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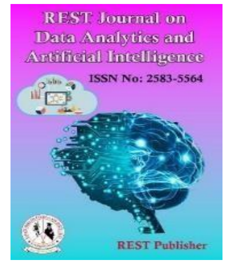

Agriculture food-tech and Rural Development

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Abstract: *Agricultural yield prediction is a critical aspect of optimizing farming practices and ensuring food security. This project focuses on predicting crop yield, pesticide usage, fertilizer requirements, pest detection, and disease detection using deep learning techniques. Yield prediction is modelled using a deep learning algorithm, considering features such as state, area, production, rainwater availability, pesticide usage, and fertilizer application. To predict the required amounts of pesticides and fertilizers, deep learning models are employed. Furthermore, convolution neural networks (CNNs) are used for the detection of pests and plant diseases, enabling proactive interventions to minimize crop damage. By combining predictive analytics with CNNs, this project aims to provide comprehensive support to farmers, improving crop management, resource allocation, and overall agricultural productivity. The use of advanced machine learning algorithms allows for more accurate and timely predictions, ultimately contributing to sustainable agricultural practices.*

1. INTRODUCTION

Agriculture is vital for food security and rural economies, but traditional methods struggle with yield prediction and resource management, leaving farmers vulnerable to climate change and pests [1-3]. This project leverages deep learning, IoT sensors, and satellite imagery to provide real-time insights for crop yield prediction, resource optimization, and early pest detection [4-7]. The system integrates IoT sensors for soil and climate data, satellite imagery for crop health analysis, and deep learning models to improve decision-making. CNNs (Convolutional Neural Networks) detect pests and diseases early, allowing proactive interventions [8-11]. This data-driven approach enhances productivity, sustainability, and food security, enabling smart farming with efficient resource use and minimal environmental impact [12]. By transforming agriculture from a reactive to a proactive model, this technology ensures long-term resilience against climate change and population growth [13-15].

2. LITERATURE SURVEY

TABLE 1.

Paper Name	Author(s)	Proposed System	Techniques/Methods Used	Drawbacks
“Crop Yield Prediction Using Machine Learning (Palm Oil)”	Mamunur Rashid et al.	Machine learning system for palm oil yield prediction using various features.	ANN, Random Forest, SVR, Remote sensing	Focused only on palm oil, may not generalize to other crops.
"Machine Learning for Smart Agriculture: A Survey"	M. Rezwanul Mahmood et al.	Smart agriculture system using ML, IOT, and satellite data for yield prediction and resource management.	Supervised/Deep Learning, IoT, Satellite data	High deployment cost for smallscale farm
"Predicting Agriculture Yields Using Regression and Deep Learning "	Ghulam Mohyuddin et al.	Machine learning system for crop yield prediction using regression and deep learning.	Decision Tree, Random Forest, CNN, XGBoost	Risk of overfitting with small datasets, high computational needs.
“Evaluation of ML Approaches for Precision Farming in Smart Agriculture”	Ghulam Mohyuddin et al.	Precision farming system using ML for yield optimization and disease detection.	Supervised/Unsupervised Learning, Big Data, Remote sensing	Data integration and privacy challenges.

3. EXISTING SYSTEM

Traditional crop yield prediction systems typically use linear regression or time series analysis to forecast yields. While these models offer a basic level of prediction, they often fail to consider the complexity of factors affecting agricultural outcomes, such as weather variations, pest infestations, and soil quality. Additionally, most existing systems do not integrate real time data or advanced algorithms, leading to inaccurate and delayed predictions [16-19].

Limitations: Inaccurate Predictions: Traditional models often fail to capture the complexities of factors such as climate change and pest dynamics [20]. Delayed Detection: Pests and diseases are often detected too late, causing extensive damage before interventions can be made. Lack of Integration: Existing systems do not use real time data from IOT devices or incorporate modern machine learning techniques to improve accuracy.

4. PROPOSED SYSTEM

Problem Statement: The current agricultural systems are not sufficiently equipped to provide real time, accurate crop yield predictions and early detection of pests and diseases. This project aims to bridge these gaps by developing a deep learning based solution that integrates IOT and satellite data for real time insights and proactive management.

Objectives:
The specific objectives of the project include:
1. Provide accurate crop yield predictions based on multiple real time data inputs.
2. Recommend optimized usage of resources such as pesticides and fertilizers.
3. Detect pests and diseases at an early stage using Convolutional Neural Networks (CNNs).
4. Deliver actionable insights to farmers for better decision making.
5. Promote sustainable agriculture by reducing resource wastage and improving productivity.

Proposed Method: The proposed system leverages deep learning and Convolutional Neural Networks (CNNs) to enhance agricultural practices by providing accurate crop yield predictions and early detection of pests and diseases. By integrating real-time data from IoT sensors, satellite imagery, and drone-captured images, the system helps optimize resource usage, minimize losses, and improve productivity. Deep learning models analyze multi-dimensional data to predict crop yields more accurately than traditional methods. CNNs process crop images, identifying pest infestations and diseases at an early stage, allowing farmers to take timely interventions and reduce pesticide use. The system dynamically updates predictions using real-time IoT sensor data, enabling farmers to make informed decisions on irrigation, fertilization, and harvesting. Additionally, the system includes a self-improving evaluation mechanism that continuously fine-tunes predictions by comparing past forecasts with actual outcomes. This ensures that accuracy improves over time, making the system more reliable and effective for long-term agricultural success.

5. METHODOLOGY

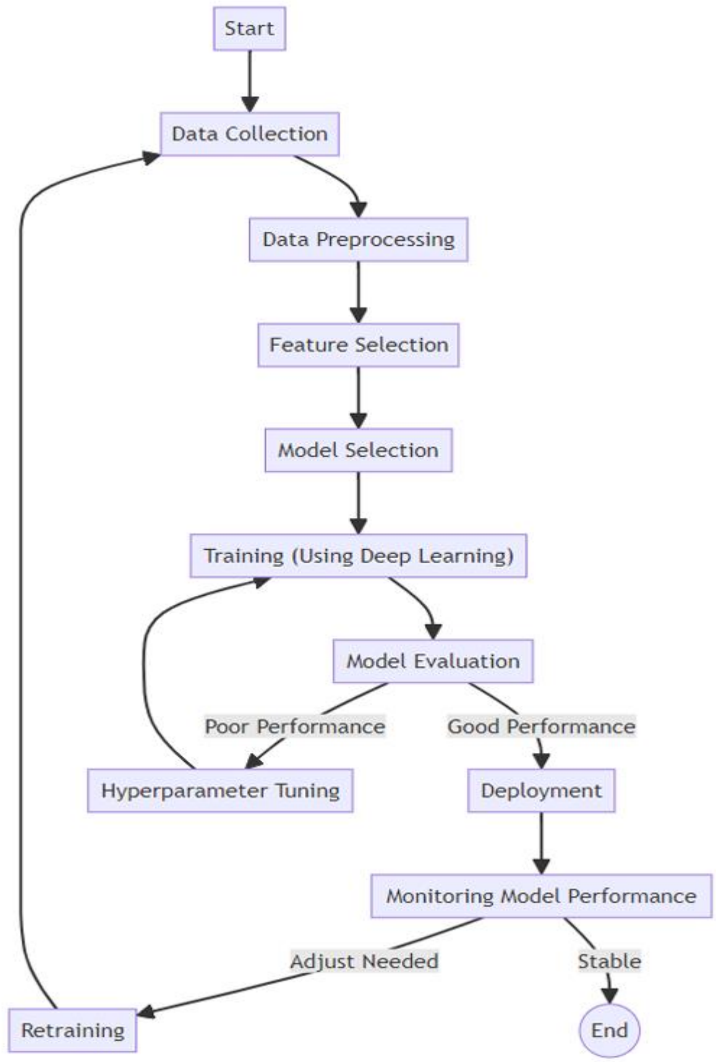


FIGURE 1. Methodology

Requirements:

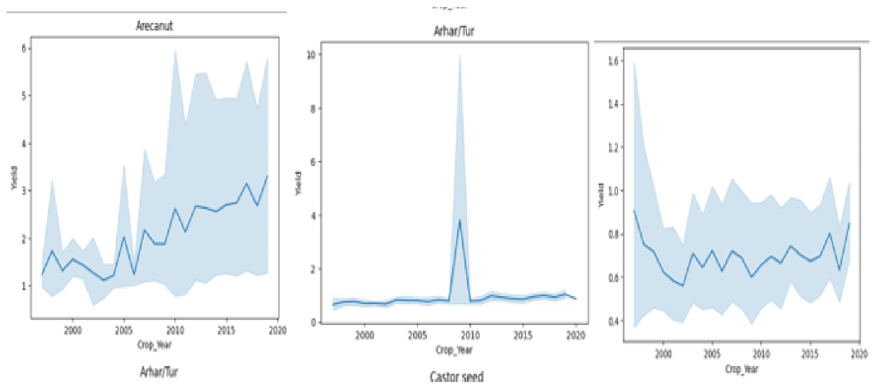
Software Requirements:

- Google Colab
- Python
- Tensorflow
- Seaborn & Matlab
- Convolution Neural Network

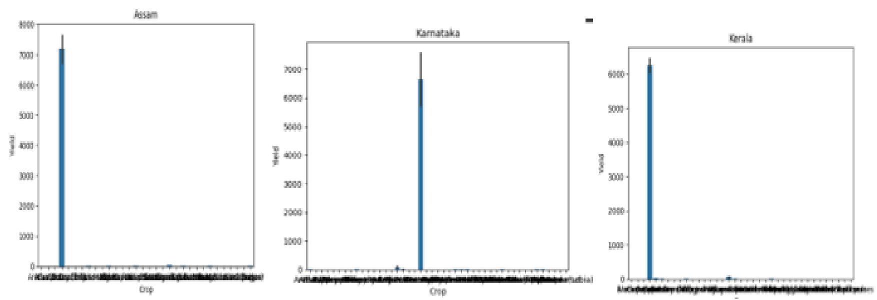
Hardware Requirements:

- IOT Sensors
- Cloud Storage

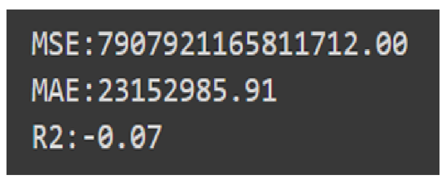
Results:



Crop Yield vs Year



Crop vs Yield



MSE, MAE and R2Score

FIGURE 2.

6. CONCLUSION

This project successfully integrates deep learning and IOT technologies to provide farmers with accurate predictions and actionable insights. The system addresses key challenges in traditional farming methods, offering real time crop yield predictions, proactive pest and disease management, and optimized resource use. By improving decision making processes, this system helps farmers boost productivity, minimize losses, and promote sustainable agricultural practices.

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