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Abstract

Agriculture wears around 17% on Indian GDP and employs more than 60% of the country's population. Despite technological advances such as vertical agriculture, many Indian farmers continue to rely on traditional practices, which are often less productive due to unpredictable weather patterns. This study proposes a harvest recommendation system that uses machine learning models to enable farmers to select the best plant based on environmental factors such as soil nutrients, pH, humidity, and precipitation. A variety of machine learning techniques such as Decision Trees (DT), Support Vector Machines (SVM), Logistic Regression (LR), and Gaushenive Bayes (GNB) are used to predict the best crop selection for a variety of scenarios.

Keywords: *Budget Management; Customized Travel Plan; Enhanced User Experience.*

1. Introduction

Agriculture is an important pillar of the Indian economy, giving the country's gross domestic product (GDP) of about 17% of the country and is employed in more than 60% of the population [1]. Despite its importance, the sector still faces challenges. Especially due to the traditional practices that many farmers follow. Indian farmers often rely on traditional wisdom rather than modern technology, or consider changing climatic conditions [2]. This reliance on outdated methods, including reliance on expected weather patterns, often leads to poor crop yields, which leads to financial burdens for farmers and suicide in extreme cases. By using this technique, farmers can receive tailor-made recommendations for the most appropriate plant to grow based on a variety of factors such as soil composition, nutritional level, and environmental conditions [4]. Precision agriculture not only improves harvest productivity, but also improves resource use and improves profitability and sustainability of agricultural practices [5]. Remove this without and resource loss. Algorithms for machine learning (ML) demonstrate the potential to improve the accuracy of such systems. Decision-Monitoring learning techniques such as manufacturing trees (DT), support vector machines (SVM), logistic regression (LR), and GaußscherNa±Bays (GNB). Nitrogen phosphorus (NPK) mirrors suggest the most suitable plants as bed pH, humidity and precipitation. The purpose of this system is to support Indian farmers in order for their country to select the best harvest, so that their country can maximize productivity and minimize financial risks [7].

2. Related Work

Harvest recommendations were widely used, with various approaches and techniques being used to improve crop yield predictions. These studies use different algorithms for machine learning to suggest suitable plants based on environmental and soil factors. Below is a summary of related research. In [1], Kumar et al. Using previous historical data such as temperature, air humidity, pH, precipitation, and plant type, we proposed a viewed approach for machine learning to predict yield. They used random forests and decision-making structure algorithms to predict optimal harvests for specific outdoor weather conditions and improve accuracy. Suresh et al. [2] developed an efficient recommendation system for harvest application regulation using support vector machines (SVMs) to achieve high accuracy and productivity. The model processed data records containing nutrient values such as nitrogen, phosphorus (P), potassium (K), and soil pH values to

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identify optimal harvests for specific soil and environmental conditions. In a similar way, Reddy et al. [3] addressed systems that attack bottom characteristics, soil types, and harvest data, and harvested harvest data to recommend suitable plants for farmers in the Ramtek region. The system used algorithms for machine learning such as Random Forest, Chaid, K-nearest Neighbor (KNN), and Na±PU Bayes. The plants are based on local soil and weather conditions. Rajak et al. [4] We focused on maximizing yield using machine learning techniques. Their study used classifiers such as SVM, Artificial Neural Networks (ANN), Randallswald, and Na±Bays to predict plants based on various attributes such as floor depth, texture, pH, and permeability. This approach helped farmers prevent soil degradation and use their water resources efficiently. Doshi et al. [5] proposed an intelligent system called Agricultural Consultants, which predicted both appropriate plants and precip itation patterns. Your system was applied to systems, k-nearest Neighter (KNN), random forests and neural networks to predict plants based on soil and climate data. This study achieved an accuracy of 91% for harvest forecasts and 71% for precipitation forecasts. Research by Dighe et al. [6] We checked several algorithms for machine learning used in harvest recommendation systems, reception decision trees, K-mean, Chaid, K-nearest Neighbor, Neuronal Networks, and Sweets. They implemented the Hadoop framework to improve efficient processing and system accuracy. In another study, Kulkarni et al. [7] used an ensemble of machine learning techniques such as Randall Swald, Na±ve Bayes, and Linear SVM to recommend plants based on soil type, precipitation and temperature. Their system categorized harvests in the Kharif and Rabbis categories, achieving an accuracy of 99.91%.

3. Proposed System

The proposed system aims to recommend the best harvest based on environmental parameters such as nitrogen, phosphorus (P), potassium (K), bed pH, air humidity, temperature, and precipitation. Data records are used in 22 cultures including rice, corn, chickpeas, kidneys, and more from Kaggle [27]. The system uses machine learning algorithms such as the Decision Tree (DT), Support Vector Machine (SVM), Logistic Regression (LR), and Gaushena ± VE Bayes (GNB) to predict plant suitability.

3.1 System Overview

The proposed system predicts the most appropriate plants based on input parameters such as bed nutrients, pH values, air humidity, and precipitation according to a structured methodology. The system architecture can be divided into five stages:

Data collection
¢Preparation (noise removal)
Function extraction
Machine learning model application
¢Crop recommendations

3.2 Data Collection

The dataset used in this study was obtained from the Kaggle platform [27]. The data record includes over 2,200 instances covering 22 different cultures, including rice, corn, chickpeas, kidney beans, pigeons, lentils, pomegranates, bananas, mangoes, and grapes. Attributes in the dataset include soil nutrients (nitrogen (S), phosphorus (P), potassium (K)), soil pH value, air humidity, temperature, and precipitation. This allows the machine learning model to be well trained and evaluated under the appropriate conditions.

3.3 Pre-processing (Noise Removal)

Before processing, it is essential to ensure that your data is clean and ready for analysis. The collected data is often done in a raw form and can include redundant, inconsistent, or missing values. To improve this, a preprocessing stage is used involving the following steps: ¢Normalization: Scaling the data ensures that each feature contributes equally to the performance of the model. This step will help you improve the accuracy of your model. Feature Extraction focuses on selecting the most relevant attributes from the data records, which has a major impact on harvest descriptions. The purpose of this process is to remove irrelevant or redundant information that can reduce the efficiency of machine learning models. Extracted properties include
Nitrogen, Phosphorus (P), Potassium (K)
bed pH values.

3.4 Application of Machine Learning Models

Four monitored algorithms for machine learning were

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applied to preprocessed data: decision tree (DT), support vector machine (SVM), logistic regression (LR), and Gaushena ± VE Bayes (GNB). These algorithms were selected for their ability to classify the data and create accurate predictions based on input parameters.

3.4.1 Decision Tree (DT)

A decision tree is the deworming agent structure of a fluid in which each knot represents a property, each branch represents a decision rule, and each leaf node represents a result. The algorithm divides the recursion of the data into sub-quantities based on the most important attributes in all knots. The decision tree is implemented using the decision treeClassifier from the Sklearn. Tree library in Python. This system uses SVM to classify input data points (plants) in various classes. The goal is to maximize the edge between classes while minimizing abuse.

3.4.2 Logistic Regression (LR)

Logistic regression is used for binary classification problems, but in this case, it is extended to treat classification in several classes. Use the logistic functions of the input function to predict the likelihood of data instances belonging to a particular harvest class. The characteristics of the Gauschen (normal) distribution are assumed to be calculated following the probability of each characteristic that contributes independently to the final classification. This method works efficiently with smaller data records and is particularly useful in this context due to its simplicity and accuracy.

3.5 Proposed System Flow

The total flow rate of the proposed system is shown in Figure 1. The river can be summarised as follows: SVM, LR, GNB) are trained using preprocessed data. Recommended harvests are shown to farmers.

3.6 Accuracy and Performance Evaluation

To evaluate the performance of the proposed system, we calculated the accuracy of various machine learning models. As shown in Figure 1. 2, Decision Tree and Gaußsche Na±VE Bayes model created the highest accuracy. A confusion matrix was used to assess the classification performance of the test data. The accuracy results are summarized in Table I.

3.7 Result And Analysis

The harvest recommendation system demonstrates considerable potential to optimize agricultural production by providing crop proposals based on various parameters such as soil type, climate and historical revenue data. The system uses machine learning, particularly decision-making- algorithms to create trees and random forests. 85% in forecasting appropriate harvests for specific conditions. The analysis shows that inclusion of local climate data such as temperature and precipitation patterns significantly improves the predictability of the model. Furthermore, the integration of nutritional analysis allows the soil to enable farmers to carry out properly discovered derivatives, reducing input costs and increasing revenue. System User-Friendly Interface ensures farmers' accessibility and encourages the introduction of technology into traditional farming practices. Overall, implementation of this system could lead to improved sustainable agricultural practices, improved resource management, and improved food security.The Krishi Sewak system offers considerable potential to optimize agricultural productivity by providing intelligent crop selection based on several key parameters such as soil composition, climatic conditions, and historical revenue data. The system uses mechanical learning, particularly advanced techniques for determining decisions, to analyze large amounts of agricultural data and create tree and random forest algorithms to generate accurate harvest proposals. Through rigorous testing and verification, the system exhibits an accuracy rate of 85% in predicting the plants that are most suitable for a particular environmental and soil condition, significantly improving agricultural decision-making. This sophisticated approach allows farmers to receive insights tailored to their own environmental factors, with more regional recommendations. Additionally, the inclusion of soil nutrition analysis in the system improves its functionality and allows farmers to make appropriate informational decisions in relation to the use of fertilizer, soil changes and rotational strategies. This not only maximizes yields, but also reduces excessive input costs, improves soil fertility, and promotes long-term sustainability. The intuitive layout, combined with AI-controlled chatbot support,

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simplifies interaction and provides knowledge of harvest recommendations that are easily available to those who are not familiar with digital platforms. By promoting the introduction of technology-driven agricultural practices, this system closes the gap between traditional agricultural methods and modern precision cultivation techniques. By equipping farmers with accurate, data-controlled harvesting recommendations, the system can make more intelligent plant decisions, reduce risks associated with unpredictable environmental conditions, increase profitability, and at the same time maintain soil health. In the long term, this technology-equipped approach will greatly help improve global agriculture resilience, increase the efficiency of food production, and ensure sustainable agriculture for future generations.

Conclusion

In this article, we have developed a comprehensive and intelligent harvest recommendation system aimed at making informed decisions about plant selection based on environmental factors and ground characteristics. Agriculture is the foundation of the Indian economy, which contributes significantly to GDP and provides employment to a large part of its population. However, traditional farming methods are often based on empirical decisions that do not always achieve optimal results due to unpredictable climatic conditions and changes in soil properties. By using algorithms for machine learning, our systems provide data-controlled recommendations to ensure farmers select the plants that are most suitable for their country. These models analyze various important parameters such as nitrogen, phosphorus (P), potassium (K), soil pH value, moisture, temperature, and precipitation patterns. An extensive analysis of these attributes ensures that the system will make accurate harvest forecasts and help farmers adapt efficiently to ground and climatic conditions. The results of our study show that the decision tree and Gaußschenna've Bayes classifier reach the highest accuracy, training and validation accuracy of 99.5% or 99.3%. These high levels of accuracy indicate the effectiveness of the model in predicting appropriate plants. This allows farmers to get the right information to maximize yields, optimize resource use and improve profitability. Traditional agriculture is susceptible to unpredictable weather changes, soil degradation and water shortages, which can have a major impact on yield and economic stability. By integrating environmental data in real time, our system allows farmers to predict challenges, make positive adjustments, and minimize losses due to unexpected farming risks. The widespread adoption of this technology will lead to general improvements in the nation's agricultural productivity, and may focus on India's vision of precision and sustainable agriculture. Coupled with AI-controlled harvest forecasts, precision cultivation techniques can help government and agricultural political decision-makers make better decisions about resource allocation, subsidies distribution and sustainable land use plans. This can lead to optimized irrigation practices, improved plant diversification, and increased productivity in various regions. Considering the results, we recommend expanding the data record by including additional agronomic and weather attributes that affect plant growth and sustainability. Future research should focus on developing advanced AI models that can diagnose crop disease through image detection and deep learning techniques. Creating a user-friendly interface in the form of mobile and web applications makes this system more accessible to farmers, receiving immediate recommendations, monitoring soil health, and accessing real-world knowledge. By integrating modern technology into traditional agricultural practices, the system allows farmers to refine their farm funds, increasing efficiency, sustainability and economic resilience in the Indian agricultural sector.

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