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ADVANCED INTELLIGENT AGRICULTURE SYSTEM FOR CROP YIELD AND GROWTH PREDICTION USING MACHINE LEARNING TECHNIQUES

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| Keywords | Abstract |
|---|---|
| Machine Learning, Deep Learning, Crop Yield Prediction, Random Forest, MobileNetV2, Smart Agriculture, Disease Detection, Precision Farming, Streamlit. | Agriculture plays a vital role in the economic development of many countries, and improving crop productivity is essential for ensuring food security and sustainable farming. Traditional agricultural methods often rely on manual monitoring and experience-based decision-making, which may lead to inaccurate yield estimation and delayed disease detection. This paper presents an Advanced Intelligent Agriculture System for Crop Yield and Growth Prediction using Machine Learning and Deep Learning techniques. The proposed system integrates Machine Learning algorithms such as Linear Regression, Decision Tree Regression, and Random Forest Regression for crop yield prediction based on soil nutrients and environmental parameters. Additionally, a Deep Learning-based MobileNetV2 model is used for plant leaf disease detection through image |



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| | |
|--|---|
| | classification. The system provides farmers with intelligent advisory recommendations, nutrient correction suggestions, and yield improvement analysis through an interactive Streamlit dashboard. Experimental results demonstrate that the Random Forest model achieves superior prediction accuracy compared to other models. The proposed system enhances agricultural productivity, supports precision farming, and enables data-driven decision-making for sustainable agriculture. |
|--|---|

I. INTRODUCTION

Agriculture is the backbone of many developing economies and plays a significant role in ensuring food security and sustainable development. Increasing population growth, climate change, soil degradation, and limited agricultural resources have created a need for intelligent farming systems capable of improving productivity and reducing crop losses [1][11]. Traditional agricultural methods are often inefficient due to inaccurate prediction methods and delayed disease diagnosis.

Machine Learning and Deep Learning technologies have emerged as powerful tools for intelligent agricultural analysis. Machine Learning algorithms can analyze large agricultural datasets to identify hidden relationships between soil nutrients, weather conditions, and crop productivity [2]. Deep Learning techniques, especially Convolutional Neural Networks (CNNs), have shown remarkable performance in plant disease classification using leaf images [3].

The proposed Advanced Intelligent Agriculture System integrates Machine Learning-based crop yield prediction with Deep Learning-based disease detection. Soil nutrient values, crop type, soil type, and environmental information are used for predicting crop yield, while uploaded leaf images are analyzed using MobileNetV2 for disease classification [11]. The objectives of the proposed system are: 1. To predict crop yield accurately using Machine Learning algorithms. 2. To detect plant diseases using Deep Learning techniques. 3. To provide intelligent nutrient advisory recommendations. 4. To support precision agriculture and sustainable farming

II. LITERATURE SURVEY

Several researchers have developed intelligent agricultural systems using AI and ML technologies. Ramesh et al. proposed a crop prediction system using Random Forest and Support Vector Machine algorithms for improving agricultural productivity [4]. Their model achieved good accuracy but lacked disease detection functionality.

Patel and Shah developed a Deep Learning-based disease classification system using CNN architecture for leaf image analysis [5]. Although the system achieved high classification accuracy, computational complexity was high. Sharma et al. introduced an IoT-enabled smart agriculture system integrating sensor networks and Machine Learning models [6]. The system improved automation but required expensive hardware infrastructure.



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Dr. Anand K et al. proposed AGRI PREDICT, an AI-based crop advisory system integrating IoT sensors, weather data, and ML algorithms for monitoring agricultural conditions [7]. However, the system lacked precise disease prediction and integrated yield optimization.

The proposed system addresses these limitations by combining:

- Ensemble Machine Learning models
- MobileNetV2 transfer learning
- Nutrient advisory generation
- Interactive Streamlit dashboard
- Disease detection and yield prediction in a single framework

III. PROPOSED SYSTEM

The proposed Advanced Intelligent Agriculture System is designed to provide intelligent crop yield prediction and disease detection using Machine Learning and Deep Learning techniques.

A. System Architecture

The system consists of the following modules: 1. Input Module 2. Data Preprocessing Module 3. Machine Learning Module 4. Deep Learning Module 5. Advisory Module 6. Visualization Module

The user provides crop details, soil nutrient values, and leaf images through the dashboard interface. The system preprocesses the data and applies Machine Learning models for crop yield prediction. Simultaneously, uploaded leaf images are analyzed using MobileNetV2 for disease classification.



Figure 1. Overall System Architecture



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B. Input Parameters

The following parameters are used:

- Crop Type
- Soil Type
- Potassium (K)
- Calcium (Ca)
- Magnesium (Mg)
- Sodium (Na)
- Phosphorus (P)
- Sulfur (S)
- Iron (Fe)
- Zinc (Zn)
- Manganese (Mn)
- Boron (B)
- Leaf Image

C. Output Parameters

The system generates:

- Predicted Crop Yield
- Yield Improvement Percentage
- Nutrient Advisory Suggestions
- Disease Classification Result
- Confidence Percentage
- Model Performance Metrics

IV. METHODOLOGY

The methodology of the proposed system involves several phases including data collection, preprocessing, model training, evaluation, prediction, and advisory generation.



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A. Data Collection

Agricultural datasets containing soil nutrients, crop types, and yield values are collected from agricultural sources. Leaf image datasets are used for disease detection training.

B. Data Preprocessing

The preprocessing phase includes:

- Handling missing values
- Label encoding
- Feature normalization
- Dataset splitting
- Image resizing and preprocessing



Figure2.Image Preprocessing

C. Machine Learning Models

Three Machine Learning algorithms are used: 1. Linear Regression 2. Decision Tree Regression 3. Random Forest Regression

Random Forest is selected as the best-performing model based on R^2 score and prediction accuracy.



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D. Deep Learning Model

MobileNetV2 is used for leaf disease detection due to its lightweight architecture and high efficiency. Transfer learning is applied to reduce training complexity and improve performance.

E. Advisory Generation

The system compares input nutrient values with optimal mean values and generates corrective recommendations for improving crop yield.

V. ALGORITHMS USED

A. Linear Regression

Linear Regression predicts crop yield by modeling the relationship between soil nutrients and output yield.

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_n X_n$$

Where:

- Y = Predicted Yield
- X = Input Features
- β = Coefficients

B. Random Forest Regression

Random Forest is an ensemble learning algorithm that combines multiple decision trees for improved prediction accuracy and robustness.

Advantages:

- Handles nonlinear relationships
- Reduces overfitting
- High prediction accuracy
- Suitable for agricultural datasets

C. MobileNetV2

MobileNetV2 is a lightweight Convolutional Neural Network architecture used for image classification and disease detection.

Key features:

- Transfer Learning



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- Reduced computational complexity
- High classification accuracy
- Fast inference speed

VI. IMPLEMENTATION

The system is implemented using Python and open-source Machine Learning libraries.

Software Tools Used

- Python
- Streamlit
- Scikit-learn
- TensorFlow
- Pandas
- NumPy
- Matplotlib

Hardware Requirements

- Intel i3 Processor or above
- 4 GB RAM
- 20 GB Storage
- Optional GPU Support

Workflow

1. User enters agricultural data.
2. System preprocesses input data.
3. Machine Learning model predicts crop yield.
4. Advisory module suggests corrections.
5. User uploads leaf image.
6. MobileNetV2 detects disease.
7. Dashboard displays results.



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VII. RESULTS AND DISCUSSION

Input Data:

1. **Crop:**Bajra
2. **SoilType:**Alluvial

Soil Nutrient Values:

3. Potassium(K):80
4. Calcium(Ca):500
5. Magnesium(Mg):1000
6. Sodium(Na):0.01
7. Phosphorus(P):50
8. Sulfur(S):50
9. Iron(Fe):4000
10. Zinc(Zn):5
11. Manganese(Mn):100
12. Boron(B):2

The screenshot displays the 'Smart Agriculture Assistant' web application. The 'Input Panel' section includes dropdown menus for 'Crop' (set to 'Bajra') and 'Soil Type' (set to 'Alluvial'). Below this, the 'Nutrients' section features ten input fields with numerical values and arrows for adjustment: Potassium (K) at 80, Calcium (Ca) at 500, Magnesium (Mg) at 1000, Sodium (Na) at 0.01, Phosphorus (P) at 50, Sulfur (S) at 50, Iron (Fe) at 4000, Zinc (Zn) at 5, Manganese (Mn) at 100, and Boron (B) at 2. The 'Leaf Image Analysis' section at the bottom contains a file upload area with a 'Browse File' button and a 'Predict & Analyze' button.

Figure 3. Input Data



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The proposed system was tested using multiple agricultural datasets and sample leaf images. Different Machine Learning algorithms were evaluated using MAE, RMSE, and R² metrics.

Model Performance

| Algorithm | MAE | RMSE | R ² Score |
|-------------------|------|------|----------------------|
| Linear Regression | 0.62 | 0.81 | 0.88 |
| Decision Tree | 0.48 | 0.69 | 0.91 |
| Random Forest | 0.32 | 0.51 | 0.96 |

The Random Forest algorithm achieved the highest prediction accuracy with an R² score of 0.96.

The MobileNetV2 model successfully classified leaf diseases such as:

- Leaf Blight
- Powdery Mildew
- Leaf Spot
- Healthy Leaf

The disease detection module achieved high confidence scores and enabled early diagnosis of crop diseases.

The dashboard interface improved usability and allowed users to interact with the system efficiently.



Figure 4. Leaf Disease Report



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VIII. ADVANTAGES OF THE PROPOSED SYSTEM

1. Accurate crop yield prediction.
2. Early disease detection.
3. Intelligent nutrient advisory system.
4. User-friendly dashboard interface.
5. Reduced computational complexity.
6. Scalable and cost-effective architecture.
7. Supports precision agriculture.

IX. APPLICATIONS

The proposed system can be used in:

- Smart Farming
- Precision Agriculture
- Agricultural Research
- Crop Monitoring
- Government Agricultural Departments
- Educational Institutions

X. FUTURE ENHANCEMENTS

1. Integrate real-time weather and satellite data for more accurate location-specific crop yield predictions.
2. Train MobileNetV2 on Plant Village dataset for reliable and precise leaf disease detection.
3. Develop a mobile-friendly multilingual platform to provide crop advisory directly to farmers via smart phones.

XI. CONCLUSION

This paper presented an Advanced Intelligent Agriculture System for Crop Yield and Growth Prediction using Machine Learning and Deep Learning techniques. The system integrates Machine Learning models for crop yield prediction and MobileNetV2 for plant disease detection. Random Forest Regression achieved superior prediction accuracy compared to other algorithms. The proposed system provides intelligent recommendations, improves agricultural productivity, and supports data-driven farming practices. The integration of AI technologies into agriculture enables



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sustainable farming, efficient resource utilization, and improved crop management. The proposed framework offers a scalable and practical solution for modern precision agriculture systems.

AUTHOR(S) CONTRIBUTION

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CONFLICTS OF INTEREST

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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REFERENCES

- [1] R. Sharma, S. Kumar, and A. Singh, "Crop Yield Prediction Using Machine Learning Techniques," International Journal of Agricultural Science, vol. 12, no. 4, pp. 210–218, 2023.
- [2] P. Patel and M. Shah, "Deep Learning Based Plant Disease Detection Using CNN," IEEE Access, vol. 10, pp. 45678–45689, 2022.
- [3] S. Ramesh and K. Reddy, "Smart Agriculture System Using IoT and Machine Learning," International Journal of Smart Farming, vol. 8, no. 2, pp. 110–120, 2021.
- [4] T. Brown et al., "Applications of Artificial Intelligence in Agriculture," Computers and Electronics in Agriculture, vol. 178, pp. 105-115, 2020.
- [5] A. Krizhevsky, I. Sutskever, and G. Hinton, "ImageNet Classification with Deep Convolutional Neural Networks," Advances in Neural Information Processing Systems, vol. 25, pp. 1097–1105, 2012.
- [6] M. Sandler et al., "MobileNetV2: Inverted Residuals and Linear Bottlenecks," Proceedings of IEEE CVPR, pp. 4510–4520, 2018.
- [7] L. Breiman, "Random Forests," Machine Learning Journal, vol. 45, no. 1, pp. 5–32, 2001.
- [8] F. Pedregosa et al., "Scikit-learn: Machine Learning in Python," Journal of Machine Learning Research, vol. 12, pp. 2825–2830, 2011.



Ennam Govinda, Setti Sirisha, P. Raghava Kumari, M. Semal Sekhar, B. Ramesh Kumar & M. Ranganath Sarath (2026). Advanced Intelligent Agriculture System for Crop Yield and Growth Prediction Using Machine Learning Techniques. International Journal of Multidisciplinary Research & Reviews, 5(5),399-410.

- [9] M. Abadi et al., "TensorFlow: Large-Scale Machine Learning on Heterogeneous Systems," 2016.
- [10] W. McKinney, "Data Structures for Statistical Computing in Python," Proceedings of the Python in Science Conference, pp. 56–61, 2010.
- [11] D. E. Govinda, K. Ganesh, N. Nagamani, S. Sirisha and N. A. Kumar, "Optimized Deep Learning Framework for Early Detection and Classification of Leaf Diseases," International Journal of Innovative Research in Technology (IJIRT), vol. 12, no. 12, pp. 1618–1625, 2026.

