algorithms to perform mapping of Datasets. The proposed system uses Support Vector Machine Algorithm to perform Machine Learning. On an analysis conducted within various algorithms, the SVM was found to provide highest efficiency and precision compared to Decision tree, Random Forest etc. Hence the SVM algorithm is used in the proposed system to find the suitable crop list.

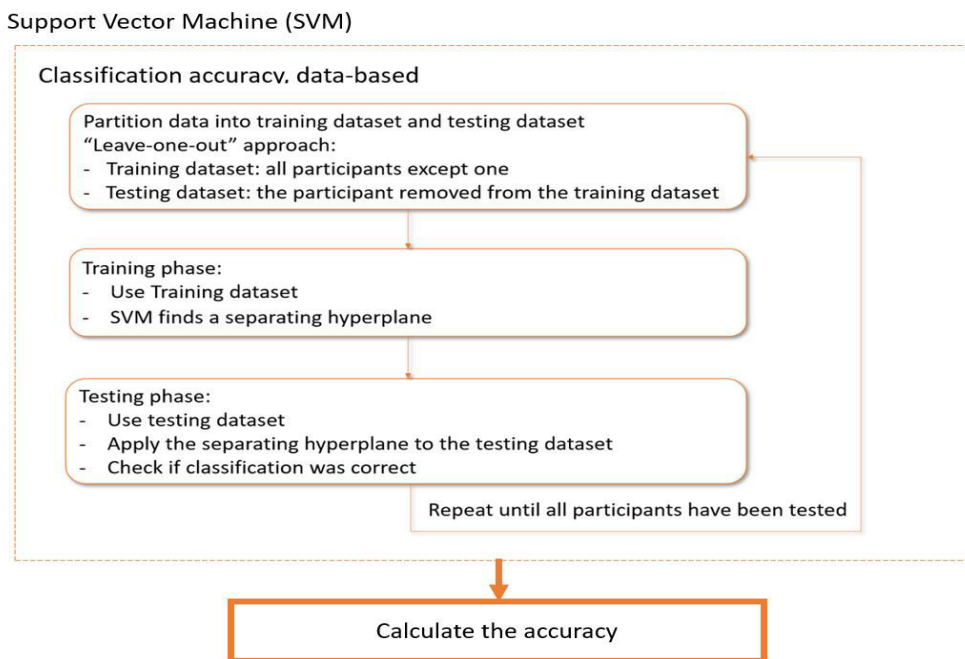


Fig.4 Flow chart for SVM algorithm

E. Listing the suitable crops for the soil provided as input:

The system uses Supervised Machine Learning Algorithm to recommend suitable crops with higher accuracy and efficiency. The system lists the suitable crops based on the soil and leaves it upon the farmers to decide on the crop to be sown.

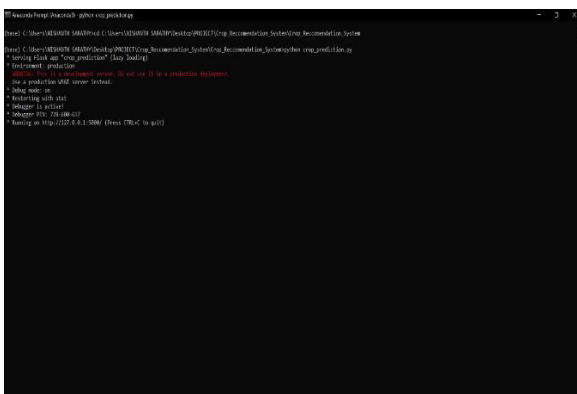


Fig.5 Server page



Fig.6 Home page

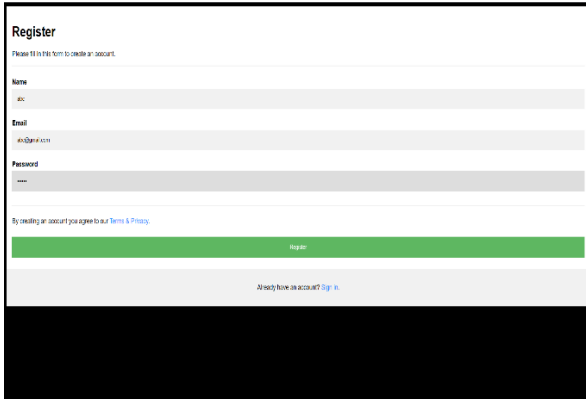


Fig.7 Register page

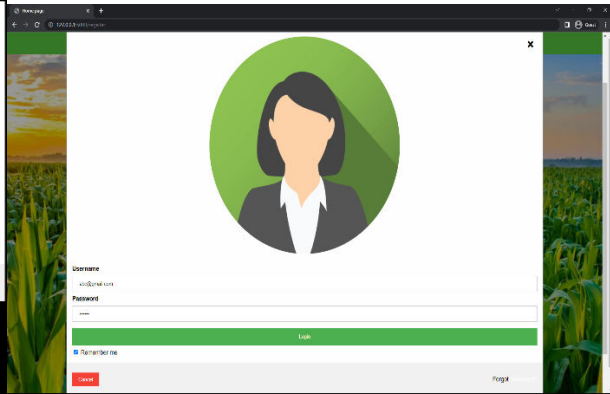


Fig.8 Login page

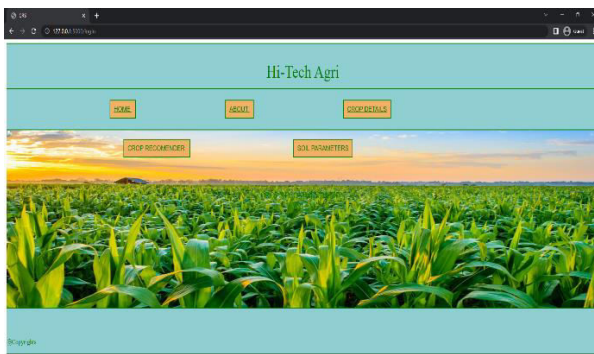


Fig.9 Prediction page

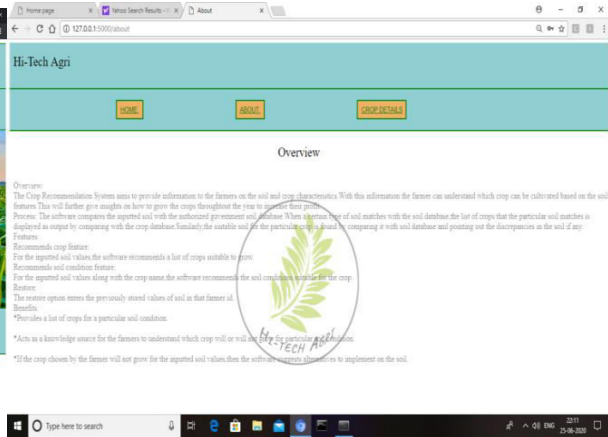


Fig.10 Overview page

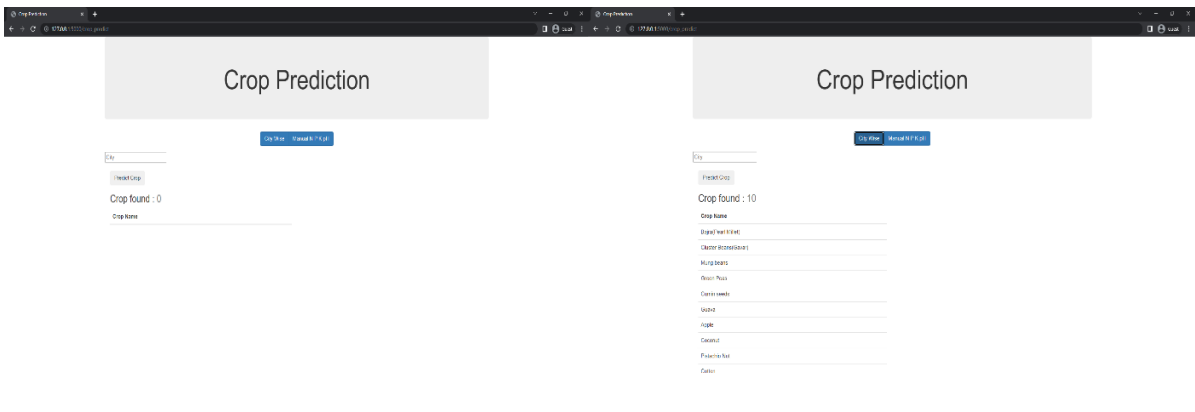


Fig.11 Crop recommender Page

Fig.12 Crop Prediction by city wise

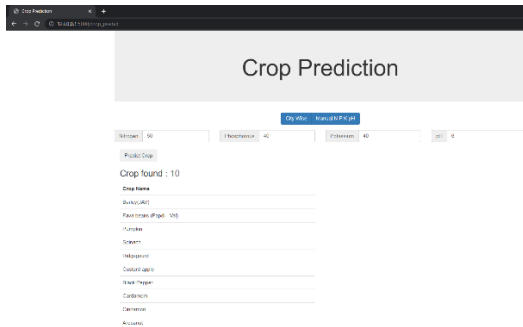


Fig.13 Crop prediction by nutrient contents in location

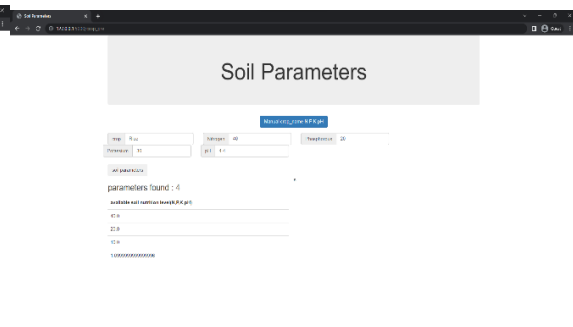


Fig.14 Soil Parameter page

SAMPLE OUTPUT FOR CROP RECOMMENDER
(using nutrient contents)

Nutrients				Recommended Crops
N	P	K	pH	
65	40	37	5	Ridge gourd, Tamarind, Custard apple, Cloves, Cardamom
90	45	66	6	Black eyed beans, Green peas, Guava, Rapeseed, Pigeon peas
25	73	54	5	Black gram, Kidney beans, Sesame seed, Onion, Ginger
39	20	75	5.5	Mustard seeds, Curry leaves, Mushroom, Radish, Brinjal
70	42	35	5	Maize, Tapioca, Banana, Cloves, Spinach

SAMPLE OUTPUT FOR SOIL PARAMETER

Crop Name	Nutrients available				Required quantity of fertilizers			
	N	P	K	pH	N	P	K	pH
Rice	77	35	38	5	3.0	5.0	2.0	0.5
Maize	65	28	15	5.5	15.0	12.0	5.0	0.0
Black gram	30	49	20	5	10.0	11.0	0.0	0.0
Carrot	36	35	50	5	4.0	10.0	10.0	0.5
Radish	20	80	35	5.5	5.0	20.0	15.0	0.5

V. CONCLUSION

The system uses Supervised Machine Learning Algorithm to recommend suitable crops with higher accuracy and efficiency. The system lists the suitable crops based on the soil and leaves it upon the farmers to decide on the crop to be sown.

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