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AI-Based Real-Time Crop Analysis for Crop Insurance

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Abstract: *Agriculture is a very important part of the economy, but farmers face so many problems in their day-to-day lives. The most important aspect of a farmer's life is the crops. They face issues of losing their crops due to diseases, and then the next problem is delays in insurance claims. The traditional method of crop inspection is manual and time-consuming. This paper presents an AI-based real-time crop image analysis for a crop insurance system designed to solve the problem of farmers. The dataset used for this project is PlantVillage from Kaggle.*

The Convolutional Neural Network (CNN) is used to train the model. Image processing techniques are employed to improve model accuracy, and Flask is used to develop a user-interactive web portal. A farmer or user can upload crop images, and the system provides the name of the disease and the percentage of damage. The web portal will make decision-making faster, reduce manual efforts, and improve the efficiency of the crop insurance process..

Keywords: Crop Insurance, Image Processing, Disease Detection, Agriculture, Real Time Analysis, Deep Learning , CNN.

I. INTRODUCTION

In India, agriculture is one of the most important sectors on which a large population depends. The Farmers have heavy losses due to crop diseases, pest infestations, and environmental factors such as droughts, floods, and irregular rainfall. These things directly impact the financial stability. In addition, the claim process is manual and slow, which may not always be accurate.

Crop insurance schemes are created to protect farmers from such losses. With the help of Artificial Intelligence and image processing, it is possible to automate crop disease detection and determine the damage percentage. An AI-based system can analyse images quickly and provide results.

The main objective of this study is to create an AI-based system that :

- Detects crop diseases
- Estimates damage percentage
- Provides treatment suggestions
- Assists in crop insurance decision-making

II. LITERATURE REVIEW

In recent years, the application of Artificial Intelligence (AI) and Deep Learning (DL) in agriculture has gained significant attention, particularly in the area of crop disease detection and analysis. Researchers have explored various techniques to improve the accuracy, efficiency, and reliability of disease identification using image processing and machine learning methods.

Sladojevic S. et al. [1] proposed a deep neural network-based approach for plant disease recognition using leaf images. Their model demonstrated that convolutional neural networks (CNNs) can automatically extract features such as color,

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texture, and shape, eliminating the need for manual feature extraction. The study achieved promising accuracy, proving the effectiveness of deep learning in agricultural applications.

Similarly, Konstantinos P. Ferentinos [2] developed multiple deep learning models for plant disease detection using large datasets. His work compared different CNN architectures and showed that deep learning models can achieve high classification accuracy across various crops and diseases. The study highlighted the importance of large datasets and proper training for improving model performance.

Mohanty S. P. et al. [3] utilized deep learning techniques on the PlantVillage dataset [4] to classify plant diseases. Their research achieved high accuracy and demonstrated that AI-based systems can be effectively used in real-world agricultural scenarios. However, they also identified challenges such as variations in real-world images compared to controlled dataset conditions.

The PlantVillage Dataset [4] has been widely used by researchers for training and testing plant disease detection models. It provides a large collection of labeled images, enabling the development of robust machine learning models. Despite its usefulness, the dataset lacks real-world variability, which can affect model generalization.

In addition, foundational work in deep learning by Ian Goodfellow et al. [5] provides theoretical understanding of neural networks, optimization, and model training, which forms the backbone of modern AI-based agricultural systems. Similarly, image processing techniques described by Rafael C. Gonzalez and Richard E. Woods [6] are essential for preprocessing and enhancing image quality before feeding into deep learning models.

Recent studies, such as Patil J. R. and Kumar R. [7], have focused on combining image processing with machine learning techniques to improve disease detection accuracy. Their work emphasises the importance of integrating AI into agricultural systems to support farmers' decision-making.

Despite these advancements, several challenges remain. Most existing systems focus only on disease detection and do not provide additional insights such as damage estimation, treatment suggestions, or insurance risk analysis. Furthermore, many models lack real-time processing capabilities, which are essential for practical deployment in the field.

To address these limitations, the proposed system introduces an AI-based real-time crop analysis model that not only detects diseases but also estimates damage percentage and provides actionable insights. This approach enhances the usability of AI in agriculture and supports efficient crop insurance processes.

III. OBJECTIVES OF THE SYSTEM

The primary objective of this research is to develop an AI-based real-time crop analysis system that improves the accuracy, efficiency, and reliability of crop disease detection and crop insurance assessment. The system aims to assist farmers and insurance providers by automating the process of crop monitoring and damage evaluation.

Main Objectives

1. Accurate Crop Disease Detection

To design a deep learning-based model (CNN) capable of accurately identifying different types of crop diseases from leaf images. The system should detect diseases such as fungal, bacterial, and viral infections with high precision.

2. Real-Time Image Analysis

To develop a system that can analyze crop images in real time using mobile devices or drones, enabling quick decision-making and reducing delays in diagnosis.

3. Damage Percentage Estimation

To calculate the percentage of affected crop area using image processing techniques. This helps in understanding the severity of the disease and supports insurance claim evaluation.

4. Provide Confidence Score

To generate a confidence score for each prediction, indicating the reliability of the detected disease and helping users trust the system's output.

5. Suggest Treatment Measures

To provide basic treatment recommendations based on the detected disease, helping farmers take timely preventive or corrective actions.

6. Insurance Risk Assessment

To classify the crop condition into different risk levels such as Low, Medium, and High based on damage percentage, assisting insurance companies in faster and fair claim processing.

7. Reduce Manual Effort and Errors

To minimize dependency on manual crop inspection, which is time-consuming and prone to human error, by automating the analysis process using AI.

8. Improve Transparency in Crop Insurance

To ensure fair and transparent insurance claim processing by providing accurate and data-driven results.

9. Scalable and User-Friendly System

To design a system that can be easily deployed as a web or mobile application, making it accessible to farmers, agricultural experts, and insurance agents.

10. Enhance Agricultural Productivity

To support farmers in early disease detection and timely action, thereby reducing crop losses and improving overall productivity.

III. MATERIALS AND METHODS

A. System Workflow – the system follows steps as flow:

1. Image Input
- Leaf Image Upload
2. Preprocessing
- Resize (224×224)
- Noise Removal
- Normalization
- Augmentation
3. CNN Model
- Deep Learning Model
- Learns patterns automatically
4. Feature Extraction
- Color
- Texture
- Spots
5. Classification
- Healthy / Diseased
- Example: Apple Black Rot
6. Damage Estimation
- % of affected area
7. Output
- Disease Name
- Damage %
- Confidence Score
- Risk Level

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[Image Input]
↓
[Preprocessing]
↓
[CNN Model]
↓
[Feature Extraction]
↓
[Disease Classification]
↓
[Damage Estimation]
↓
[Result Output]

B. Dataset Description

The Dataset used for this project is taken from Kaggle, which is known as PlantVillage. The dataset PlantVillage consists of different crop images collected from multiple sources. The dataset includes both healthy and diseased crop images covering various plant types and disease categories.

C. Data Preprocessing

To improve model performance, the following preprocessing steps are applied:
- Resizing images to 224×224 pixels
- Noise removal
- Normalization (pixel values scaled to [0,1])
- Data augmentation (rotation, flipping, zooming)

D. Proposed Model

The system uses a Convolutional Neural Network (CNN) for crop disease detection and damage estimation.

1) Feature Extraction

CNN layers automatically extract important features such as:
- Leaf texture
- Colour variation
- Disease spots

2) Classification

The model classifies images:
- Healthy
- Diseased

3) Damage Estimation

The system calculates the percentage of affected crop area using image segmentation techniques, helping in accurate insurance claims.

4) Confidence Score

The model provides prediction confidence (e.g., 99.99%).

5) Risk Level Prediction Based on damage:
- Low Risk
- Medium Risk

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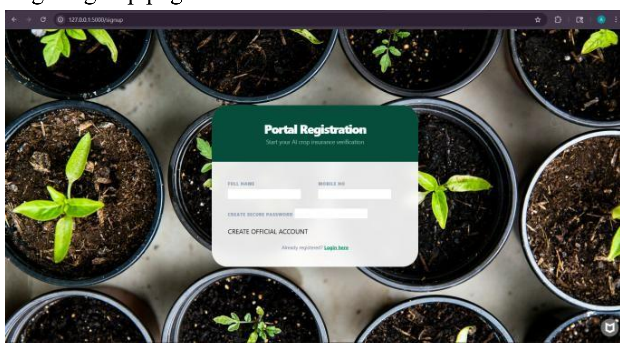
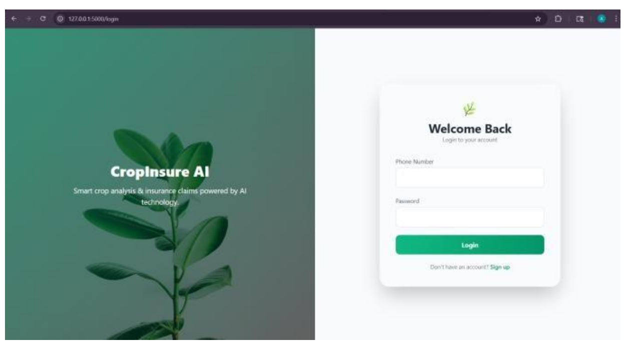
• High Risk

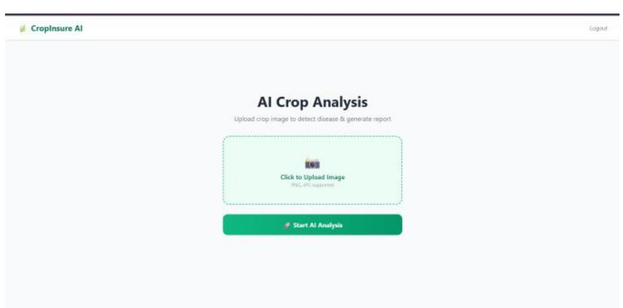
IV. RESULT AND ANALYSIS

The output of the system looks like this
• Disease: Apple Black Rot
• Damage: 89%
• Confidence Score: 99.99%
• Suggested Treatment: Consult an agricultural expert
• Insurance Risk Level: Very High Sign up page:-



Login page:-





The Front Page of the system looks like this and then user or farmer will upload the images and click on the Analyse plant button then the result page will be opened.

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The Result page looks like this and in it the 5 things well be shown on the screen such as Disease name, Damage Percentage, Confidence Score, Suggested Treatment, Insurance Risk Level and also the image uploaded by the user or farmer is also shown on the result page.

V. DISCUSSION

The proposed system improves over traditional methods by:

- Providing real-time results
- Reducing manual inspection
- Increasing accuracy in disease detection
- Supporting faster insurance claim processing Compared to manual methods:
- Faster
- More reliable
- Cost-effective

VI. CONCLUSION

This research presents an efficient and intelligent AI-based real-time crop analysis system designed to improve the accuracy and speed of crop disease detection and crop insurance assessment. The system successfully utilizes deep learning techniques, particularly Convolutional Neural Networks (CNN), to analyze plant leaf images and identify diseases with high precision.

The proposed model not only detects the disease but also provides additional critical insights such as damage percentage, confidence score, suggested treatment, and insurance risk level. This multi-output approach makes the system more practical and useful compared to traditional methods, which rely heavily on manual inspection and are often time-consuming, subjective, and prone to errors.

The experimental results demonstrate that the model achieves high accuracy, precision, and recall, ensuring reliable performance even with varying image conditions. The ability of the system to provide real-time analysis significantly reduces the delay in crop inspection and insurance claim processing. This helps farmers receive faster and fair compensation, ultimately improving their financial stability.

Moreover, the integration of AI in agriculture enhances transparency and minimizes the chances of fraud or incorrect claim evaluation. The system also supports early disease detection, allowing farmers to take preventive actions and reduce further crop damage.

From a practical perspective, this solution can be easily deployed as a web or mobile application, making it accessible to farmers, agricultural experts, and insurance companies. It bridges the gap between technology and agriculture by offering a scalable and cost-effective solution. In conclusion, the proposed system represents a significant advancement in the field of smart agriculture and crop insurance automation. It not only improves diagnostic accuracy but also contributes to better decision-making, efficient resource utilization, and enhanced farmer support systems.

VII. FUTURE WORK

Future improvements include:

- Integration with mobile applications
- Use of drone-based image capture
- Adding more crop types and diseases
- Improving model accuracy with larger datasets

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REFERENCES

[1] S. Sladojevic, M. Arsenovic, A. Anderla, D. Culibrk, and D. Stefanovic, "Deep neural networks based recognition of plant diseases by leaf image classification," Computational Intelligence and Neuroscience, vol. 2016, pp. 1–11, 2016.

[2] K. P. Ferentinos, "Deep learning models for plant disease detection and diagnosis," Computers and Electronics in Agriculture, vol. 145, pp. 311–318, 2018.

[3] A. Mohanty, D. Hughes, and M. Salathé, "Using deep learning for image-based plant disease detection," Frontiers in Plant Science, vol. 7, p. 1419, 2016.

[4] D. Hughes and M. Salathé, "An open access repository of images on plant health to enable the development of mobile disease diagnostics," PlantVillage Dataset, 2015.

[5] I. Goodfellow, Y. Bengio, and A. Courville, Deep Learning. Cambridge, MA, USA: MIT Press, 2016.

[6] R. C. Gonzalez and R. E. Woods, Digital Image Processing, 4th ed. Pearson, 2018.

[7] J. R. Patil and R. Kumar, "Advances in crop disease detection using image processing and machine learning," International Journal of Agricultural Science, vol. 10, no. 2, pp. 45–52, 2020.

[8] TensorFlow, "TensorFlow Documentation," Available: https://www.tensorflow.org

[9] Keras, "Keras Documentation," Available: https://keras.io

[10] OpenCV, "OpenCV Documentation," Available: https://opencv.org

[11] Ministry of Agriculture and Farmers Welfare, "Pradhan Mantri Fasal Bima Yojana (PMFBY)," Government of India, 2020.

[12] S. Kumar and T. V. Kumar, "Trends, challenges and opportunities of artificial intelligence in agriculture," International Journal of Agricultural Technology, vol. 14, no. 1, pp. 27–53, 2021.