VISVESVARAYA TECHNOLOGICAL UNIVERSITY

Jnana Sangama, Belgaum-590018

A MINI-PROJECT (21CSMP67) REPORT

ON

"PLANT LEAF DISEASE DETECTION"

Submitted in partial fulfilment of the requirements for the award of the degree of

BACHELOR OF ENGINEERING

IN

COMPUTER SCIENCE AND ENGINEERING

Submitted by

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KALPATARU INSTITUTE OF TECHNOLOGY

NBA Accredited 2022-25 & NAAC Accredited

N H -206, TIPTUR-572201 2023-2024

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CERTIFICATE

This is to certify that the Mini – Project (21CSMP67) entitled "**PLANT LEAF DISEASE DETECTION**" is a bonafide work carried out by

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are Students of Kalpataru Institute of Technology in partial fulfilment for the award of **Bachelor of Engineering** in **Computer Science & Engineering** in **Visvesvaraya Technological University, Belgaum** during the year 2023-2024. It is certified that all corrections/suggestions indicated for Internal Assessment have been incorporated in the report deposited in the departmental library. The Mini-Project report has been approved as it satisfies the academic requirements in respect of work prescribed for the said Degree.

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DECLARATION

We, **NAMITHA C [1KI21CS066], PREETI T L [1KI21CS082] , SHAMANTH B M [1KI21CS099]**, students of Sixth semester Bachelor of Engineering, Department of Computer Science and Engineering, Kalpataru Institute of Technology, Tiptur, would hereby declare that the Mini - Project(21CSMP67) program titled "PLANT LEAF DISEASE DETECTION" has been carried out by us at Kalpataru Institute of Technology , in partial fulfilment of the course requirement for the award of degree of Bachelor of Engineering in Computer Science and Engineering of Visvesvaraya Technological University, Belagavi, during the academic year 2023-2024. We further declare that the work embodied in this report has not been submitted to any other university or institution for the award of any other degree.

Place: Tiptur
Date: / /

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Thanking you

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ABSTRACT

Agriculture field has a high impact on our life. Agriculture is the most important sector of our Economy. Proper management leads to a profit in agricultural products. Farmers do not expertise in leaf disease so they produce less production. Plant leaf diseases detection is the important because profit and loss are depending on production. CNN is the solution for leaf disease detection and classification. Main aim of this research is to detect the apple, grape, corn, potato, Blueberry, and tomato plants leaf diseases. Plant leaf diseases are monitoring of large fields of crops disease detection, and thus automatically detected some feature of diseases as per that provide medical treatment. Plant leaf disease detection has wide range of applications available in various fields such as Biological Research and in Agriculture Institute. Plant leaf disease detection is the one of the required research topics as it may prove benefits in monitoring large fields of crops, and thus automatically detect the symptoms of diseases as soon as they appear on plant leaves.

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Chapter 1

INTRODUCTION

Agriculture is the backbone of our economy, playing a critical role in food production, employment, and economic stability. However, the productivity and health of crops are constantly threatened by various plant diseases, particularly those affecting the leaves. Leaf diseases can significantly impair photosynthesis, stunt plant growth, and ultimately lead to substantial reductions in crop yield. Therefore, effective and timely detection of leaf diseases is of paramount importance.

One of the primary challenges in managing leaf diseases is the lack of expertise among farmers in identifying and diagnosing these diseases. Traditional methods of detection, such as visual inspection, are not only time-consuming but also prone to errors. This often results in delayed or incorrect treatments, exacerbating the problem and leading to significant crop losses.

To overcome these challenges, modern technology has introduced deep learning techniques for the detection and diagnosis of leaf diseases. These techniques use advanced algorithms and large datasets to accurately identify disease symptoms from images of plant leaves. For instance, in the context of apple, grape, corn, potato, and tomato plants, deep learning models have been trained on a dataset containing twenty-four types of leaf diseases and twenty-four thousand leaf images.

Deep learning models are trained to recognize these diseases by analyzing images of plant leaves and identifying characteristic patterns and features associated with each disease. This approach not only improves the accuracy of disease detection but also significantly reduces the time required for diagnosis. By providing farmers with precise and timely information, these technologies enable better disease management strategies, including targeted treatments and preventive measures.

Incorporating deep learning techniques into agricultural practices represents a significant advancement in the fight against plant diseases. It empowers farmers with the tools they need to maintain healthy crops, optimize production, and maximize profits. As these technologies continue to evolve, they hold the potential to revolutionize agriculture, making it more efficient, sustainable, and resilient to the challenges posed by plant diseases.

Chapter 2

2.1 PROBLEM STATEMENT:

Develop an automated system to accurately detect and classify plant leaf diseases using image processing and machine learning. The system should handle diverse plant species, varying image qualities, and provide real-time results with high accuracy.

2.2 OBJECTIVE:

The objective of this research is to develop an advanced system for detecting diseases in the leaves of potato, tomato, corn, grapes, and apple plants using Convolutional Neural Networks (CNN). These crops were chosen due to their significant economic importance and the common occurrence of leaf diseases that can severely impact their yield and quality. CNNs, known for their exceptional performance in image recognition tasks, will be employed to analyse images of plant leaves. The system will distinguish between healthy and diseased leaves, enabling accurate and timely diagnosis. This involves collecting a large dataset of labelled images, preprocessing these images to enhance quality and consistency, and then using CNNs to automatically extract relevant features such as colour, texture, and shape that indicate disease. The model will be trained on this data to learn the specific indicators of health and disease for each crop. After rigorous evaluation to ensure high accuracy, the system will be deployed with a user-friendly interface, allowing farmers and agronomists to upload leaf images and receive immediate diagnostic results. This tool aims to improve agricultural productivity by enabling early and precise disease detection, thereby reducing economic losses and enhancing food security.

2.3 MOTIVATION:

Identifying and recognition of leaves disease is the solution for saving the reduction of large farm in crop disease detection and profit in productivity, it is beneficial in agricultural institute, biological research

Chapter 3

LITERATURE SURVEY

1.CNN based Leaf Disease Identification and Remedy Recommendation System.

Publication Year: 2019

Author: Sunku Rohan , Triveni S Pujar ,Suma VR Amog Shetty, Rishabh F Tated [2].

Journal Name: IEEE conference paper

Summary: Agriculture field has a high impact on our life. Agriculture is the most important sector of our Economy. Farmers are difficult to identify the leaf disease so they produce less production. Though, videos and images of leaves provide better view for agricultural scientists can provide a better solution. So that can solve the problem of related to crop disease. It is required to note that if the productivity of the crop is diseased then, it has high risk of providing good nutrition. Due to the improvement and development in technology where devices are smart enough to recognize and detect plant diseases. Acknowledge diseases faster treatment in order to lessen the negative impacts on harvest. In this paper focus on plant disease detection using image processing techniques. This paper access open dataset images that consist 5000 images of healthy and diseased plant leaves, and there used semi supervised techniques for crop types and detect the disease of four classes.

2.Time Detection of Apple Leaf Diseases Using Deep Learning Approach Based on Improved Convolution Neural Networks.

Publication Year: 2019

Author: Bin Liu, Peng Jiang, Yuehan Chen, Dongjian He, Chunquan Liang.

Summary: This paper contains five types of apple leaf disease that are, aria leaf spot, Brown spot, Mosaic, Grey spot, and Rust. That is affected in apple. This paper used deep learning techniques to improved convolution neural networks (CNNs) for detection in apple leaf diseases. In this paper, the apple leaf disease dataset (ALDD) is used, which consist complex images and laboratory images, and rest constructed via data augmentation and image annotation technologies to create new apple leaf disease detection model that uses deep-CNNs is by using Rainbow concatenation and Google Net Inception structure. In testing dataset used 26,377 images of apple leaves disease, the proposed INAR- model is trained and then detect five common apple leaf diseases. In the experimental results show that the INAR- SSD model realizes 78.80% detection performance, with a high-detection speed of 23.13 FPS. The results demonstrate that the novel INAR-SSD model provides a high- performance solution for the early diagnosis of apple leaf diseases that can perform real-time detection of these diseases with higher accuracy and faster detection speed than previous methods.

3. Automatic Disease Symptoms Segmentation Optimized for Dissimilarity Feature Extraction in Digital Photographs of Plant Leaves.

Publication Year: 2019

Author: Masum Aliyu Muhammad Abdu, Musa Mohd Mokji, Usman Ullah Sheikh, Kamal

Journal Name: IEEE 15th International Colloquium on Signal Processing & its applications

Summary: Segmentation of diseased symptom regions in images of plant leaves is a crucial stage in the application of machine learning for plant diseases detection. This process also known as Region of Interest (ROI) segmentation involves separating purely colour variant symptom lesions from surrounding green tissue from which discriminant features are later extracted. However, investigations have shown that vivid anatomy of a disease symptom progression right from inception to manifestation through which finer disease characterization dissimilarity features can be fostered are not captured in a segmented ROI. Furthermore, the typical ROI segmentation process is often plagued by challenges ranging from intrinsic factors such as image capture conditions to extrinsic factors such as disease anatomy where symptoms fade into healthy green tissue the separation boundary to become impalpable. This adds further complexity to the process or produce erroneous result. This research proposes an automatic extended region of interest (EROI) segmentation to incorporate symptom progression information by extending the border region to cover some part of healthy tissue using colour homogeneity thresholding. To produce a ground truth, the typical ROI segmentation alongside a reduced ROI were implemented on a well-known Plant Village dataset from which separate textural and colour features were extracted and used to build a linear classifier. A comparison between the classification results further reinforced the advantages of the proposed approach for dissimilarity features extraction. Through this research, finer characterization features can be extracted for the classification and severity estimation of plant diseases.

Chapter 4

IMPLEMENTATION

4.1 Overview of Existing Work

Existing work related to leaf disease detection using CNN show to detect and classify leaf disease using image processing techniques that follow steps like

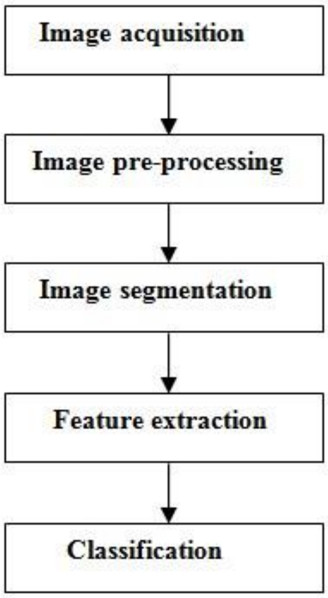

Fig.4.1 General Block Diagram of Feature Based Approach

The above figure describes about the automated plant leaf disease detection system involves several key steps. First, image acquisition captures and stores images using a digital camera for further MATLAB processing. Next, image preprocessing enhances image quality by adjusting size and shape, filtering noise, converting images, and applying morphological operations. Image segmentation uses the K-means clustering technique to partition images into clusters, isolating areas with significant disease presence. Texture features are then extracted using the Gray-Level Co-occurrence Matrix (GLCM). Finally, classification is performed using a Random Forest classifier to accurately identify and diagnose leaf diseases.

4.2 ARCHITECTURE:

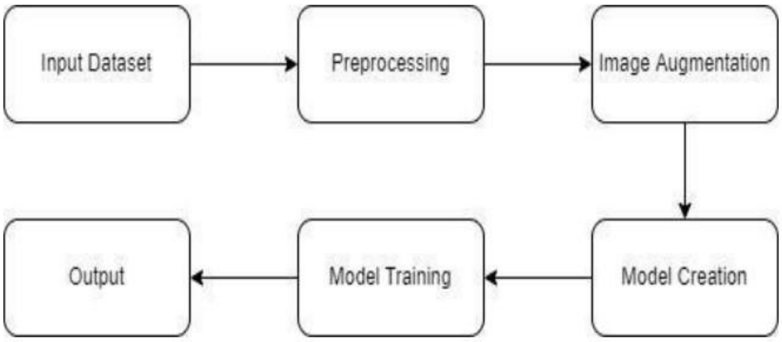

Fig 4.2 Architecture

4.3 SOFTWARE REQUIREMENTS:

- Windows 10.
- PyCharm.
- 8GB RAM.
- Python 3.7.

4.4 HARDWARE REQUIREMENTS:

- Intel i5 11th gen and above.
- Minimum 2GB of RAM or more
- 2.5 GB of available hard-disk space
- 5400 RPM hard drive
- 1366 × 768 or higher-resolution display
- DVD-ROM drive

4.5 IMPLEMENTATION WORK

Apple, grape, potato, and tomato plant leaves which are categorized total 24 types of labels apple label namely: Apple scab, Black rot, Apple rust, and healthy. Corn label namely: Corn Cercospora Gray spot, Corn rust, Corn healthy, Corn Blight. Grape label namely: Black rot, Esca, healthy, and Leaf blight. Potato label namely: Early blight, healthy, and Late blight. Tomato label namely: bacterial spot, early blight, healthy, late blight, leaf mold, septoria leaf spot, spider mite, target sport, mosaic virus, and yellow leaf curl virus.

Here we have collected some dataset of plant leaves images and these images are resized into 256x 256, that images divided into two parts training and testing dataset, the whole range of the train test split using 80-20 (80% of the whole dataset used for the training and 20% for the testing). Then train CNN model.

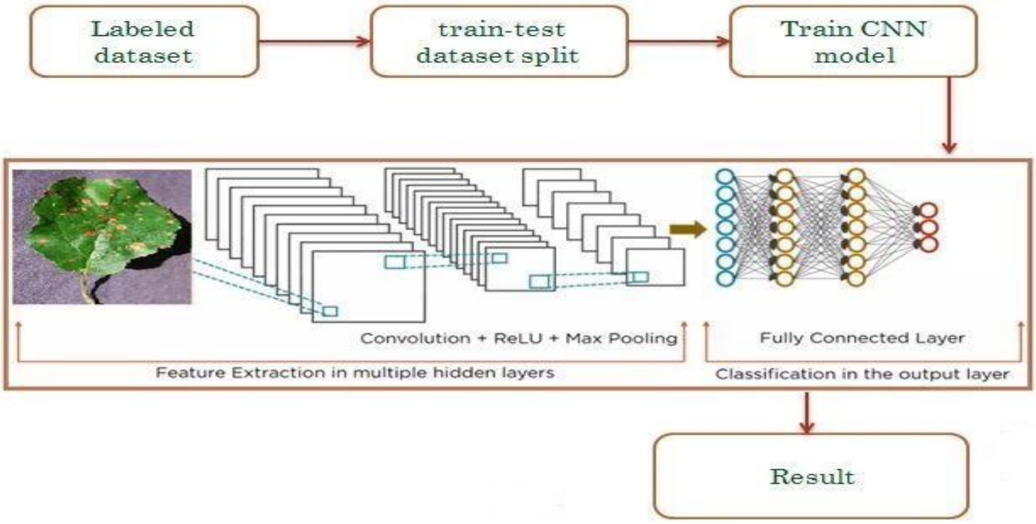

Fig 4.3: Proposed workflow

Convolutional neural networks (CNN) can be used for the computational model creation that works on the unstructured image inputs and converts to output labels of corresponding classification. They belong to the category of multi-layer neural networks which can be trained to learn the required features for classification purposes Less pre-processing is required in comparison to traditional approaches and automatic feature extraction is performed for better performance. For the purpose of leaf disease detection, the best results could be seen with the use of a variation of the LeNet architecture.

LeNet consists of convolutional, activation, max-pooling and fully connected layer also LeNet is simple CNN model. This architecture used for the classification of the leaf diseases in LeNet model [13]. It consists of an additional block of convolution, activation and pooling layers in comparison to the original LeNet architecture. The model used in this paper been shown in Fig. 2. Each block consists of a convolution, activation and a max pooling layer. Three such blocks followed by fully connected layers and soft-max activation are used in this architecture. Convolution and pooling layers are used for feature extraction whereas the fully connected layers are used for classification. Activation layers are used for introducing non-linearity into the network.

Convolution layer applies convolution operation for extraction of features. With the increase in depth, the complexity of the extracted features increases.

The size of the filter is fixed to 5 × 5 whereas number of filters is increased progressively as we move from one block to another. The number of filters is 20 in the first convolution block while it is increased to 50 in the second and 80 in the third. This increase in the number of filters is necessary to compensate for the reduction in the size of the feature maps caused by the use of pooling layers in each of the blocks. After the application of the convolution operation feature maps are zero padded, in order to preserve the size of the image. The max pooling layer is used for reduction in size of the feature maps, speeding up the training process, and making the model less variant to minor changes in input. The kernel size for max pooling is 2×2. Re-LU activation layer is used in each of the blocks for the introduction of non-linearity. Also, Dropout regularization technique has been used with a keep probability of 0.5 to avoid overfitting the train set. Dropout regularization randomly drops neurons in the network during iteration of training in order to reduce the variance of the model and simplify the network which aids in prevention of over fitting. Finally, the classification block consists of two sets fully connected neural network layers each with 500 and 10 neurons respectively. The second dense layer is followed by a soft max activation function to compute the probability scores for the ten classes.

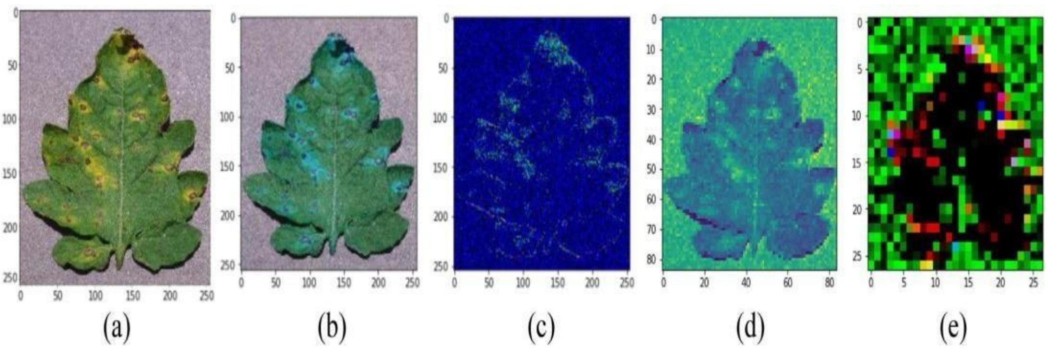

Fig.4 Experimental result (a) input image (b) convolution layer-1 (c) convolution layer-2 (d) convolution layer-3 (e) flatting layer

Further, in every experiment, the overall accuracy over the whole period of training and testing regular intervals (for every epoch) will be computed. The overall accuracy score will be used for performance evaluation.

Chapter 5

SNAPSHOTS

5.1: HOME PAGE

Fig 5.1: home page

5.2: AI ENGINE:

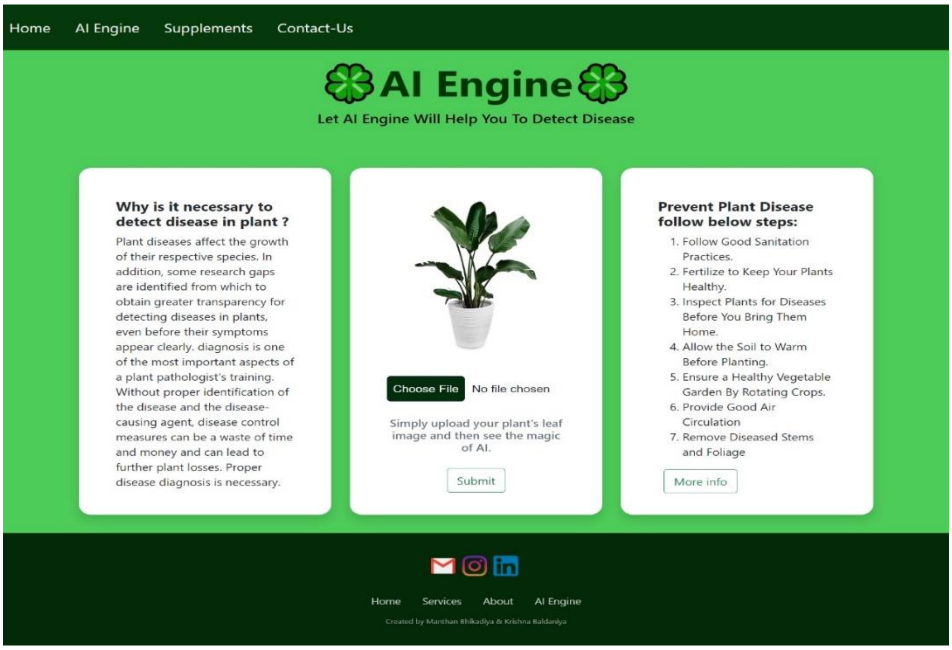

Fig 5.2: AI Engine

5.3: LEAF DISEASE DETECTION:

Fig 5.3: Leaf disease detection and related supplements for the disease

5.4: SUPPLEMENTS:

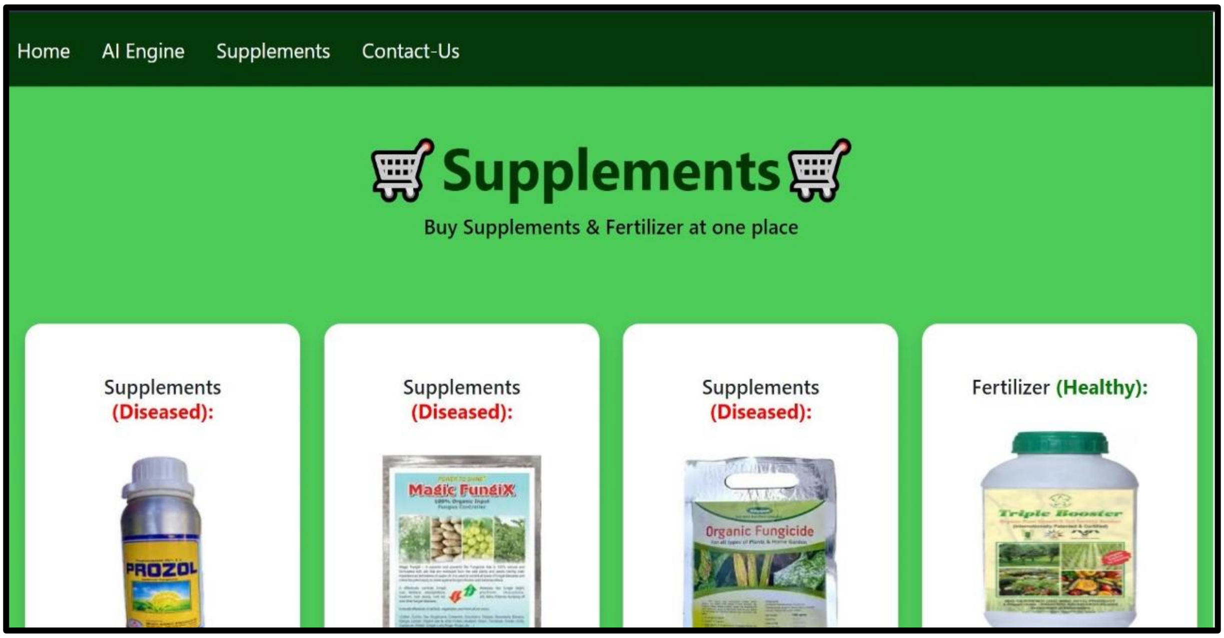

Fig 5.4: Supplements

Chapter 6

6.1 CONCLUSION:

In conclusion, the application of technology in plant disease detection represents a pivotal advancement in agricultural practices. By harnessing the capabilities of artificial intelligence, machine learning, and computer vision, researchers and farmers alike can identify diseases swiftly and accurately. This proactive approach not only minimizes crop losses but also optimizes resource allocation, leading to improved yield and sustainability in agriculture. As these technologies continue to evolve and become more accessible, the future promises a more resilient agricultural sector capable of feeding a growing global population while reducing environmental impact. Embracing innovation in plant disease detection is therefore crucial for ensuring food security and sustainable farming practices in the years to come.

6.2 FUTURE SCOPE:

The future scope for plant leaf disease detection encompasses several promising advancements aimed at enhancing the system's accuracy, accessibility, and functionality. Expanding the detection capabilities to cover a broader range of crops will make the technology more versatile and beneficial to a wider array of farmers.

Integrating the system with Internet of Things (IoT) devices can enable continuous monitoring and real-time data collection directly from the fields, facilitating prompt detection and immediate action against diseases. Developing mobile applications will allow farmers to use their smartphones to capture leaf images and receive instant diagnostic results, making the technology more accessible and user-friendly. Additionally, integrating climate and environmental data can enhance the predictive capabilities of the system by understanding the impact of weather conditions on disease prevalence.

The system could also evolve to offer automated treatment recommendations, guiding farmers on specific pesticide usage and remedial measures. By integrating with broader agricultural management systems, the detection system can contribute to comprehensive farm management, optimizing resource allocation and decision-making.

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