ISSN (Online): 2456-0448
International Journal Of Innovative Research In Management, Engineering And Technology
Vol. 9, Issue 11, November 2024

Multi Class Classifier For Crop Yield Prediction

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Abstract: ***Crop yield prediction focuses mostly on agricultural research, which have an enormous impact on taking decisions for example import-export, price, along with crop management. Soil is the main component and plays a significant role in agriculture. Based on the nutrients and pH value of the soil, crop yielding is determined. Farmers are still using traditional approach to analysis the soil quality. The techniques like Data Mining, Artificial Intelligence, Machine Learning, Deep learning and Predictive Analytics are the emerging technologies in research to improve the agricultural field. Predictive analysis is a technique of machine learning that predicts the future outcomes and analysis is based on the historical or past data. In agriculture, predictive analytics helps to predict or identify the soil nutrients level required for the crops like Paddy, Raagi, Cumbu etc., Predicting the crop yield well ahead of its harvest would help farmers and market contractors strategize befitting actions to market and store their produce. These kinds of predictions will also help farmers minimize losses due to crop failure and can also help businesses that depend on agricultural products to plan their business logistics and resources. In this project, a method is proposed which would help predict the estimate of the crop yield for a specific land based on the analysis of geographical and climatic data using Machine Learning using LSTM. Firstly, it is able to capture the time dependency on temperature and rainfall. Secondly, it is able to work on a large and diverse dataset, unlike most models which only perform well in small regions. Lastly, it is able to use several diverse features - geographical, social, and economic to make a prediction. In addition to crop prediction, the system helps farmers to monitor the soil nutrients evolution so that action can be done on real time. The main chemical elements which are taken into the proposed model are nitrogen, phosphorus, potassium, hydrogen along with rainfall and temperature.***

I. INTRODUCTION

Crops are plants grown by the farmers. Agriculture plays a very important role in the Indian economy. It is the backbone of our country. 70% of the Indian population depends on agriculture for food and money. It is the major occupation in the rural areas. The cultivation of crops depends primarily on the weather and soil conditions. Animals and Plants are the two major sources of food. People have always collected plants and hunted animals to fulfil the needs of food and nutrition. Later, people who started agriculture became dependent on it for their nutritional needs. “Agriculture” is a complex term encompassing all the human activities in which the Earth’s resources are used appropriately to meet human needs for food, fiber, feed, fuel, etc. Therefore, the classification of crops has been done to utilize the resources properly.

II. SOFTWARE ANALYSIS

- Server Side : Python 3.7.4(64-bit) or (32-bit)
- Client Side : HTML, CSS, Bootstrap
- IDE : Flask 1.1.1
- Back end : MySQL 5.
- Server : Wampserver 2i
- DL Packages : TensorFlow, Pandas, SiKit Learn

PYTHON 3.7.4

Python is a general-purpose interpreted, interactive, object-oriented, and high-level programming language. It was created by Guido van Rossum during 1985- 1990. Like Perl, Python source code is also available under the GNU General Public License (GPL). This tutorial gives enough understanding on Python programming language.

MYSQL

MySQL tutorial provides basic and advanced concepts of MySQL. Our MySQL tutorial is designed for beginners and professionals. MySQL is a relational database management system based on the Structured Query Language, which is the popular language for accessing and managing the records in the database. MySQL is open-source and free software under the GNU license. It is supported by Oracle Company. MySQL database that provides for how to manage database and to manipulate data with the help of various SQL queries. These queries are: insert records, update records, delete records, select records, create tables, drop tables, etc. There are also given MySQL interview questions to help you better understand the MySQL database.

MySQL is currently the most popular database management system software used for managing the relational database. It is open-source database software, which is supported by Oracle Company.

MACHINE LEARNING

Deep learning is the most hyped branch of machine learning that uses complex algorithms of deep neural networks that are inspired by the way the human brain works. DL models can draw accurate results from large volumes of input data without being told which data characteristics to look at. Imagine you need to determine which fishing rods generate positive online reviews on your website and which cause the negative ones. In this case, deep neural nets can extract meaningful characteristics from reviews and perform sentiment analysis. Deep learning is a subset of machine learning, but it is advanced with complex neural networks, originally inspired by biological neural networks in human brains

III. EXISTING SYSTEM

Traditionally, farmers and agricultural experts have relied on manual methods to predict which crops to grow in a given region. Some of the commonly used manual methods include:

- **Experience-based knowledge:** Farmers with years of experience in a particular region can make informed decisions about which crops are suitable for that area based on past experience and observation.
- **Expert consultation:** Farmers can consult with agricultural experts or extension officers who have knowledge about crop suitability in a given area.
- **Soil and water analysis:** Soil and water analysis can provide information about the nutrient content and water-holding capacity of the soil, which can be used to determine the suitability of different crops.
- **Climate-based analysis:** Analysis of historical weather data can provide information about the climate of a region and help determine the suitability of different crops.

While these manual methods have been used for decades and are still in use, they have several limitations. They are often subjective, relying on the individual farmer's or expert's experience and knowledge. Additionally, they may not take into account the complex interactions between climate, water, and rainfall, which can significantly affect crop yield. The manual methods are also time-consuming and may not provide accurate and reliable predictions, leading to reduced crop yield and financial losses.

PROPOSED SYSTEM

The proposed system "Crops2Go" is a web-based application that aims to predict the appropriate crops to grow based on several environmental factors such as temperature, humidity, pH, rainfall, and soil nutrients (N, P, K). The system collects the data from reliable sources and pre-processes it by removing null, missing values, redundant data, and misspelled data. After pre-processing, feature extraction is done using a confusing matrix to identify the most important features for crop prediction. The system uses the LSTM algorithm for classification and prediction of crops based on the extracted features. The LSTM model is trained on a dataset of historical crop data and environmental factors to predict the best crops to grow in a given area. The trained model is deployed in the production environment and can be accessed through a user-friendly web interface. The end-users of the system are system administrators who train and maintain the model and farmers who want to predict which crops to grow based on the climate, soil, and water features of their region. Farmers can access the system through a web-based interface and get recommendations, suggestions, and alert notifications based on the predictions made by the model. The proposed system uses Python Flask, Tensor Flow, Keras, and MySQL for its development and deployment. Performance analysis is done regularly to ensure that the system is accurate and up-to-date with the latest data. Overall, the proposed system is an effective tool for farmers to make informed decisions about which crops to grow based on environmental factors.

IV. MODULES

1.Crops2Go Web App

Crops2Go is a web-based application for predicting suitable crops based on climate, water, and rainfall features. It is developed using the Python Flask framework for web development and the MySQL module for database management. The design and development of Crops2Go involve several modules. These modules are responsible for different tasks in the application, such as data pre-processing, feature extraction, model training, and performance analysis.

2. End User Interface

The End User Module of "Crops2Go" is designed to provide a user-friendly interface for farmers or other users to predict the crop to grow according to climate, water, and rainfall features.

3.End users

System Admin

The System Admin module of "Crops2Go" is designed to provide administrative access to the system, allowing the admin to manage the system and its components. The module includes the following functionalities:

Data management

The admin can manage the data collected by the system, such as adding or deleting data, modifying data, or updating data.

Model management

The admin can manage the machine learning model used by the system, such as training the model, updating the model, or fine-tuning the model.

4.Crops2Go LSTM Model: Build and Train

The Crops2Go LSTM model has two main modules: the build module and the train module.

The build module is responsible for building the LSTM model architecture. This includes defining the input layer, the hidden layer, and the output layer. The input layer accepts the input features such as temperature, humidity, pH, rainfall, and soil NPK values. The hidden layer is where the LSTM algorithm is applied to the input features to learn and extract the relevant features for crop prediction.

5. Crops2Grow Prediction

The Prediction module in "Crops2Go" is responsible for taking in input data from the user (i.e., climate, water, soil NPK and rainfall features) and using the trained LSTM model to predict which crops are most suitable for cultivation in the given conditions.

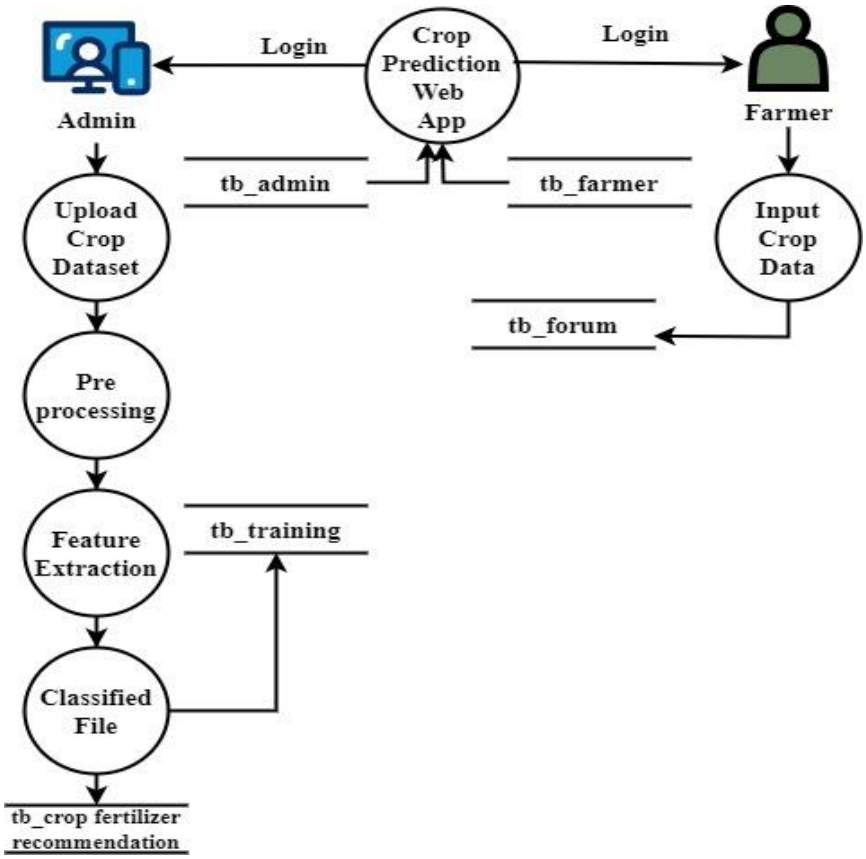
6. Recommendation

The recommendation module in "Crops2Go" provides suggestions to farmers or users on which crops to grow based on the predictions made by the LSTM model. The recommendation system takes into account several factors such as the predicted yield, climate, water availability, and other relevant features of the crops that are suitable to grow in the given conditions

7. Suggestion

The Suggestion module in "Crops2Go" provides additional advice and tips to farmers on how to improve their crop yield and quality. This module takes into account various factors such as soil quality, fertilization, irrigation, and pest management, and provides customized recommendations to farmers based on their specific needs and circumstances.

ARCHITECTURE DIAGRAM



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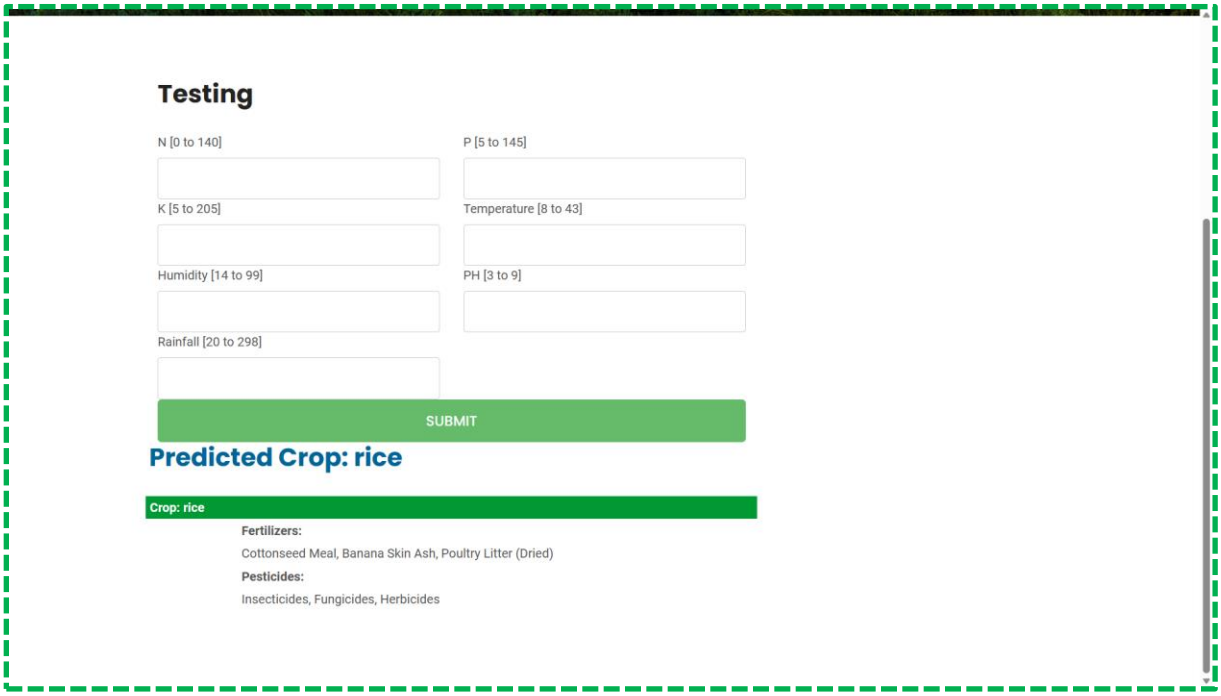
V. RESULT

Crop yield prediction involves estimating the amount of a particular crop that will be produced in a given season based on various factors like weather, soil quality, historical yields, pest infestations, and farming practices. The result of such predictions can take many forms depending on the methods and data used, but it generally involves statistical models or machine learning algorithms to output the expected yield, often in units like tons per hectare or bushels per acre.



VI. CONCLUSION

In conclusion, "Crops2Go" is a web-based application that allows farmers or users to predict the best crops to grow based on climate, water, soil NPK and rainfall features using LSTM. The application has been developed using Python Flask, Tensor Flow, Keras, and MySQL, and it has undergone extensive testing to ensure its functionality, reliability, and accuracy. The system has several modules such as Data Collection, Pre-processing, Feature Extraction, Classification, Prediction, Performance Analysis, and Alerts/Notification module. The datasets used for training and testing the model have been obtained from Kaggle, and they have been adequately described The feasibility study showed that the project is viable and can be successfully implemented. The software testing phase ensured that the system is robust and meets the requirements of the end-users

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