Precision Crop Care Recommender System Using Machine Learning Techniques

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Abstract— **Agriculture is India's main source of employment and revenue. Choosing the incorrect crop for their land and using the incorrect fertilizer are the two biggest problems Indian farmers face. Their output will thus considerably decrease. With the help of the Precision Crop Care Recommender System, the farmer's problem has been solved. The Precision Crop Care Recommender System is a modern farming method that suggests the best crop to farmers as well as fertiliser suggestions based on site-specific attributes using research data on soil properties, soil types, and crop production statistics. This increases output and decreases the frequency of incorrect crop selection. A recommendation system using ML models and a majority vote technique is developed in order to accurately and effectively recommend a crop for the site-specific factors. It employs Logistic Regression, Support Vector Machine (SVM), Random Forest, and Decision Tree. Python logic serves as the only foundation for the fertiliser recommendation system. After classifying the most variable nutrient t as HIGH or LOW, recommendations are then retrieved in line with the findings.**

***Index Terms*— Agriculture, Recommendation system, Random Forest, Support Vector Machine (SVM), Logistic Regression.**

I. INTRODUCTION

Usually, a farmer's intuition and other immaterial factors, such as the desire to earn quick money, ignorance of market demand, exaggeration of a soil's capacity to support a certain crop, and so on, impact his choice of what crop to produce. a very stupid decision the farmer made can put great pressure on his family's financial circumstances. perhaps this is one of the many causes contributing to the daily media headlines on countless farmer suicide cases. in a nation like India, where agriculture and related industries account for over 20.4% of its gross value added, such an incorrect evaluation would be devastating to not just the farmer's family but also the whole local economy. As a result, we've come to the conclusion that a farmer's choice of crop to grow during a certain season is a very important one. the need to develop a system that could provide Indian farmers with predictive information so they could make informed crop decisions is critical. in light of this, we propose a system, an intelligent system, that would evaluate environmental factors (temperature, rainfall, and state geographic location) and soil characteristics (n, p, k, pH value, soil type, and nutrient concentration) before advising the user on the crop that would be most suitable for their needs. additionally, a fertiliser recommendation based on the ideal nutrients of the produced crops is also made.

II. PROBLEM STATEMENT

Agriculture is one of the most significant occupations in India. Many individuals work in agriculture but are unable to identify the crops that would grow best in their soil. Meaning that certain crops can only be grown in moist soil, while others need medium soil humidity to thrive, but both farmers and newcomers with an interest in farming are less likely to be aware of this. There are now a relatively limited number of tools and software available to them that will aid in quality improvement. This problem of farmers has been addressed through a precision crop care recommender system.

III. MOTIVATION

In developing countries like India, where agriculture is the economic backbone, over 70% of the population is dependent on it. Agriculture is a major contributor to India's economy and employment. Indian farmers' biggest problem is that they usually don't choose the proper crop to satisfy the demands of their soil or understand which fertiliser to use for their crop. Their productivity is significantly harmed by this. Farmers have employed the precision crop care recommender system to address this problem.

IV. PROJECT OVERVIEW

The purpose of this project is to investigate the feasibility of using machine learning algorithms for the prediction and crop recommendation with required fertilizer based on the machine learning algorithms such as Random Forest, Decision Tree, Support Vector Machine and Logistic regression. It helps to identify and store the NPK values of soil after that this data is used to recommend the specific crop for that soil which is suitable. This is designed for users with effective support for their soil. This project is divided into different stages data collection, pre-processing, feature selection, model training and evaluation, and model testing and refinement.

V. LITERATURE SURVEY

Authors [1] proposed a system for water management systems and improved current irrigation techniques in their work, "Low-cost IOT + ML design for smart farming with multiple applications." An IoT and ML-based agricultural system constantly keep farmers informed of the potential weather patterns and offers the best recommendations for crops and irrigation techniques, resulting in increased production.

In article [2], the authors put forth a smart system that may help farmers manage their crops by taking into account sensed data (temperature, humidity), as well as other parameters (soil type, farm location, rainfall), which indicate the crop that would do best in that environment.

Using four modules and the well-known machine learning method MODIFIED SUPPORT VECTOR REGRESSION, Reference Paper [3] calculates real-time sampling of soil parameters. The modules comprise analysing the real-time sensor data, an IoT device interfaced sensor, an agricultural cloud, and an agricultural user interface (AUI). The first module is a mobile Internet of Things device (NodeMCU) with environmental sensors including pH and soil moisture sensors Storage is Included in the Agri cloud module. Processing of various crops and tiny plants recommended using a modified support vector machine method is part of the real-time data analysis module. A simple web interface is the agri-user interface. Thus, with the aid of soil attributes and a modified support vector machine, a farmer will be able to determine the kinds of crops and tiny plants that may be cultivated on farmland.

IOT and machine learning are two of the new technologies that the author of article [4] proposes using. Using an IOT system, real-time data from the field may be gathered. The trained model receives input from the field area's gathered data. Then, using the data, the trained model generates the predictions. The model's output significantly aids in planting the appropriate crops in the targeted field area.

In the reference work [5], it is established that a model is put out for predicting the kind of soil and suggesting a crop that may be grown in that soil. Different machine learning techniques, including KNN, SVM, and logistic regression, have been used to evaluate the model.

One flaw we found in all of these well-known published papers was that each paper's authors concentrated on one factor (either weather or soil) to determine whether crops will grow well.

VI. RESEARCH SCOPE

The scope of this research project is to develope a machine learning based model for the prediction of crop growth. The study will focus on developing a predictive model that accurately identifies the crop growth recommendation based on their NPK Values and some other soil conditions. The research will include the collection, preprocessing and analysis of NPK values for better result on suggesting the crop grow recommendation. The study will also include the evaluation of the performance of the trained model using a variety of algorithms and libraries present in python.

VII. METHODOLOGY

The datasets used in this study consisted of crop recommendation records and fertilizer information including N,P,K,Ph,Rainfall Value status. The data was preprocessed to remove corrupt and repeated values and then merged according to the need of recommendation. The methodology for this project is designed to develop a machine learning based model for the prediction of crop recommendation.

Acquisition of Training Dataset : The delicate of any machine learning algorithms depends on the number of parameters and the correctness of the training datasets.

Data Preprocessing : This step includes replacing the null and 0 values for yield by-1 so that it doesn't effect the overall data present in datasets.

Training ML model : After the preprocessing step we used the dataset to train different machine learning models like Random forest, Decision Tree, Support Vector Machine(SVM) and Logistic retrogression to attain accuracy as high as possible.

Model Evaluation and Saving Model : All the ML models which are trained would be estimated by comparing their performance Evaluations Metrics and Final effective model is saved using library.

Model Exportation and Integration with Webapp : The saved effective ML model would be integrated with Flask Web operation which would further mean for use in simpler friendly web interface.

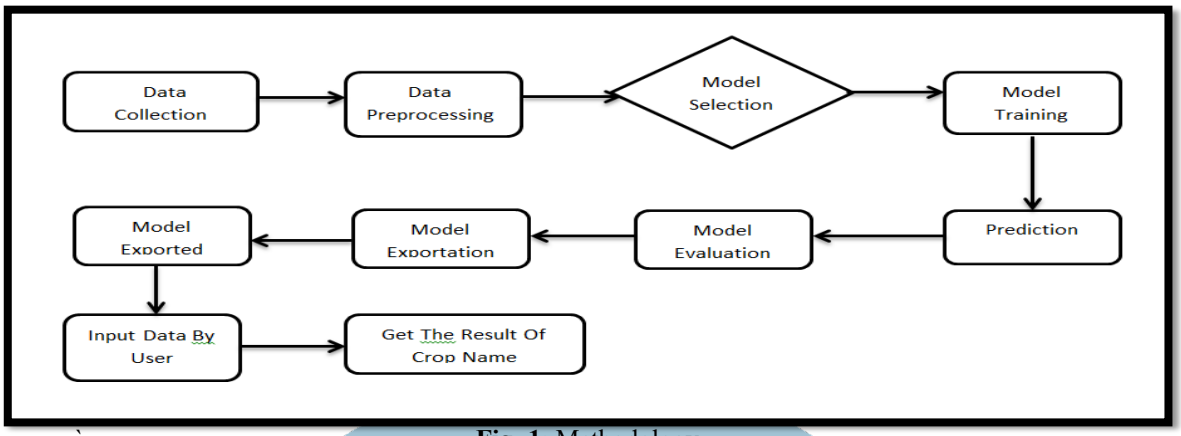

Fig -1: Methodology

VIII. UML DIAGRAM

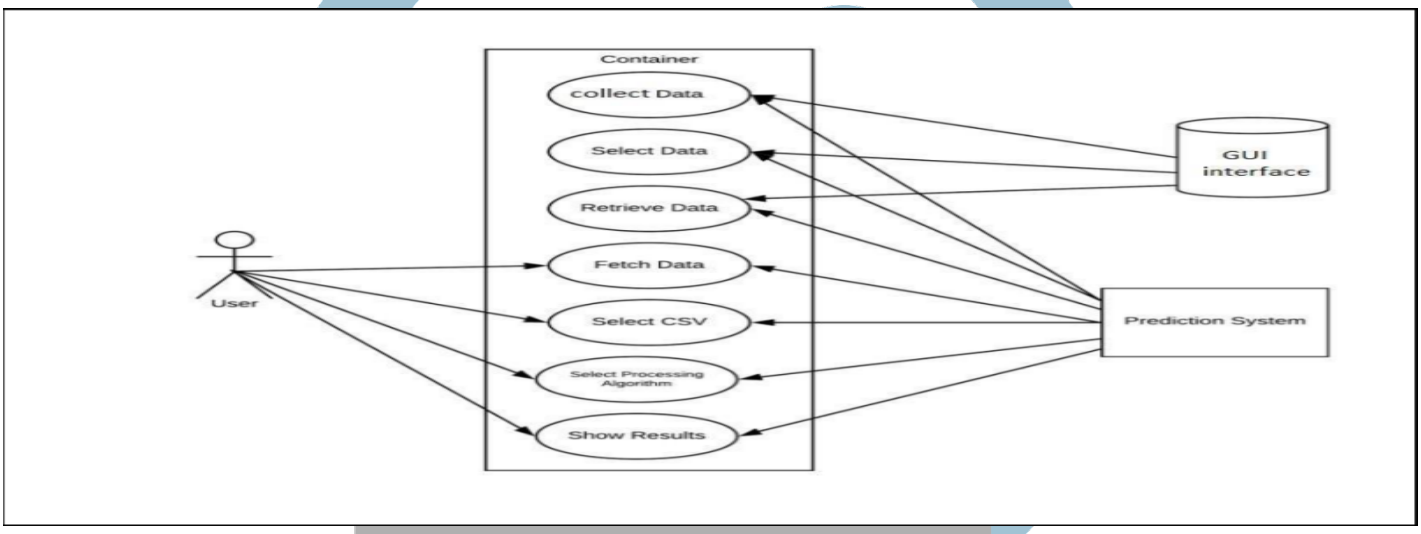

Fig -2: UML Diagram

IX. WORKING OF ALGORITHM

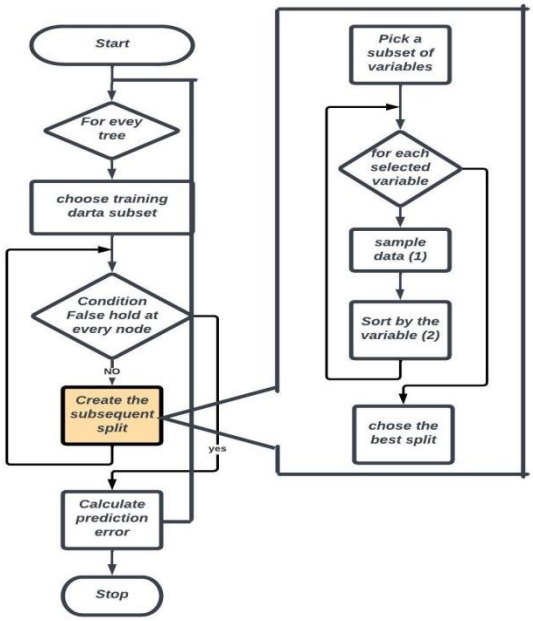

Fig -3: Working of algorithm

X. FUTURE SCOPE

The project's future work will involve adding ever-larger datasets in order to obtain precise crop growth results. Since the agricultural sector is expanding, we must continually update and collect accurate data. As a result, we must forecast correct data because the dataset's values can vary often and frequently. Users can evaluate these to get the finest prediction model ever. We can use AWS hosting to store the data also can use more algorithm to achieve more than 90% accuracy.we cab bulid software app.

XI. CONCLUSION

This technology assists the farmer in selecting the best crop by offering information that most farmers do not monitor, reducing the likelihood of crop failure and boosting output. Additionally, it stops them from suffering losses. Millions of farmers around the nation may access the system, which can be expanded to the online. With the Decision Trees, the Support Vector Machine, the Logistic Regression, and the Random Forest model.

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