IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

STUDY ON CROP RECOMMENDATION MODELS AND YIELD PREDICTION MODELS

[1]Dr.Priya Nandihal ,[2]K Sai Datha Nikhil, [3]N Sree Sai Charitha, [4]Pavani A, [5]Pravalika D B

[2 3 4 5] UG Students, Department of Computer Science and Engineering,

[1]Associate Professor, Department of Computer Science and Engineering,[1 2 3 4 5] Dayananda Sagar Academy of

Technology and Management, Bangalore, Karnataka,India

Abstract: The crop recommendation and yield prediction system using geographical location with user-friendly web interface desires to address the problems of new farmers, who are unaware about the fertility level of soil. The new farmers may not be knowledgeable about the suitable crops for their land. This system tackles these problems with the help of fast-growing technology, Machine Learning. The system recommends suitable crops along with the yield prediction based on the user's geographical location. The system helps farmers make wiser decisions and make more profits.

I. INTRODUCTION

The Agriculture sector plays a significant role in Indian economy. Agriculture is the art and science of cultivating the soil, growing crops, and raising livestock. It includes the preparation of plant and animal products for people to use and their distribution to markets.Agriculture provides most of the world's food and fabrics. Cotton, wool, and leather are all agricultural products.Environment factors like rainfall, temperature, humidity ,pH and others affect the growth of crops.The crop yield depends on crop selection, crop rotation,etc.The humans may not understand about the suitable crops to their land because of drastic changes in the weather conditions.The introduction of evolving technologies into the farming practices has been favourable to enhancement of agricultural productivity .The technologies that are being implemented in current agricultural practices helps in increasing efficiency and also helps in resource management. Apart from these,there are certain systems that helps farmers to get better yield. One such system is crop recommendation and yield prediction system based on geographical location with web interface One of the most fast growing technology is machine learning, this technology uses large sets of data, called training data ,to imitate the human intelligence. With the help of previously available data ,algorithms will be developed and the accuracy of these algorithms will be tested with testing data. The resultant algorithms will be used to make predictions for complex data.The crop recommendation and yield prediction system using geographical location also uses machine learning technology to recommend crops and predict the yields of each recommended crops.

II. LITERATURE SURVEY

Many techniques are used in this process. For example, machine learning models analyze historical data on crop yields in a particular region, learn patterns, and make predictions about future yields.Additionally, remote sensing technologies such as satellite imagery help collect instant information about crops and soil conditions, helping to reach clear agreement. One of the main topics addressed by these studies is understanding the causes of crop failure. Factors such as inadequate water use, poor soil management, and exposure to local pests and diseases play important roles. By identifying these factors, researchers can

develop strategies to increase crop resilience and reduce risk. Increasing productivity is the main goal. Some of the suggestions include using agricultural technologies such as sensor based irrigation systems and using different technologies. These not only improve resource use but also lead to permaculture practices.In short, the establishment of a geographical are a according to agreement, with the cooperation of scientists,is a continous development. By combining data analytics, technology and a deep understanding of local conditions, we are moving towards a future where farmers can make informed decisions, resulting in maximum efficiency and stability .

[1] This paper proposes a crop recommendation system that uses a Convolutional Neural Network (CNN) and a Random Forest Model to predict the optimal crop to be grown by analyzing various parameters including the region, soil type, yield, selling price, etc. The CNN architecture gave an accuracy of 95.21 %, and the Random Forest Algorithm had an accuracy of 75%.

[2] Machine learning has proven its efficacy in solving agricultural problems in the recent years such as crop recommendation, crop yield prediction, and many such. With the advancement in the sub-domain of machine learning i.e., deep learning, multiple problems are minutely solved in agricultural sector. This paper focuses on recommending 22 types of crops with the aid of correlation analysis, distribution analysis, ensembling, and majority voting. A three-tiered framework is proposed in order to implement the crop recommendation problem. It includes data preprocessing, classification, and performance evaluation modules. The feature analysis is done through correlation plots and density distribution followed by classification using ensembling techniques. Finally, performance evaluation is performed using majority voting technique. This article further uses ensembling with base learners i.e., decision trees, random forest, Naïve Bayes, and support vector machines using majority voting. Further, majority voting is used to decide the final performance metrics. The practical visualization of the correlation plot, density histogram distribution plots, confusion matrices, and performance plot are presented. The accuracy achieved post implementation is 99.54& by using Naïve Bayes classifier. The majority voting ensembler has not shown much accuracy i.e., 98.52&. Thus, Naïve Bayes classifier is proved to be the best fit for this problem statement. Some challenges and future research directions are also epitomized in this article.

[3] A wide variety of algorithms are used in machine learning to develop models that can anticipate future data that has not yet been observed and learn predictive rules from existing data. Using machine learning techniques in agriculture is one of the emerging topics in recent research fields. The main objective of smart agriculture is to increase profit by lowering agricultural costs. Smart farming is made possible by machine learning algorithm's predictive nature.To increase productivity, clever farmers use this technique in their agriculture. Soil is one of several important factors that need to be considered. The composition of soil nutrients, its texture and pH have serious impacts on the growth of crops, while many farmers are not aware of this. One of the most important criteria in agriculture is selecting the right crop for the soil conditions of the farmland. The main focus of this survey is on crop suggestions and crop recommendations. This paper provides a brief analysis of the use of machine learning techniques in crop recommendation systems based on soil and crop yield prediction systems.

[4] Progressions in machine learning and crop simulation techniques have created new opportunities for improving agro-based prediction. In crop yield analysis, machine learning is a rapidly expanding research area. Predicting yield is a crucial issue in agriculture. Machine learning (ML), on the other hand, aims to make forecast by discovering associations between input and response variables.Various elements, including weather and soil, are making it challenging for farmers to cultivate crops. Developing effective agricultural and food policies on a regional and international scale requires accurate crop yield forecasts. Our proposed solution combines two machine learning algorithms to optimize agriculture by predicting crop yield and recommending fertilizer. This script is innovative because it allows the user to predict the most suitable crop based on basic information such as soil characteristics and weather conditions. We have utilized Random Forest and Logistic Regression for the system’s implementation. This model serves as an example of hybrid ML approaches which could solve the above mentioned issues and increase the yield.

[5] As crop production has already started to suffer from climate change, improving crop output is consequently desirable because agronomists are impotent to select the appropriate crop(s) depending on environmental and soil parameters, and the mechanism of forecasting the selection of the appropriate crops manually has failed. Factors like soil characteristics, soil types, climate characteristics, temperature, rainfall, area, humidity, geographic location etc. affect crop forecast. This chapter focuses mainly on building a recommendation system, i.e., suggesting the kind of the crop by applying various machine learning and deep learning techniques depending upon several parameters. The system would help the farmers for the appropriate decision to be taken regarding the crop type.

[6] Agriculture plays a significant role in increasing the economic development of our nation. Crop production has greatly affected due to changes in weather pattern. Emerging technologies can be used to improve productivity of the crops by converting traditional farming to precision farming. The new technologies that are used include data analysis and Internet of things (IOT). The major issue yet to be resolved is cultivating precise crop at precise time. This can be done with the help machine learning algorithms which is found to be an effective method for predicting the suitable crop. The soil parameters such as soil moisture, temperature, humidity and pH are collected from the sensors using IOT and given to Graphical User Interface (GUI). GUI gets the inputs and suggests the suitable crops. The system developed using IOT and ML greatly helps the farmers to take a valuable decision.

[7] This article provides an exhaustive review on the use of machine learning algorithms to predict crop yield with special emphasis on palm oil yield prediction. Initially, the current status of palm oil yield around the world is presented, along with a brief discussion on the overview of widely used features and prediction algorithms. Then, the critical evaluation of the state-of-the-art machine learning-based crop yield prediction, machine learning application in the palm oil industry and comparative analysis of related studies are presented. Consequently, a detailed study of the advantages and difficulties related to machine learning-based crop yield prediction and proper identification of current and future challenges to the agricultural industry is presented. The potential solutions are additionally prescribed in order to alleviate existing problems in crop yield prediction. Since one of the major objectives of this study is to explore the future perspectives of machine learningbased palm oil yield prediction, the areas including application of remote sensing, plant's growth and disease recognition, mapping and tree counting, optimum features and algorithms have been broadly discussed. Finally, a prospective architecture of machine learning-based palm oil yield prediction has been proposed based on the critical evaluation of existing related studies. This technology will fulfill its promise by performing new research challenges in the analysis of crop yield prediction and the development of a extremely effective model for the prediction of palm oil yields with the most minimal computational difficulty.

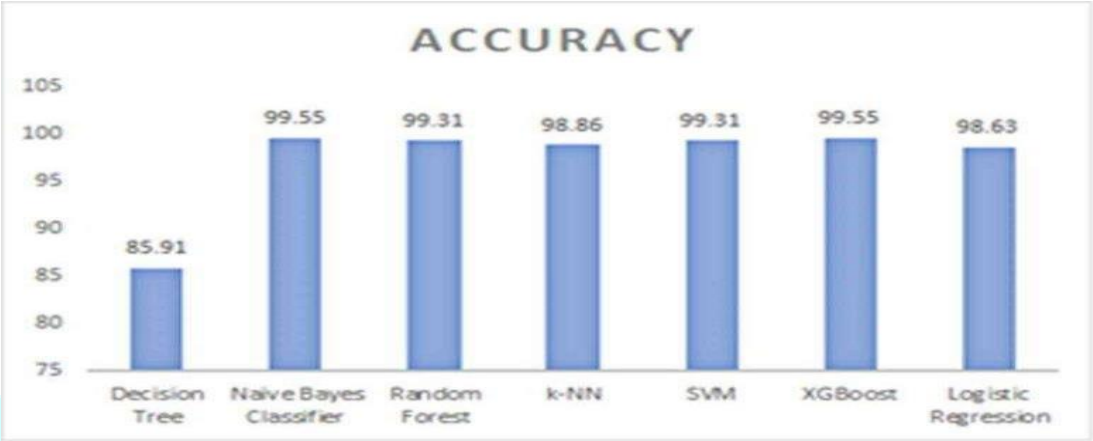
[8] Agriculture is the only industry that benefits both itself and the rest of the country. It not only offers food and raw materials to a substantial section of the people but also work prospects. Agriculture is the principal source of income for the majority of people in India. It has been in the country for thousands of years, and modern technology and equipment have substituted ancient farming practices. With the advancement of technology in every industry, it has become increasingly vital to incorporate technology into agriculture. Machine learning facilitates the study of large volumes of data and may deliver faster and more precise results, which can aid in the identification of lucrative possibilities and risky threats. The major goal of this research project is to develop a Machine Learning (ML) model to predict farm production. To estimate crop yields, the data was collected and trained using supervised machine learning with six distinct regression models. With a Mean absolute error (MAE) of 468.16 and a Cross-Validation score of 0.6087, Random Forest Regressor outperformed the other models.

[9] Agriculture is the most important and essential component for human survival. In order to prescribe fertilizers and predict which crops would provide the maximum yields, the paper focuses on using several machine learning methods. The soil properties are provided to the application by the farmer. Crop leaves are used as an additional input by this algorithm to forecast the disease. The yield of the land is entirely and partially dependent on the economy of a country, which is strongly dependent on agriculture and is influenced by organic, economic, and seasonal variables. Gathering, storing, and analysing data that can be used to predict agricultural productivity is the major goal. Farmers are able to select the greatest crop for their needs thanks to this. This study seeks to improve predictions of crop productivity, which will help the agricultural industry. The findings of this study will help farmers to decide which crops to plant based on many factors like the affordable price areas and crops with the lowest likelihood of losses.

[10] Agriculture is defined as the science and art of cultivating the flora and fauna. Farming in India is ranked as second around the globe and occupies 60.45% of Indian land. The Indian economy, dominatingly, depends upon farming along with agro industry things. The soil ingredients (like Nitrogen, Phosphorous, Potassium), crop rotation, soil clamminess, atmospheric and surface temperature, precipitation, etc, play an efficient role in cultivation. The present evidence related to this field includes a model which is incorporated with ML algorithms (Random Forest, Decision Tree, Artificial Neural Network) to determine best crop. In this paper, the proposed model is enhanced by applying deep learning techniques and along with the prediction of crop, a clear information is achieved regarding the amounts of soil ingredients needed with

their expenses separately. It provides a better accuracy than the existing model. It analyzes the given data and help the farmers in predicting a crop which in return help in gaining profits. The climatic and soil conditions of land are taken into consideration to predict a proper yield. The objective is to present a python based system that uses strategies smartly to anticipate the most productive reap in given conditions with less expenses. In this paper, SVM is executed as Machine Learning algorithm while LSTM and RNN are used as Deep Learning algorithms.

III. ACCURACY COMPARISION



IV. LIMITATIONS

Paper TITLE & authors (IEEE format citation)	Concept	Limitations	Tool used/ specific algorithm
Soil Analysis and Crop Recommendation using Machine Learning (2022)	Uses machine learning to analyze soil data and recommend crops	Limited to soil analysis and may not consider other factors influencing crop suitability	Convolutional Neural Networks (CNNs), Random Forest
Smart Crop Recommender System-A Machine Learning Approach (2022)	Uses machine learning to recommend 22 types of crops	May not consider all relevant factors influencing crop suitability, such as market demand and pest infestations	Correlation analysis, distribution analysis, ensembling, majority voting
Machine Learning Techniques in Crop Recommendation based on Soil and Crop Yield Prediction System – Review (2023)	Reviews the use of machine learning techniques in crop recommendation systems	Does not focus on specific limitations of web-based interfaces	Various machine learning algorithms discussed
Crop Yield Prediction and Fertilizer Recommendation System Using Hybrid Machine Learning Algorithms (2023)	Combines two machine learning algorithms to predict crop yield and recommend fertilizer	Limited to two machine learning algorithms, may not be suitable for complex agricultural	Random Forest, Logistic Regression

		scenarios	
AI-Enabled Crop Recommendation System Based on Soil and Weather Patterns	The system typically considers factors such as soil type, moisture levels, temperature, rainfall, and other environmental conditions. By analyzing historical data and real-time information, the AI system aims to provide personalized recommendations to optimize crop yield and minimize risks.	1. Data quality:Incomplete data leads to wrong predictions. 2.Dynamic Nature of Agriculture: Agriculture is influenced by various dynamic factors such as pest outbreaks, market demands, and government policies. These factors may not be adequately considered in the model. 3.Technology Accessibility: Farmers in certain regions may not have easy access to the technology required for data collection and AI-based recommendations.	Decision Trees Random Forests Support Vector Machines (SVM) Neural Networks K-Nearest Neighbors (KNN) Regression Models
Crop Recommendation on Analyzing Soil Using Machine Learning	The system typically considers various soil parameters such as pH, nutrient levels, moisture content, and texture. By leveraging historical data and patterns, the goal is to assist farmers in making informed decisions about crop selection based on the specific characteristics of their soil.	1.Data Quality 2.Limited Data Availability 3.Dynamic Soil Conditions	Random Forest,Naive Bayes Algorithms
A Comprehensive Review of Crop Yield Prediction Using Machine Learning Techniques (2023)	Reviews machine learning techniques for crop yield prediction	Does not delve into specific limitations of web-based systems	Various machine learning algorithms discussed
A Comparative Study of Machine Learning Algorithms for Crop Yield Prediction (2023)	Compares different machine learning algorithms for crop yield prediction	Does not address the limitations of web-based interfaces	Support Vector Machines, Logistic Regression, Random Forest
An Improved Machine	Uses a variety of	Relies on the	Support Vector Machines,

Learning based Crop Recommendation System (2023)	machine learning algorithms to make recommendations	accuracy of historical crop yield data, which may not be available or reliable for all regions	Logistic Regression, Random Forest
A Hybrid Approach to Crop Yield Prediction Using Machine Learning and Remote Sensing Data (2023)	Combines machine learning and remote sensing data to predict crop yield	Requires access to remote sensing data, which may not be available for all regions	Support Vector Machines, Random Forest

V.CONCLUSION

To encapsulate,crop recommendation and yield prediction system based on geographical location with web interface uses machine learning algorithms to predict the output for the user's location taken as an input.The machine learning algorithms are built based on different varieties of data namely historical data,user feedback data,weather data.As the best algorithms are used in the proposed system ,the results obtained will bemore accurate.The system also helps in empowering the farmers and helps farmers make better decisions with machine intelligence.Inspite of having few limitations, the system provides user friendly interface for the farmers to implement the evolving technology into their routine farming practices and increase the agricultural productivity.

VI.REFERENCES

[1] A. Motwani, P. Patil, V. Nagaria, S. Verma and S. Ghane, "Soil Analysis and Crop Recommendation using Machine Learning," 2022 International Conference for Advancement in Technology (ICONAT), Goa, India, 2022, pp. 1-7, doi: 10.1109/ICONAT53423.2022.9725901.

[2] R. K. Ray, S. K. Das and S. Chakravarty, "Smart Crop Recommender System-A Machine Learning Approach," 2022 12th International Conference on Cloud Computing, Data Science & Engineering (Confluence), Noida, India, 2022, doi:10.1109/Confluence52989.2022.9734173.

[3] S. S. B, Anusha, A. Shetty, R. R. Shetty, B. A. D. Alva and A. D. Shetty, "Machine Learning Techniques in Crop Recommendation based on Soil and Crop Yield Prediction System – Review," 2022 International Conference on Artificial Intelligence and Data Engineering (AIDE), Karkala, India, 2022, pp. 230-235, doi: 10.1109/AIDE57180.2022.10078849.

[4] K. P. K. Devan, B. Swetha, P. Uma Sruthi and S. Varshini, "Crop Yield Prediction and Fertilizer Recommendation System Using Hybrid Machine Learning Algorithms," 2023 IEEE 12th International Conference on Communication Systems and Network Technologies (CSNT), Bhopal, India, 2023, doi:10.1109/CSNT57126.2023.10134662.

[5] Sharma, Priyanka & Dadheech, Pankaj & Senthil, A.. (2023). AI-Enabled Crop Recommendation System Based on Soil and Weather Patterns. 10.4018/978-1-6684-8516-3.ch010.

[6] Raj, Angu & Balashanmugam, Dr.Thiyaneswaran & Jayanthi, J & Yoganathan, N & Srinivasan, P.. (2021). Crop Recommendation on Analyzing Soil Using Machine Learning. Turkish Journal of Computer and Mathematics Education (TURCOMAT). 12. 1784-1791.

[7] M. Rashid, B. S. Bari, Y. Yusup, M. A. Kamaruddin and N. Khan, "A Comprehensive Review of Crop Yield Prediction Using Machine Learning Approaches With Special Emphasis on Palm Oil Yield Prediction," in IEEE Access, vol. 9, pp. 63406-63439, 2021, doi: 10.1109/ACCESS.2021.3075159.

[8] Bharati Panigrahi, Krishna Chaitanya Rao Kathala, M. Sujatha,A Machine Learning-Based Comparative Approach to Predict the Crop Yield Using Supervised Learning With Regression Models,,Volume 218,2023,Pages 2684-2693,doi.org/10.1016/j.procs.2023.01.241.

[9] B. S. Sri, G. Pavani, B. Y. S. Sindhuja, V. Swapna and P. L. Priyanka, "An Improved Machine Learning based Crop Recommendation System," 2023 International Conference on Sustainable Computing and Data Communication Systems (ICSCDS), Erode, India, 2023, pp. 64-68, doi: 10.1109/ICSCDS56580.2023.10105119.

[10] Agarwal, Sonal, Tarar and Sandhya, “a hybrid approach for crop yield prediction using machine learning and deep learning algorithms” 2021 Journal of Physics: Conference Series, dx.doi.org/10.1088/1742-6596/1714/1/012012