Cropvista: Precision Crop Recommendation Using Python And ML

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Abstract- *Agriculture is the one amongst the substantial area of interest to society since a large portion of food is produced by them. Agriculture is the most important sector that influences the economy of India. Predicting crop yield based on the environmental, soil, water and crop parameters has been a potential research topic. Growth of IT world drives some highlights in Agriculture Sciences to help farmers with good agricultural information. Intelligence of applying modern technological methods in the field of agriculture is desirable in this current scenario. The idea is to suggest farmers about the suitable crop-type for agriculture with respect to nature of soil and atmospheric status of the field. The System is web-based application which is developed using python and machine learning algorithms. The quality of soil is stated based on its PH, NPK, and temperature. The atmospheric status is analyzed through humidity and rainfall prediction. Finally, the crop will be suggested by matching the gained results with predefined datasets. This system provides guidelines for selecting suitable type of crop for cultivation by considering the real time status of the field and atmosphere. This system provides less prediction accuracy and promotes food production and security.*

Keywords- PH values, NPK values,Rainfall prediction, Random Forest, Python, Data Mining, Machine learning, algorithm,KNN.

I. INTRODUCTION

The objective of this Python data mining project is to develop a crop type suggestion system leveraging machine learning algorithms and agricultural data. The project aims to address the challenge of recommending suitable crop types to farmers based on various factors such as soil type, climate conditions, historical crop yield data, and market demand. Through data mining techniques, the system will analyze large datasets containing information on soil properties, weather patterns, geographical location, and past agricultural performance. Utilizing supervised learning algorithms such as decision trees, random forests, or neural networks, the system will be trained to recognize patterns and correlations between these factors and successful crop types. Additionally, unsupervised learning techniques like clustering may be employed to identify distinct groups of regions with similar agricultural characteristics. The ultimate goal is to provide personalized crop recommendations to farmers, enhancing their decision-making process and optimizing agricultural productivity while considering sustainability and economic factors. This project will not only contribute to the advancement of precision agriculture but also empower farmers with data-driven insights to improve their crop selection strategies.

II. LITERATURE SURVEY

"A CNN-RNN Framework for Crop Yield Prediction" [1] The proposed CNN-RNN model, along with other popular methods such as random forest (RF), deep fully connected neural networks (DFNN), and LASSO, was used to forecast corn and soybean yield across the entire Corn Belt (including 13 states) in the United States for years 2016, 2017, and 2018 using historical data. Deep learning framework that takes advantage of the state-of-the-art modelling and solution techniques to predict crop yield based on environmental data and management practices. *"***Crop** *yield prediction with deep convolutional neural networks"* [2] . Using remote sensing and UAVs in smart farming is gaining momentum worldwide. The main objectives are crop and weed detection, biomass evaluation and yield prediction. Evaluating machine learning methods for remote sensing-based yield prediction requires availability of yield mapping devices, which are still not very common among farmers. The CNNs are able to reduce crop yield prediction uncertainty considerably. Sufficient network depth with regularization were required for better performance.*" Crop Yield Prediction Using Deep Reinforcement Learning Model for Sustainable Agrarian Applications"* [3]. The Q- learning network constructs a crop yield prediction environment based on the input parameters. A linear layer maps the Recurrent Neural Network output values to the Q-values. The reinforcement learning agent incorporates a combination of parametric features with the threshold that assist in predicting crop yield. The advantage can definitely minimize expert dependency and prior knowledge for developing crop yield prediction models.*"Comparative*

Analysis of ANN-ICA and ANN-GWO for Crop Yield Prediction "[4]. In this study the performance of artificial neural networks-imperialist competitive algorithm (ANN-ICA) and artificial neural networks-grey wolf optimizer (ANN-GWO) models for the crop yield prediction are evaluated. That hybrid machine learning methods are considered is that the accuracy of the prediction of such models is higher. Comparative analysis with deep learning models is proposed to identify models with higher efficiency."*A Survey on Classification Techniques Used for Rainfall Forecasting "[5].*Extensive research is being done on classification, which is one of the functionalities of data mining. A variety of classification techniques such as Decision Tree Induction, Bayesian Classification, Naïve Bayes Classifiers, Multi-Layer Perceptron, Genetic algorithms, Fuzzy logic and Support Vector Machines have been developed. Many researchers have made comparative analysis of different classification techniques with respect to different applications. In this paper, we discuss different classification techniques used for rainfall forecasting. The main aim of this paper is to generate sound knowledge on various techniques of classification used for rainfall forecasting."*A survey on rainfall prediction techniques "*[6].This paper reports a detailed survey on rainfall predictions using different rainfall prediction methods extensively used over last 20 years. From the survey it has been found that most of the researchers used Machine Learning techniques for rainfall prediction and got significant results. The survey also gives a conclusion that the forecasting techniques that use MLP are suitable to predict rainfall than other forecasting techniques such as statistical and numerical methods. However, some limitations is clearly noticed in all the methods of rainfall prediction discussed in this survey paper. The extensive references in support of the different developments of methods provided in this research should be of great help to researchers to accurately predict rainfall in the future and to select the method that would solve their problem they will be facing in their proposed prediction model.

III. EXISTING SYSTEM

The existing model utilizes a Deep Recurrent Q-network (DRQN) architecture, which combines Recurrent Neural Networks with Q-learning for crop yield prediction. The Deep Recurrent Q-Network (DRQN) model, an integration of Recurrent Neural Networks (RNNs) and Q-Learning, is employed for crop yield forecasting. The RNN layers are structured in a stacked fashion and are fed with data parameters relevant to crop yield prediction. The Q-Learning network creates an environment for crop yield prediction based on these input parameters, defining the state space, action space, and reward system. The agent, operating within this environment, receives an aggregate score for its actions, with the objective of minimizing errors and maximizing the accuracy of the crop yield forecasts.

IV. PROPOSED SYSTEM

In this system, we propose a comprehensive approach for predicting soil quality, atmospheric status, and suggesting crops based on input data from a dataset repository. Our system leverages the use of PH checker, NPK Checker, and temperature checker for soil quality prediction. For atmospheric status prediction, we employ a random forest algorithm to effectively predict humidity and rainfall. To suggest crops, we utilize the KNN algorithm, which considers both soil quality and atmospheric status to provide accurate suggestions.

To evaluate the performance of our system, we split the data into test and train sets. The test set is used to predict the model, while the train set is used to evaluate the model. We assess the performance of our system using metrics such as accuracy and error rate. Our experimental results demonstrate the effectiveness of our approach in predicting soil quality, atmospheric status, and suggesting crops, highlighting its potential for practical application in agriculture.

V. ALGORITHM

K-Nearest Neighbours (KNN) is a popular machine learning algorithm used for classification and regression tasks. In the context of crop type, KNN can be applied to predict or classify the type of crop based on features such as soil properties, climate conditions, and historical data. The contemporary landscape of machine learning applications in various domains demands advanced algorithms capable of handling complex decision-making processes. **Decision Trees**, as a fundamental machine learning technique, play a crucial role in classification and regression tasks. However, the challenges lie in optimizing Decision Trees for diverse datasets, ensuring robustness, and interpreting the resulting models for actionable insights. **Random Forest algorithm** can be applied to predict the amount of rainfall based on various features such as historical rainfall data, atmospheric pressure, temperature, humidity, wind speed, and geographical location.

VI. METHODOLOGY ARCHITECTURE

In soil quality, system can check the PH, NPK and temperature of soil. In atmospheric status, the system can predict the humidity and rainfall by using random forest (ML

algorithm)effectively. In crop suggestion, based on that soil quality and atmospheric status, with the help of KNN, can predict or suggest the crop effectively. Then, we can split the data into test and train. In this step, test is used for predict the model and train is used for evaluate the model. Finally, the experimental results shows that the performance metrics such as accuracy and error rate.

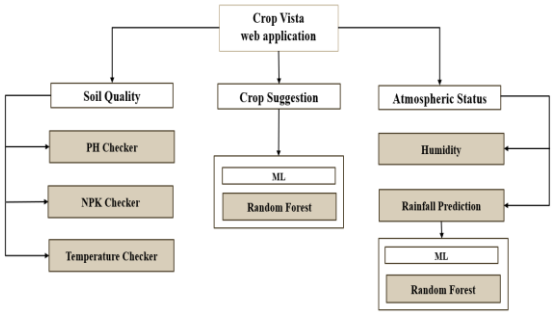
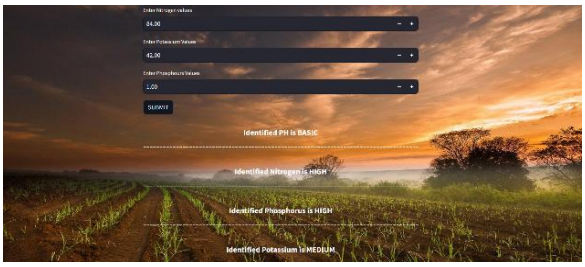
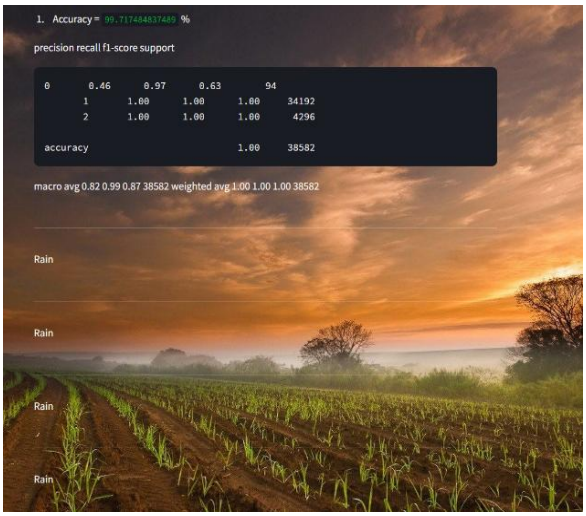
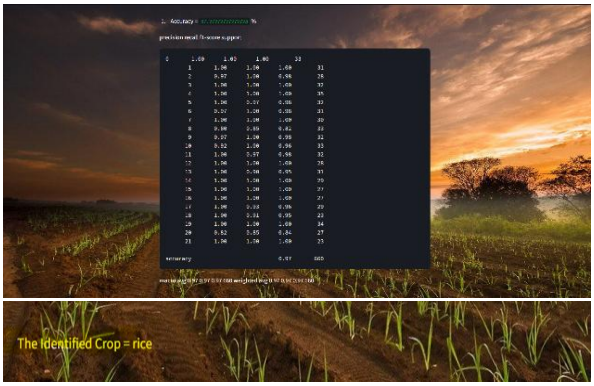


Figure1. Architecture System

VII. EXPERIMENTAL RESULTS







VIII. CONCLUSION

The Crop Type Suggestion Python project aims to assist farmers in making informed decisions about suitable crop choices based on various environmental factors. Through the utilization of machine learning algorithms and agricultural data analysis, the project successfully predicts the most suitable crop types for specific geographical regions. By integrating weather patterns, soil conditions, and historical crop yields, the system provides tailored recommendations, optimizing agricultural productivity and sustainability. The implementation of this project not only empowers farmers with valuable insights but also contributes to the advancement of precision agriculture, promoting efficient resource utilization and crop diversification. Overall, the Crop Type Suggestion Python project demonstrates the potential of technology to revolutionize traditional farming practices, fostering resilience and adaptability in the face of evolving environmental challenges.

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