Industrial Engineering Journal
ISSN: 0970-2555
Volume : 54, Issue 5, May : 2025

SMART FARMING PLATFORM USING AI FOR CROP DISEASE DETECTION AND PREDICTION

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ABSTRACT

In India, a major portion of the population relies on agriculture as their primary source of livelihood. However, the rising challenge of plant diseases has led to substantial losses in both crop quality and yield. Early and accurate detection of these diseases is essential for maintaining food security and improving farmers' income. This project aims to develop a Convolutional Neural Network (CNN)-based web application that assists in identifying plant diseases using images of affected crops.

The proposed system enables farmers to upload images through a user-friendly interface, which are then analyzed using a pre-trained CNN model to detect and classify potential diseases. The application is built using Python and deployed through cloud services to ensure scalability and real-time access. By integrating deep learning techniques with accessible technology, the system provides a practical solution for disease diagnosis, minimizing the need for physical consultations with agricultural experts. This tool empowers farmers with timely insights, reduces dependence on harmful chemical treatments, and ultimately supports sustainable agricultural practices.

INTRODUCTION:

Agriculture is the cornerstone of human sustenance. In densely populated developing nations like India, enhancing the yield and quality of crops, fruits, and vegetables is crucial. However, these objectives are often compromised by plant diseases, many of which are infectious and can lead to total crop failure. The vast expanse of agricultural lands, coupled with limited farmer education and scarce access to plant pathologists, renders human-assisted disease diagnosis insufficient. To address this gap, it's essential to develop automated, cost-effective, and accurate machine-assisted diagnostic tools that are easily accessible to farmers.

Advancements in technology, such as robotics and computer vision, have been explored to tackle various agricultural challenges. Image processing, in particular, has shown promise in precision agriculture, aiding in weed management, plant growth monitoring, and nutrition assessment. Deep learning algorithms, especially Convolutional Neural Networks (CNNs), have revolutionized image analysis since the success of "AlexNet" in the 2012 ImageNet competition. The synergy of enhanced computational power, extensive image datasets, and improved neural network algorithms has propelled AI's capabilities. Open-source platforms like TensorFlow have further democratized AI, making it more affordable and accessible.

Previous initiatives have focused on collecting images of healthy and diseased crops, employing techniques like feature extraction, RGB imaging, spectral analysis, and fluorescence spectroscopy. While neural networks have been utilized for plant disease identification, earlier approaches primarily relied on texture features. Our proposal leverages the advancements in mobile technology, cloud computing, and AI to create a comprehensive crop diagnosis solution. This platform emulates the expertise of plant pathologists, offering farmers a collaborative tool that continuously improves its disease classification accuracy through user contributions and expert feedback.

1. Literature Survey:

A Survey of Image Processing Techniques for Agriculture

Authors: *Lalit P. Saxena and Leisa J. Armstrong*

This paper reviews the application of image processing in agriculture, highlighting its role in enhancing productivity. Techniques discussed include precision agriculture practices, weed and herbicide technologies, plant growth monitoring, and nutrition management. The study underscores the potential of image processing in various agricultural contexts.

ImageNet Classification with Deep Convolutional Neural Networks

Authors: *A. Krizhevsky, I. Sutskever, and G. E. Hinton*

The authors trained a deep CNN to classify 1.2 million high-resolution images into 1,000 categories, achieving top-1 and top-5 error rates of 37.5% and 17.0%, respectively. The network comprises five convolutional layers and three fully connected layers, utilizing techniques like dropout for regularization. This model marked a significant advancement in image classification accuracy.

Integrating SOMs and a Bayesian Classifier for Segmenting Diseased Plants in Uncontrolled Environments

Authors: *D. L. Hernández-Rabadán, F. Ramos-Quintana, and J. Guerrero Juk*

This study presents a methodology combining self-organizing maps (SOMs) and a Bayesian classifier to segment diseased plants in uncontrolled environments. The approach addresses challenges like variable illumination and background interference, demonstrating improved performance over traditional color index methods.

EXISTING SYSTEM:

In India, approximately 35% of crop yield is lost annually due to diseases and pest attacks, resulting in significant financial losses for farmers. A major contributing factor is the lack of timely detection and effective monitoring systems. To compensate, many farmers rely heavily on pesticides, often using them without proper guidance. This excessive and unregulated use of pesticides not only leads to environmental pollution but also poses serious health hazards, as many pesticides are toxic and can accumulate in the food chain through biomagnification.

Traditionally, crop diseases are identified based on visible symptoms observed by agricultural specialists. However, most farmers have limited or no direct access to these experts, especially in remote areas, making early detection and accurate diagnosis difficult.

Disadvantages:

Overuse of harmful pesticides due to lack of accurate diagnosis.

Health risks to humans and animals through toxic pesticide residues.

Environmental damage due to pesticide runoff and biomagnification.

Delayed or incorrect disease identification because of limited expert availability.

Reduced crop productivity and increased losses due to ineffective disease management.

PROPOSED SYSTEM

This project leverages **Convolutional Neural Networks (CNNs)**, a powerful AI technique, to identify plant diseases from images. Initially, the CNN model is trained using a diverse set of plant disease images. Once the training is complete, users can upload new plant images, and the system will automatically detect and classify any disease present in the uploaded image using the trained CNN model.

To ensure accessibility and cost-effectiveness, the system is built as a **Python-based web application**, instead of a mobile application, to avoid the additional development time and expense associated with Android app creation. Users can conveniently upload images through this web interface. If deployed on a live server, the system can also capture the user's geographic location via the request object and visualize it on a map for analysis.

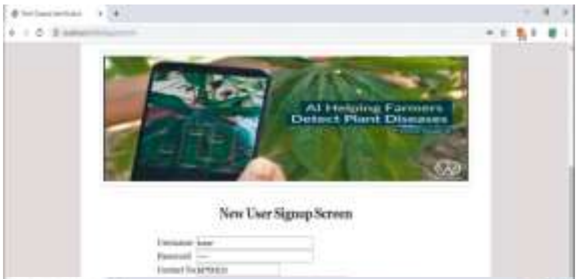
All trained models and user-uploaded images are securely stored using **cloud services**, ensuring scalability and efficient data management.

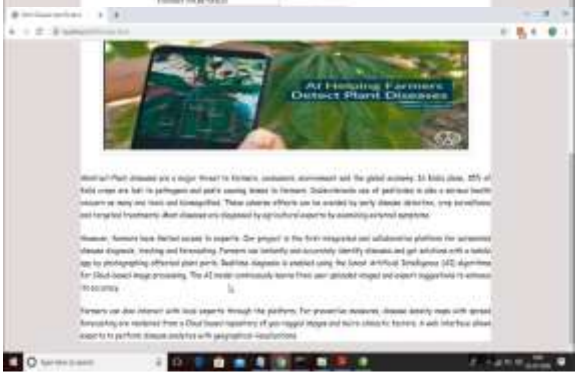
Advantages

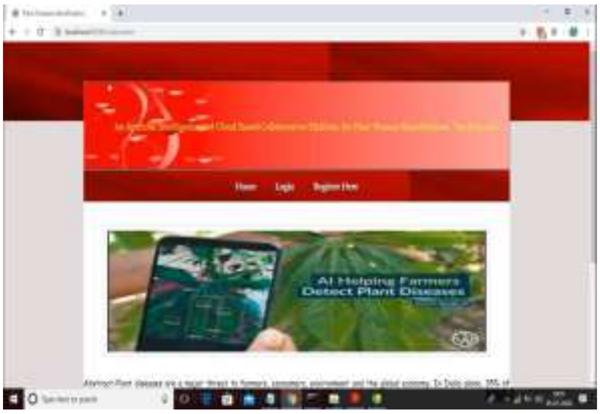
- Enables farmers to **accurately detect plant diseases** by simply capturing an image of the affected plant part.
- Provides **quick and reliable solutions**, improving decision-making for disease

control.

- Cloud storage supports **scalability** and **real-time access** to trained models.
- Capable of detecting **early disease symptoms**, aiding in prevention and management.







MODULES DESCRIPTION

REGISTER :

In this module user/former has to register himself.

LOGIN:

In this module user/former has to login with valid user name and password.

UPLOAD PLANT IMAGE:

In this module user/former should upload plant image and can identify the plant disease.

LOGOUT:

After completion of user activities can logout from the application by using this module.

RESULT & ANALYSIS:

CONCLUSION:

This project introduces a cost-effective, AI-powered plant disease detection system, specifically tailored for agricultural use. It offers a complete end-to-end solution, from disease detection to geographical visualization, using cloud-based architecture and deep learning. By employing the Inception CNN model, the system ensures high accuracy in real-time disease classification.

The system continuously improves over time through a collaborative model where user-submitted images contribute to retraining and enhancing the model. These images, when geotagged, also help in creating disease density maps to visualize and track outbreaks.

Overall, the system is practical for deployment due to its scalable infrastructure, adaptability to multiple disease categories, and robustness in identifying early disease symptoms. It stands as a promising tool in modern precision agriculture.

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