Predicting Agriculture Yeilds Based on Machine Learning Using Regression and Deep Learning

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***Abstract*—** 3. Various essential elements are crucial for the survival and well-being of human beings. other beings for their survival, agriculture plays a crucial role in the development of the economy of India. The major impediment to food security is population growth resulting in increasing demand for food. To increase the supply, farmers need to grow more on the same land. Tech can help farmers produce more through crop yield prediction. 1. The primary goal of this. paper is to predict 3. Applying crop yield. rainfall, crop, meteorological conditions, area, production, and yield variables, which have threatened the long-term sustainability of agriculture (Mahmood et al., 2017). Crop yield forecasting: a decision-making tool that employs machine learning and deep learning techniques to assist in making informed choices regarding agricultural production

Keywords: Deep Learning, Machine Learning.

I. Introduction

Agriculture has a utmost importance of humanity not only the food but also the working and economy. It is relatively ‘‘new’’ for crops or arable land, despite the fact that humans have been eating grains and plants for well over 1,00,000 years. It was about 11,000 years ago, in the Neolithic or New Stone Age period, when people began actively managing the land and its vegetative growth. Agriculture provides significant economic support for the country, and the bulk of the country’s food requirements in India. A range of scientific methods has been adopted in agriculture to preserve the balance between the supply of food and its demand. The great climatic variability does not help farmers decide where to be more versatile and sustainable. Hence, estimation of crop production is important in

I. LITERATURE SURVEY

Crop yield can be predicted using machine learning methods. The total area under cultivation, canal length, average maximum temperature, water sources (tanks and wells) for irrigation from the dataset were utilized to predict the crop output. The computational model that was developed is better than the model built using Regression Tree, Lasso, Deep Neural Network, Shallow Neural Network approach (study). For the dataset validation using projected weather data, RMSE is 50% of the standard deviation and 12% of the average yield. For the Kharif season during 1998 to 2002, the accuracy was 97.5 percent using parameters: min/max/average temperatures, area, rainfall, production, and yield. Kharif crop yield estimation amongst different methodologies.

A.Existing System

Climate irregularities are the major concern for the world's food resources, especially where farmers live under survival conditions in droughts. Soil composition renders the yield of crops an advantage or disadvantage. Fertilizers suggested in proper doses might help the farmer make a better decision in this regard [1]. The application of information and communication technology (ICT) in predicting crop yields has been extensively studied. Additionally, data mining techniques can also be utilized for crop yield forecasting. suggests better crop-yielding advice for farmers by fully analyzing the previous data [3]

B. Proposed Solutions

This model is designed to utilize machine learning and deep learning methodologies to predict agricultural yields and facilitate improved decision-making in the realm of crop production. It uses rainfall, weather variables, crop type, area under cultivation, and yield records as parameters. For yield estimation, regression-based machine-learning models are applied: Among the models assessed—Decision Tree, Random Forest, and XGBoost—Random Forest demonstrated the best performance, reaching an accuracy of 98.96%. Deep learning models such as CNN and LSTM were also attempted, with CNN registering the least loss (0.00060). Evaluation measures of accuracy, RMSE, MAE, and losses were used to assess the models. Both Random Forest and CNN have outperformed other algorithms in providing precision in yield prediction. This system greatly assists farmers in crop selection and growing season management to curb losses and augment productivity. It offers near-time predictions for data-driven decision- making in sustainable agriculture. should not repeat The proposed system predicts agricultural yields, given parameters of rainfall, weather condition, and types of crop and area under cultivation. Various machine learning models, specifically Decision Tree, Random Forest, and XGBoost, have been employed for estimating yields, with Random Forest achieving the greatest accuracy. Furthermore, deep learning approaches like CNN and LSTM have facilitated the identification of complex patterns and the handling of sequential data, leading to improved predictions of yield. Random Forest gave the best prediction accuracy, and CNN ensured the accuracy of results by minimizing the error rates. The integration of historical data and real-time data gave insights for on-the-ground actions by farmers. Its accuracy has been assessed through metrics including RMSE and MAE. Alongside catering to the rising demands of food, it works to minimize losses through optimizing crop selection and growing-up strategies.

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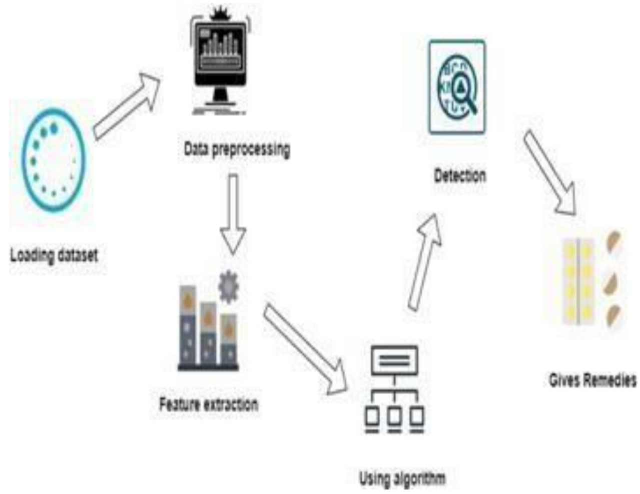

Fig. Overall System Architecture

Data can be fed into the system straight from farmers to record their observations of pest infestation, soil conditions, or irrigation trends. This firsthand information on yield correlates in real-life situations with improved yield predictions in the model. Also, historical market trends and pricing information reported by farmers and traders can give clues to finding demand-and-supply gaps for better crop selection on account of profitability. Expert agronomists also provide much-wanted information regarding the outbreak of various diseases, fertilizer recommendations, Incorporating region-specific best practices into the model can significantly improve the quality of predictions. Also, the real-time experiences of farmers-offering information on their successes and failures-borrow human variability, thereby improving the model not necessarily appreciated by machine-derived data. The decisions made by the government concerning subsidies and agricultural schemes have a substantial impact on the types of crops chosen and the strategies employed in farming. Incorporation of these human- reported policy changes would ensure that external factors impacting yields are modeled accordingly. Genuine knowledge of traditional and region-specific farming practices, passed down generations, Supply additional information that will aid in enhancing machine learning predictions.

Direct farmer input often captures seasonal variability such as Thunderbird droughts, strange floods, or rainfalls that are not seasonally due. While weather models offer prediction, observations from human operators on the ground provide accuracy in yield estimates. In a similar vein, precise agriculture inputs regarding the fertilizer, pesticide application, and farmers' irrigation schedule will also contribute as invaluable microdata for model refinements. Ground truth verification through farmer and agricultural officer feedback ensures that the predicted outputs from the model are matched with what actually occurred.

CONCLUSION

Food demand and supply have also become increasingly difficult as the population grows. For the past few years, experts have been trying to predict agricultural yield production to provide help to farmers. This research employs several machine learning and other techniques to yield forecast in India. The study shows the benefits of these contemporary processes. Small farmers will particularly benefit as they can now use the predictions to assess crop production for the coming years and to plant it accordingly. Five The field of machine learning and deep learning encompasses various algorithms, particularly Decision Tree and Random Forest, XGBoost regression, Convolutional Neural Network, and Long-Short Term Memory Networks were applied to the considered dataset. When the data were analyzed at the country level, Random Forest (accuracy- 98.96%, mean absolute error-1.97, RMSE- 2.45, and standard deviation-1.23) and CNN (minimum loss- 0.00060) have been foreseen to perform better according to the present validation. Experimental results show that the procedure holds extreme potential for accurate prediction of crop productivity, and Its credibility has been affirmed. using real data and from the interaction with the users. Further, more data per crop year having an extensive historical record of climate and environment is required. Further, more deep learning models should be employed on the dataset to select the best-performing method. To improve model accuracy in predicting crop production, remote-sensing data could be fused with statistical data from the district. The prediction can be more accurate if land cover or satellite image classification data are used.

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