IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Smart Agriculture Management Using Machine Learning Algorithms

Rushikesh Baravkar,

Department of Computer Engineering, Bharati Vidyapeeth College of Engineering,

Pune

Shubham Bhosle,

Department of Computer Engineering, Bharati Vidyapeeth College of Engineering,

Pune

Avinash Dhakane,

Department of Computer Engineering, Bharati Vidyapeeth College of Engineering,

Pune

Sohan Chaudhari,

Department of Computer Engineering, Bharati Vidyapeeth College of Engineering,

Pune.

Prof. Yogesh Kadam,

Department of Computer Engineering, Bharati Vidyapeeth College of Engineering,

Pune.

Abstract

Crop prediction plays a crucial role in agricultural planning and decision-making. In this research paper, we propose an automated crop prediction system that utilizes machine learning algorithms to forecast crop yields. The system leverages historical climate data, soil characteristics, and crop-specific features as input variables to train and develop accurate predictive models. To build our crop prediction system, we employ a comprehensive dataset comprising years of historical agricultural data, including weather patterns, soil properties, and crop yields. Feature engineering techniques are applied to extract meaningful features from the dataset, while ensuring data quality and consistency. Several machine learning algorithms, such as random forests, support vector machines, and gradient boosting, are employed to develop predictive models. These algorithms are trained and validated using cross-validation techniques to

optimize their performance and generalization capabilities. The automated crop prediction system demonstrates robust performance, achieving high accuracy in forecasting crops. The system's predictions enable farmers to make informed decisions regarding crop selection, resource allocation, and risk management. Furthermore, the proposed system provides real-time updates and recommendations, facilitating adaptive agricultural practices in response to changing climatic conditions. By incorporating machine learning algorithms, our system offers a scalable and efficient solution to enhance crop productivity and sustainability. In conclusion, this research presents an automated crop prediction system that utilizes machine learning algorithms to forecast crop yields accurately. The system's ability to leverage historical agricultural data and provide real-time insights empowers farmers to optimize their agricultural practices and make informed decisions, ultimately contributing to improved food security and sustainable farming practices.

Keywords - Crop prediction, machine learning, automated system, data pre-processing, feature engineering, algorithm evaluation, performance metrics, Smart farming

I. Introduction

Predicting crop output accurately is critical for ensuring optimal agricultural production and addressing the increasing demand for food globally. Traditional methods of crop prediction often rely on historical data and simplistic statistical models, which may not capture the complexity and dynamic nature of agricultural systems. However, the emergence of artificial intelligence techniques offers promising solutions to overcome these limitations. By harnessing the power of machine learning algorithms, AI-based crop prediction models can analyse vast amounts of data, including climatic variables, soil conditions, satellite imagery, and historical crop performance, to provide more precise and timely forecasts. This paper presents an overview of the application of AI in predicting crop output, highlighting its potential benefits and implications for agricultural optimization.

II. Objective

1.Increase the yield of crops.

2.To make farmers' lives better.

3.To forecast the crop that will boost productivity.

4. Successful prediction approach.

5. Important for strategic decision-making.

III. Methodology

1. **Data Collection:**

Collect relevant agricultural data, including historical crop yields, weather patterns, soil conditions, agricultural practises, and any other pertinent variables. Ensure the data is comprehensive, accurate, and covers a sufficiently long period to capture variability.

2. **Data Pre-processing:**

Clean up the collected data by removing duplicates, handling missing values, and addressing outliers. Normalise or standardise numerical features to bring them to a common scale. Perform feature engineering to extract meaningful features from the data, such as aggregating weather data to derive seasonal patterns or creating interaction variables.

3. **Feature Selection:**

Select the most relevant features for predicting crop output. This step involves analysing the relationships between variables, considering domain knowledge, and employing techniques like correlation analysis, mutual information, or feature importance from machine learning models.

4. **Model Selection:**

Choose an appropriate machine learning algorithm for crop output prediction. Commonly used algorithms include decision trees, random forests, support vector machines (SVM), gradient boosting, and deep learning models like convolutional neural networks (CNN) or recurrent neural networks (RNN). Consider the

characteristics of the data, the interpretability of the model, and the computational requirements when making the selection.

5. **Model Training:**

Partition the pre-processed data into distinct training and testing sets. Use the training set to train the selected machine learning model by feeding the input features and the corresponding crop output labels. Adjust the model's hyperparameters (e.g., learning rate, regularisation parameters) through techniques like grid search or random search to optimise performance. Validate the model using the testing set to assess its generalisation ability.

6. **Model Optimisation:**

Fine-tune the model if necessary to improve its performance. This step may involve adjusting hyperparameters further, optimising feature selection, exploring ensemble methods, or incorporating domain-specific knowledge into the model.

7. **Predicting Crop Output:**

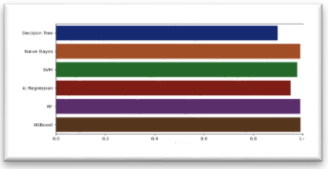
Once the model is trained and optimised, utilise it to predict crop output for unseen data or future time periods. Provide the model with the relevant input variables, such as weather conditions, soil quality, and agricultural practises, to obtain predictions of crop yields or production levels.

8. **Model Monitoring and Updating:**

Continuously monitor the model's performance and compare its predictions with actual crop output data. If discrepancies or deviations are observed, revaluate the model and consider updating it with new data or retraining it with an improved methodology.

IV. Implementation

1. Algorithm



Random forest

Random Forest, a well-known machine learning algorithm, uses the supervised learning strategy. It can be used in machine learning for both classification and regression. Regression problems, too. It is based on ensemble learning, a technique for integrating multiple classifiers to tackle a challenging problem and improve the performance of the model. Random Forest is a classifier that, as the name suggests, "consists of a number of decision trees on various subsets of a given dataset and takes the average to boost the dataset projected accuracy. In our model Random Forest have maximum accuracy is 9.734.

Decision Tree

Decision Tree, a well-known machine learning algorithm, uses classification and regression problems. In a decision tree, split the data into different branches to find the best solution. It consists of a leaf node, a decision node, and a root node. In our model decision tree are performing well with an accuracy of 9.58.

2. Dataset

To train the algorithm, we need a labelled dataset. Many datasets are available online for training and testing. For crop prediction, we need different types of features like potassium level in soil, pH, temperature, humidity, etc. Then we have collected data on different online websites from previous research on crops and soil, and these data are available in various formats. The collected data is arranged in a proper way and performing different operations for cleaning and removing noise from the data because of noisy data gives wrong predictions.

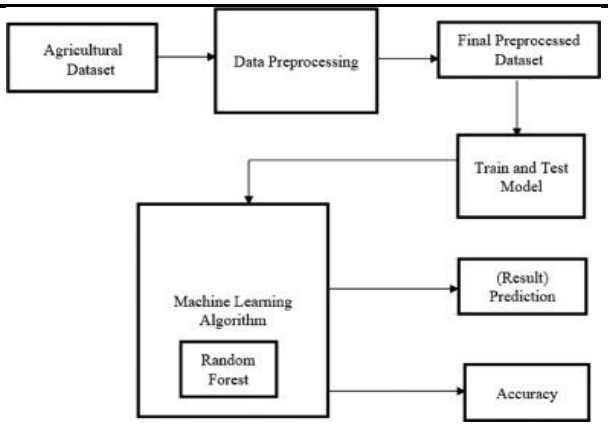
	Crops	Nitrigen	Phosphorus	Potassium	pH value
0	Rice	80	40	40	
1	Jowar(Sorghum)	80	40	40	
2	Barley(JAV)	70	40	45	
3	Maize	80	40	20	
4	Ragi(naachnnii)	50	40	20	
5	Chickpeas(Channa)	40	60	80	
6	French Beans(Farasbi)	90	125	60	
7	Fava beans (Papdi - Va	90	125	60	
8	Lima beans(Pavta)	40	60	20	

	temperature	humidity	ph	rainfall	crops
0	20.87974371	82.0027442	6.502985292	202.9355362	rice
1	21.77046169	80.3196441	7.038096361	226.6555374	rice
2	23.00445915	82.3207629	7.840207144	263.9642476	rice
3	26.49109635	80.1583626	6.980400905	242.8640342	rice
4	20.13017482	81.6048729	7.628472891	262.7173405	rice
5	23.05804872	83.3701177	7.073453503	251.0549998	rice
6	22.70883798	82.6394139	5.70080568	271.3248604	rice
7	20.27774362	82.8940862	5.718627178	241.9741949	rice
8	24.51588066	83.5352163	6.685346424	230.4462359	rice
9	23.22397386	83.0332269	6.336253525	221.2091958	rice

V. Workflow

Firstly, the user enters all related information in the user interface, like ph value, fertilizer information, temperature, humidity, etc. After entering the data, our train model takes the value and based on the information, will suggest the best crop to consider all conditions, like the kind of soil present on your farm and how current weather affects agriculture, and suggest which kind of crop can be grown. In the next step, if any diseases are present in plants, the user can click on the photo of the plant and upload it to our site, and it can give suggestions on how to treat and handle the situation and suggest various fertilizers to handle the situation.

And another use of our project is to recommend fertilizer for the crop. For example, if you grow sugar cane after 2 weeks, which fertiliser to use the increase the growth of the plant, how to increase the capacity of the photosynthesis, how to make the roots grow faster, and which type of fertiliser and pesticide to use.



VI. Result

The development of the Graphical User Interface (GUI) has been the Flask Framework is used by the machine learning models. Python was utilized for the website's backend.

This website will forecast the best crop to cultivate. On our home page, we first see details about our system and put the information about the crop and get the result.

On the home page, there are three services available: crop prediction, fertiliser recommendation, and disease prediction. The user can choose any of them to help do agricultural activities.

After clicking crop prediction, you can see the below interface, where the user can enter the value and which crop they want grow, and By entering this values we will get an name of predicted crop. It will also deliver a message that you should plant predicted crop.

On the next page, our model decides what disease is spreading in the crop by uploading an image of the plant and clicking the "predict" button.

After clicking on the predict button, the model tells you which diseases occur in your plant and how to tackle the situation. In this disease, which chemicals are used to handle the disease?

VII. Conclusion

Using past data, this project's goal is to forecast the crop. In this study, we suggest a smart agricultural strategy that is based on two cutting-edge technologies: machine learning.

The use of both real-time and historical data increases the accuracy of the outcome. By contrasting various machine learning algorithms, the system's accuracy is also increased. This approach will be used to help farmers get over difficulties and improve the amount and quality of their production.

VIII. References

1. "Supervised Machine learning Approach for Crop Yield Prediction in Agriculture Sector." Kumar, Y. J. N., Spandana, V., Vaishnavi, V. S., Neha, K., & Devi, V. G. R. R. (2020, June). In 2020 5th International Conference on Communication and Electronics Systems (ICCES) (pp. 736-741). IEEE

2. Kevin Tom Thomas, Merin Mary Saji, Lisha Varghese, Er.Jinu Thomas "Crop Prediction Using Machine Learning".

3. "Efficient Crop Yield Prediction Using Machine Learning Algorithms" by Kumar, A., Kumar, N., & Vats, V. International Research Journal of Engineering and Technology (2018).

4. Nischitha K, Dhanush Vishwakarma, Mahendra N, Manjuraju M.R, Ashwini "Crop Prediction Using Machine Learning Approaches".

5. Akshata Wani, Viraj Yadav, Ritika Todankar , Pradnyan Wade, Prof. Shikha Malik "Crop Prediction using IoT & Machine Learning Algorithm"

6. S. Bhanumathi, M. Vineeth and N. Rohit, "Crop Yield Prediction and Efficient use of Fertilizers," 2019 International Conference on Communication and Signal Processing (ICCSP), 2019

7. [9] I. Nitze, U. Schulthess, and H. Asche, "Comparison of Machine Learning Algorithms Random Forest, Artificial neural network and support vector

machine to maximum likelihood for supervised crop type classification,"

8. Kavita, M., & Mathur, P. (2020). Crop Yield Estimation in India Using Machine Learning. 2020 IEEE 5th International Conference on Computing Communication and Automation (ICCCA).

9. E. Khosla, R. Dharavath, and R. Priya, "Crop yield prediction using aggregated rainfall-based modular artificial neural networks and support vector regression," Environ Dev Sustain, Aug. 2019.