IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Crop Recommendation Using Machine Learning

D. SUMANTH1 , M. KIRAN2 , D. HRUTHIK REDDY3
[1]Student, [2]Student, [3]Student
[1]Computer Science and Engineering,
[1]Sreenidhi Institute of Science and Technology, Hyderabad, India

***Abstract*:** Agriculture is an important field all over the world where there are many challenges in solving problems in the process of estimating crops based on the conditions. Many solutions have been proposed regarding this problem using IOT based services and Mechanical technology to reduce manual work. These methods are mostly useful in the case of reducing manual work but not in prediction process. It is necessary to be able to predict the optimal crop to be planted based on the soil conditions to minimize losses and maximize profits. In this project we build Machine Learning models to recommend optimum crops to be cultivated by farmers based on several parameters and help them make an informed decision before cultivation. Dataset is prepared with Nitrogen, Phosphorous, Potassium and pH values of the soil. Also, it also contains the humidity, temperature and rainfall required for a particular crop. In this system, we can give input as various features of soil and temperature, humidity, rainfall conditions of the region, based on which a suitable crop will be recommended.

INTRODUCTION:

Agriculture is the primary source of food for all countries around the world, whether underdeveloped, developing, or developed. By 2025, the world's population is expected to reach 9.7 billion. The addition of uncertain weather conditions makes ensuring food sustainability challenging. The Crop Recommendation System uses nitrogen, phosphorus, potassium, and pH levels as inputs, as well as temperature and humidity, to recommend the best crop to the farmer, ensuring that the farmer makes an informed decision before planting. The technology can determine the temperature and humidity levelsbased on the user's location. With escalating food scarcity and population growth, it is critical to find answers to farmer concerns. Agriculture has remained and will continue to be an important industry. As a result, the system can be evolved with the necessary data. Because this system is based on textual data, it may be utilized anywhere there is an internet connection. There is no cost for takingimages of the soil or performing difficult operations to obtain crop details, so farmers can concentrate on selecting the best crop. Farmers may readily understand the forms because the application merely requires them to providevalues. As a result, no expensive equipment or

technical knowledge is required to determine which crop is suitable for their farm. This solution can be combined with other agricultural problem solutions to increase farm productivity.

BACKGROUND STUDY(LITERATURE)

Crop Recommendation System for PrecisionAgriculture

Authors: S.Pudumalar, R.Harine Rajashree,C.Kavya, T.Kiruthika, J.Nisha

This paper proposed a recommendation system through an ensemble model with majority voting technique using Random tree, CHAID, K-NearestNeighbor and Naive Bayes as learners to recommend a crop for the site-specific parameterswith high accuracy and efficiency.

Crop Selection Method to Maximize Crop Yield Rate using Machine Learning TechniqueAuthors: Rakesh Kumar, M.P. Singh, PrabhatKumar and J.P. Singh

This paper proposed a method named Crop Selection Method (CSM) to solve crop selection problem and maximize net yield rate of crop over season and subsequently achieves maximum economic growth of the country. The proposed method may improve the net yield rate of crops.

Intelligent Crop Recommendation System Using Machine Learning Algorithms

Authors: Zeel Doshi, Subhash Nadkarni, Rashi Agrawal, Prof. Neepa Shah

This paper proposed and implemented an intelligent crop recommendation system, whichcan be easily used by farmers all over India. This system would assist the farmers in making an

informed decision about which crop to grow depending on a variety of environmental and geographical factors. We have also implementeda secondary system, called Rainfall Predictor, which predicts the rainfall of the next 12 months.

ALGORITHMS:

Several machine learning techniques, includingRandom Forest, Decision Tree, and K-Nearest Neighbors (KNN), can be used in crop recommendation. Random Forest is an ensemble learning method that makes predictions by combining numerous decision trees. It generates alarge number of decision trees and aggregates their results to form a final prediction, increasing resilience and decreasing overfitting. Decision Tree, on the other hand, is a tree-like model that divides data into multiple qualities in order toclassify or predict the outcome. It aids in discovering key characteristics for crop recommendation. KNN is a non-parametric technique that predicts the class of a sample based on its k nearest neighbor's majority class inthe feature space.

It can be used to find similar regions or locales in order to recommend suitable crops based on neighboring samples with known information. Machine learning models may efficiently analyze relevant data and provide informed suggestions for optimal crop selection based on numerous criteria such as soil quality, climate, and historical yield data by utilizing these algorithms in crop recommendation.

MODULES:

The administrator is responsible for taking theinput from the user. When the user enters theinput, it must be transformed to a format that is suitable to be acted upon by the machine learning model. This module is also responsible for gathering the weather data for a given location using the weather API. After the data has been suitably transformed and the machine learning model has been loaded, the result of the machine learning model should be displayed to the user.

User Module*:*

This module maintains all the information pertaining to the user. Each user has their own unique input values. The user should be able to post the input data to the admin. At the end of the process, they will be able to see the result displayed by the system.

Machine Learning Model Module:

The Machine Learning Model is obtained after anextensive process of data cleaning, feature selection and splitting of the dataset into training and testing datasets. The models are trained on training data and tested for their performance on the testing data. The performance of the modelsis compared and the model that is most suitable for the task is selected. This model is loaded onto the disk for easy retrieval by the Admin. Themodel module's main responsibility is to take in the input data submitted by the admin and predict the result as appropriate. This result will then be used by the Admin.

Software Requirements

operating System: Microsoft Windows XP.

Technology: Machine Learning.

Front-End: HTML, CSS, JS.

Back-End: Python Flask Framework.

Libraries: numpy, pandas, matplotlib, seaborn,scikit-learn, flask.
IDE: Jupyter Notebook, Visual Studio Code.

Hardware Requirements

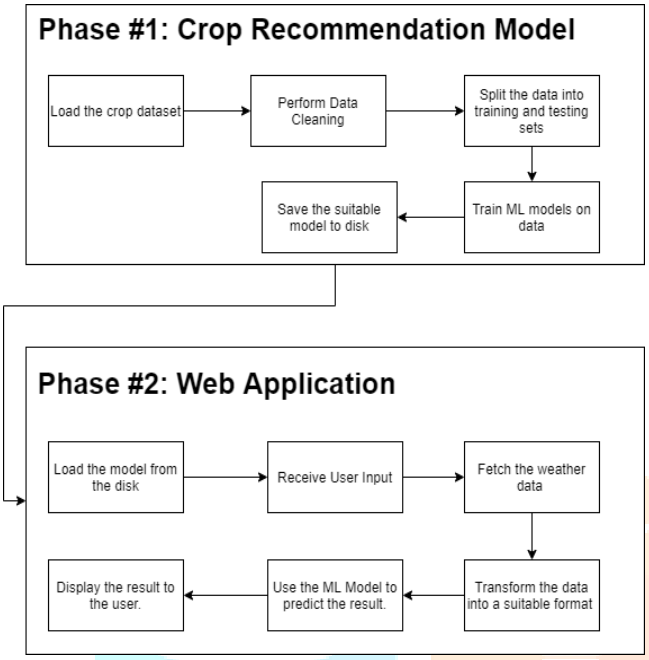
The hardware requirements are as follows:**Processor:** Intel Dual Core Processor **RAM:** >=4GB
Hard disk: >=512GB

SYSTEM DESIGN

The process of establishing the architecture, components, modules, interfaces, and data for a system in order to meet specific criteria is known as systems design. It might be viewed as a product development application of systems theory. The most extensively used approaches forcomputer system design are object-oriented analysis and design methodologies.

The application is divided into two stages. The first stage is building the required machine learning model and the second stage is deploying it to production. First, we load the crop dataset, explore the data and perform.

Architecture Design



The necessary feature engineering. Aftersubjecting our data to proper data cleaning, we split it into training and testing sets. We train the model on the training data and test its performance on our test set. After choosing the suitable model for our task, we save the data locally to be accessed by our application when required. The application loads the model thatwas saved in the previous stage and waits for userinput. The weather data is fetched using an API. The input data is transformed into a suitable format.

As a result, the proposed method predicts yield and reduces loss. The expected system assumes the role of an experienced farmer. It is, however, more precise and considers several additional parameters. There are several factors to consider, including soil condition, weather forecast, pH, humidity, and yield. The model that was saved earlier is invoked to get the result. The result is displayed to the user.

IMPLEMENTATION:

LANGUAGES ARE USED IN OUR PROJECT ARE:

Python:

Python is a flexible programming language that isextensively used for a variety of activities such asdata analysis, web development, and automation. It has a basic and clear syntax, making it suitable for beginners. Python can be used to write scripts as well as to create complicated applications.

Jupyter Notebook:

Jupyter Notebook, on the other hand, is a free andopen-source web programme that combines interactive scripting, data visualization, and documentation. It supports a variety of programming languages, the most popular of which is Python. Jupyter Notebook offers a simple interface for executing code in cells, making it simple to test and iterate on code snippets. It also supports explanatory text, equations, and visualizations, making it an ideal tool for data exploration, analysis, and sharingcomputational workflows.

- **Numpy:** NumPy (Numerical Python) is a core Python library for numerical computations andmathematical operations on huge arrays and matrices. It offers efficient data structures andfunctions for activities such as linear algebra, random number generation, and Fouriertransforms.

- **Pandas:** Pandas is a strong data manipulation toolkit that includes a DataFrame object for managing structured data. It provides data cleaning, filtering, grouping, and merging features, making it useful for data pretreatment and analysis jobs.

- **Matplotlib:** Matplotlib is a Python charting library featuring functions for line graphs, scatter plots, bar plots, histograms, and more. It supports static, animated, and interactive visualizations. It allows for aesthetic modification and supports several output

formats, making it appropriate for data visualization in a variety of disciplines.

➢ **Scikit-learn:** Scikit-learn is a widely used machine learning package with tools forclassification, regression, clustering, and dimensionality reduction, offering a standardized interface for training models, feature selection,evaluation, and prediction. Its popularity stems from its user-friendliness, scalability, and extensive documentation, making it a preferred choice in both academia and industry.

➢ **Seaborn:** Seaborn, based on Matplotlib, is a statistical data visualization library that makes it easier to create appealing and informative charts. It provides a high-level user interface for sophisticated visualizations such as heatmaps, pair plots, and category plots. Seaborn improves the visual aesthetics of plots with built-in themes and color palettes.

ADVANTAGES OF THE SYSTEM:

Our system's goal is to accurately recommend appropriate crops based on soil and temperature conditions. The models Random Forest, Decision Tree, KNN will be trained on carefully crafted textual material, and users will be able to engage with the system via a user-friendly website. The website allows users to provide their location rather than temperature and humidity numbers, and the system automatically collects the relevant weather data using a weather API. The system's benefits include its userfriendliness, Good In Accuracy, ease of usage via form submission, and convenient information sharing features.

CONCLUSION

The Crop Recommendation System is primarily used to advise the Farmer on the best crop to plant. With many industries going digital, it is critical that the agriculture industry takes use of the various technologies by utilising them to solve farmer concerns. Farmers should expect higher yields if they use the approach we explained. This system can be combined with existing smart agriculture systems. It is cost effective and assists farmers in making educated decisions. Machine learning techniques are used in a variety of agricultural fields. Create a method to forecast crop production based on historical data. Carry out a plan to speculate on generally supported rural creation. Data handling strategies are available for plant construction. Today, random forest is used to distinguish an intriguing produce from a genuine harvest. In agribusiness, it is often congruent with expected yields. The recommended methods aid ranchers in being mindful of various harvest requirements and costs. This helps ranchers decide what crops to grow. This work is usually used to identify extra plants that can be gathered monetarily and competently. This innovation has the potential to produce a wide range of yields. Indian ranchers may benefit from the ability to precisely predict yields in various parts of India.

ACKNOWLEDGMENT

I'd like to thank Dr. CH. NIRANJAN KUMAR behind the screen for assisting us in turning an idea into an actual application.

REFERENCES

[1] Stephen Marsland, ―Machine Learning – An Algorithmic Perspectivel, Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014.

[2] Grady Booch, James Rumbaugh, Ivar Jacobson. The Unified Modeling Language User Guide. Addison-Wesley, Reading, Mass., 1999.

[3] Rakesh Kumar, M.P. Singh, Prabhat Kumar and J.P. Singh, "Crop Selection Method to Maximize Crop Yield Rate using Machine Learning Technique", International Conference on Smart Technologies and Management for Computing, Communication, Controls, Energy and Materials, 2015.

[4] T.R. Lekhaa, "Efficient Crop Yield and Pesticide Prediction for Improving Agricultural Economy using Data Mining Techniques", International Journal of Modern Trends in Engineering and Science (IJMTES), 2016, Volume 03, Issue 10.

[5] Anshal Savla, Parul Dhawan, Himtanaya Bhadada, Nivedita Israni, Alisha Mandholia, Sanya Bhardwaj (2015), 'Survey of classification algorithms for formulating yield prediction accuracy in precision agriculture', Innovations in Information, Embedded and Communication systems (ICIIECS).

[6] Crop Recommendation System for Precision Agriculture S.Pudumalar*, E.Ramanujam*, R.Harine Rajashree, C.Kavya, T.Kiruthika, J.Nisha.

[7] Haedong Lee and Aekyung Moon, "Development of Yield Prediction System Based on Real-time Agricultural Meteorological Information", 16th International Conference on Advanced Communication Technology, 2014

[8] Jay Gholap, Anurag Ingole, Jayesh Gohil, Shailesh Gargade and Vahida Attar, "Soil Data Analysis Using Classification Techniques and Soil Attribute Prediction", International Journal of Computer Science Issues, Volume 9, Issue 3

[9] https://scikit-learn.org/

[10] https://materializecss.com/