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AI Based Crop Yield Prediction: A Review

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Abstract

The current stage of technological advancement is being widely applied to development internationally. The Artificial Intelligence (AI) application to intelligent farming, which generates crops in agriculture, is one of the technological advancements. India's economy depends largely on agriculture because humans are the source of all of its resources. The primary impediment to food security is population expansion, which raises food demand. To raise the supply, farmers must yield more on the same quantity of land. Technology can help farmers enhance their productivity by anticipating crop yields. This study's primary purpose is to forecast agricultural yield by using the factors of precipitation, crop, weather, region, yield, and moreover, production things provided a big danger.

Keywords: *Prediction of Crop Yield$_1$, Artificial Intelligence$_2$, Review$_3$, Agriculture$_4$, Machine Learning$_5$.*

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1 Introduction

Since agriculture generates a substantial amount of food, it is one of the key social concern sectors. Many nations continue to endure hunger today because of a lack of food resources coupled with population growth. The interaction of an increasing population, erratic weather patterns, soil deterioration and changes in climate needs the deployment of techniques to assure rapid and dependable agricultural growth and outcomes.Current requirements advocate for estimating crop yields, preserving crops, and appraising land are more crucial to the world's food production.

Therefore, for the purpose of increasing national food security, policymakers in the country must rely on an accurate crop output estimate in order to achieve meaningful export and import evaluations. Several factors, such as the crop, crop productivity is regulated by soil conditions, weather, fertilizer application, and seed type. Numerous crop modeling and yield forecasts methodologies have been applied to get satisfactory crop yield estimation results. Researchers have an inclination to utilize Deep Learning approaches for crop output estimates. The research does not address the issues in applying When employing deep learning algorithms to estimate crop yield, despite the fact that these systems can perform better. They are both dependent on the sort of crop, the type of information, the origins, and the execution mechanism. In contrast, machine learning models (ML) are less complex and consume less resources for making agricultural forecasts. After being trained on data, these Models may be employed to anticipate productivity and agricultural yield. In essence, ML models are algorithms that can predict from unseen data by learning from supplied data by detecting patterns and other characteristics.

Massive volumes of data, including soil, region, and climate records, make it possible to develop and train machine learning (ML) models with exceptional precision. In addition, ML models are a suitable answer for this problem statement because of the complicated interactions between weather, region, and soil elements that effect crop productivity. With the wealth of data accessible in agriculture, machine learning is particularly beneficial in forming judgments or predictions regarding plants and animals. Additionally, it contributes to minimizing the uncertainty surrounding agricultural trends brought on by climate change, resulting in a more accurate forecast. A wide range of agricultural applications, including disease detection, grading, irrigation, weather monitoring, keeping an eye on animal welfare, and more, use machine learning. Farmers profit significantly from the ability to estimate agricultural production and yield applying machine learning models, which additionally assist in anticipating supply in order to optimally and efficiently satisfy demand.

2 Results

The dataset's features are related to one another. Plotting the link, The crop was determined by the writers to be a significant factor. The figure illustrates the formation numbers of each of the ten crops that were into review for research. Figure displays the history link with Crop Type and Area. It is evident that the majority of the land is planted to wheat, with rice following closely behind. The previous connections between the characteristics of the dataset, including crop type, acreage, and production, are depicted in Figures pest management.

Outcomes of Study reveals that Spontaneous Forest performs more accurately compared to other machine learning algorithms. India's most accurate crop output estimate is generated by Random Forest using statistical data, with accuracy = 99.956.

Model functionality for the Tree of Decisions, XGBoost, and random forest models. With Correctness scores of 86.46 and 89.78. Random Forest performs better than Decision Tree and XGBoost Regression. A "black box" is machine learning. Technology, since it does not interpret much data. When it comes to estimating India's predicted crop output, Random Forest scored better than the other three regression algorithms in the machine learning study. The figure, layers employed in LSTM and CNN are illustrated. Table B displays test losses for the LSTM and CNN, which are determined to be 0.00060 and 0.00063, respectively.

The CNN model performance is applied to the dataset under consideration in Figures 17 and 18. When and LSTM, in that order. The current forecast suggests that Random Forest as well as CNN (with minimal loss of 0.00060), perform better when data is analyzed at the national level.

The technique has been demonstrated to have significant potential for accurate crop productivity prediction based on experimental findings, and real-time data and human interactions have been

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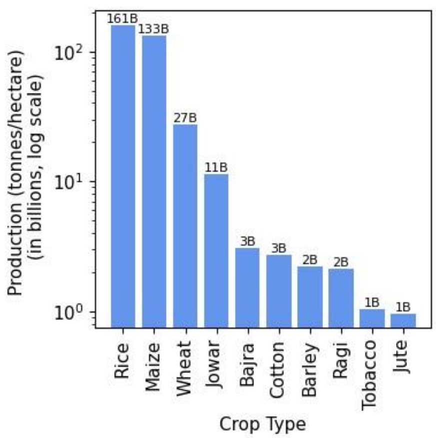
used to validate its effectiveness. District statistics data and remote sensing data could be integrated to boost the model's prediction accuracy for crop production. Using land cover or satellite image categorization, the prediction can be made more correctly.

2.1 Figures



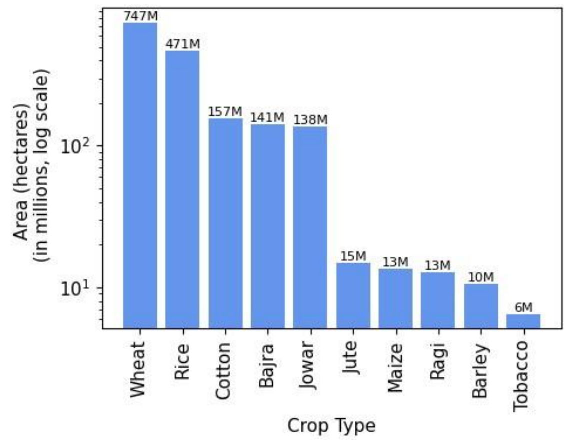
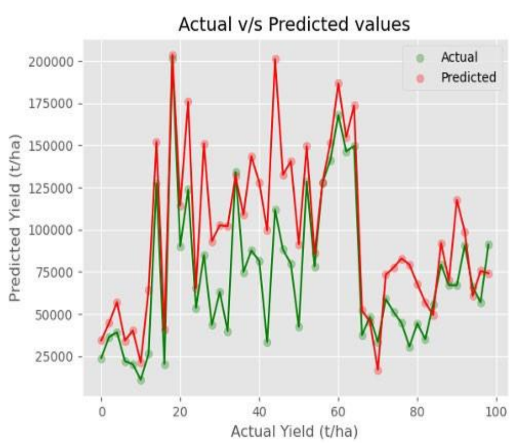


FIGURE 1 : Association between crops and agricultural output & **FIGURE 2:** Land allocated for agriculture.



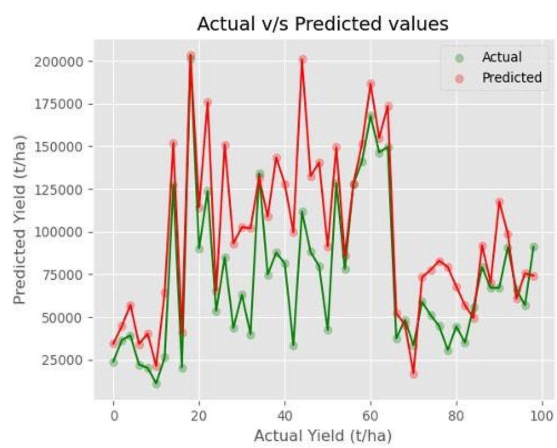


FIGURE 3 : Performance of decision tree Model. **FIGURE 4 :** Performance of random fores Model

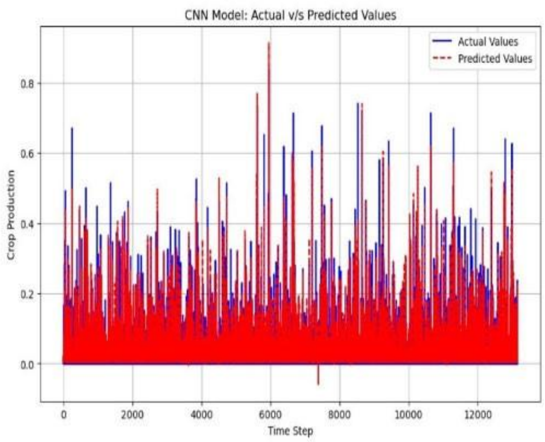


FIGURE 5 : Performance of CNN Model.

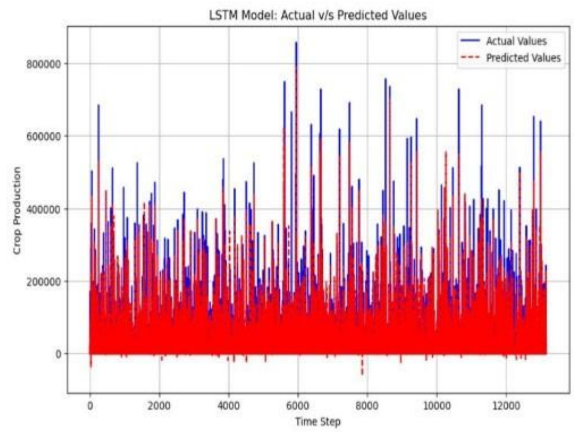


FIGURE 6 : Performance of LSTM Model

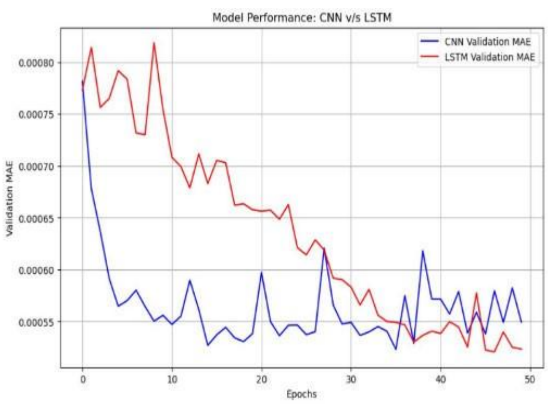


FIGURE 7 : Model Performance CNN v/s LSTM

2.2 Tables

TABLE A. Model performance simulation using area and production as an inputs.

Model	Accuracy	Mean Absolute Error (MAE)	Root Mean Square Error (RMSE)	Standard Deviation (SD)
Random Forest	98.96	1.97	2.45	1.23
Decision Tree	89.78	4.58	5.86	2.75
XGBoost	86.46	6.31	7.89	3.54

TABLE B. Test results of LSTM and CNN.

Model	Test Loss
CNN	0.00060
LSTM	0.00063

3 Conclusion

The agricultural industry has undergone a huge upheaval, thanks in great part to precision agriculture. Using AI models and wireless sensor networks for weed identification and crop prediction, as part of our suggested model, has also helped to boost agricultural output. Modern agricultural strategies that use AI and IoT principles will undoubtedly benefit farmers globally in making better judgments and in boosting the yield and efficiency of their crops overall. This is not the case with traditional agricultural processes, which take longer, involve more labor and may provide erroneous results or losses. The suggested model has the ability to precisely govern the agricultural industry.

4 Conflict of Interest

The authors declare that the study was undertaken in the absence of any business or financial ties that might be perceived as a possible conflict of interest.

5 Author Contributions

Shital Sapkal, Priya Taware, and Harshal Borate were responsible for the idea, literature review, and preparation of the text. Dr. J.S.Rangole offered advice, supervision, and critical edits throughout the research and writing process. All authors examined and approved the final version of the paper and agree to be liable for all elements of the work.

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8 Data Availability Statement

The datasets evaluated during the current investigation are accessible from the corresponding author on reasonable request. No publicly archived datasets were utilized or created for this review.

9 Reference

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