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Leaf Disease Advisory Expert System

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ABSTRACT—The Leaf Disease Advisory Expert System utilizes image processing and deep learning techniques to provide detect and solutions for plant leaf diseases. The system is designed to detect the presence of diseases in plant leaves through image analysis and provide appropriate recommendations for treatment. The deep learning algorithm used by the system is trained on a large dataset of plant leaf images to accurately identify and classify different types of diseases. The system provides a user-friendly interface that allows users to easily upload images of plant leaves and receive recommendations on how to treat any detected diseases. This project is a valuable tool for farmers and agricultural experts, enabling them to quickly and accurately diagnose and treat plant leaf diseases, ultimately improving crop yield and quality.

I. INTRODUCTION

Agriculture is a vital sector of the economy, contributing significantly to food security and economic growth. However, plant diseases can significantly affect crop yield and quality, leading to substantial losses for farmers. Therefore, it is essential to diagnose and treat plant diseases promptly to prevent their spread and minimize the economic impact.

Traditional methods of disease diagnosis require the exper- tise of trained professionals, making it time-consuming and costly. However, with the advancements in image processing and deep learning, it is now possible to develop intelligent systems that can accurately detect and diagnose plant diseases, providing effective solutions for farmers.

In this project, we have developed a Leaf Disease Advisory Expert System (LDAES) that utilizes image processing and deep learning techniques to provide solutions for plant leaf diseases. The system can analyze images of plant leaves and accurately identify any diseases present. The deep learning algorithm used by the system is trained on a vast dataset of plant leaf images to classify different types of diseases accurately.

The LDAES provides a user-friendly interface that allows farmers and agricultural experts to upload images of plant leaves and receive real-time recommendations on how to treat any detected diseases. The system's speed and accuracy make it a valuable tool for farmers, enabling them to quickly diagnose and treat plant leaf diseases, ultimately improving crop yield and quality.

II. RELATED WORKS

[1] Deep Learning Based Tomato Plant Diseases Detection on Mobile Devices" by K. R. K. Reddy, et al. (2018): This paper presents a system that uses deep learning and mobile devices for tomato plant disease detection. The system utilizes a convolutional neural network (CNN) to classify tomato plant diseases and can run on mobile devices without the need for internet connectivity.
[2]"Plant Disease Detection Using Deep Learning and Con- volutional Neural Networks" by P. V. Prakash and G. A. Rajkumar (2020): This paper proposes a deep learning-based approach for plant disease detection that utilizes a CNN. The system is trained on a large dataset of plant images and can accurately identify different types of plant diseases.
[3]" An Expert System for Plant Disease Diagnosis Based on Image Processing and Machine Learning" by M. M. Abdel Hafez, et al. (2018): This paper presents an expert system for plant disease diagnosis that utilizes image processing and machine learning. The system can diagnose several plant diseases and provide recommendations for treatment.
[4]" Automatic Detection of Plant Leaf Diseases Using Machine Learning Techniques: A Review" by S. Singh, et al. (2018): This paper provides a comprehensive review of machine learning-based

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techniques for plant leaf disease de- tection. The authors discuss various methods, including SVM, decision trees, and neural networks, and highlight the advan- tages and limitations of each approach.

These previous works provide a solid foundation for the development of the Leaf Disease Advisory Expert System and demonstrate the potential of image processing and deep learning techniques for plant disease detection and diagnosis.

III. METHODOLOGIES

Data Collection: The first step is to collect a large dataset of plant leaf images, including both healthy and diseased plants. The dataset should include images of various plant species and different types of diseases.

Preprocessing: The acquired images need to be preprocessed to enhance image quality and remove any noise or artifacts that may affect the disease detection process. This step may include image resizing, normalization, and color correction.

Image Segmentation: The preprocessed images will be segmented to identify the regions of interest that contain the plant leaves. This step involves separating the plant leaves from the background and other objects in the image.

Feature Extraction: The segmented images will be fed into a deep learning algorithm, such as a Convolutional Neural Network (CNN), to extract meaningful features from the images. The CNN will learn to identify patterns and structures in the images that are indicative of plant leaf diseases.

Training: The extracted features will be used to train the deep learning algorithm to accurately classify different types of plant diseases. The training process involves feeding the labeled dataset into the algorithm and adjusting the network parameters to optimize performance.

Validation: The trained algorithm will be validated using a separate dataset of plant leaf images to evaluate its accuracy and performance.

Disease Diagnosis and Treatment Recommendation: Once the image is classified as diseased, the system will diagnose the type of disease present in the plant leaf and provide appropriate treatment recommendations. The recommendations can be based on expert knowledge or previous successful treatments for the identified disease.

User Interface: The system will have a user-friendly inter- face that allows users to easily upload images of plant leaves and receive real-time recommendations on how to treat any detected diseases.

IV. PROPOSED SYSTEM

Convolutional Neural Network

Convolutional operation: The first building block in our plan of attack is convolution operation. In this step, we will touch on feature detectors, which basically serve as the neural network's filters. We will also discuss feature maps, learning the parameters of such maps, how patterns are detected, the layers of detection, and how the findings are mapped out.

Conv2D: Keras Conv2D is 2D Convolution Layer; this layer creates a convolution kernel that is wind with layers input which helps produce a tensor of outputs. Kernel: In image processing kernel is a convolution matrix or masks which can be used for blurring, sharpening, embossing, edge detection, and more by doing a convolution between a kernel and an image

Flattening: This will be a brief breakdown of the flattening process and how we move from pooled to flattened layers when working with Convolutional Neural Networks.

Full Connection: In this part, everything that we covered throughout the section will be merged together. By learning this, you'll get to envision a fuller picture of how Convolutional Neural Networks operate and how the "neurons" that are finally produced learn the classification of images.

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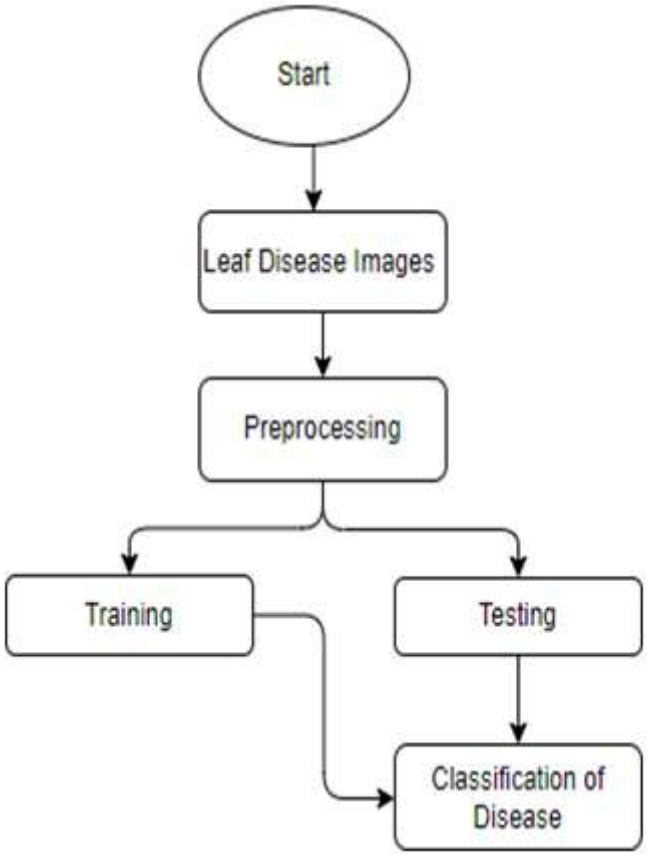
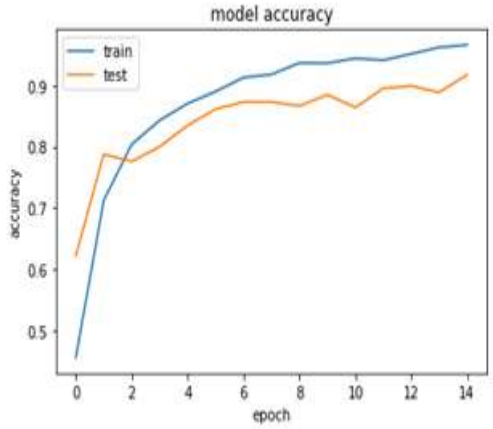
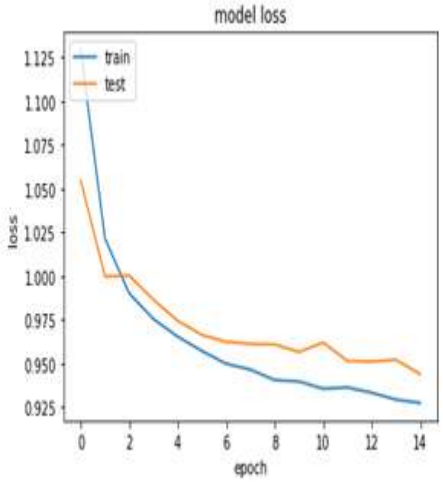


Block diagram of proposed system

Generally, the accuracy of deep learning models for plant disease using image processing and CNNs has been reported to be high with reported accuracies ranging from 85% to 99%.





Typically, the goal of training a deep learning model is to minimize the loss function, which result in higher accuracy and better performance of the model. A higher loss value means that the model is less accurate in predicting the output for a given input.

V. CONCLUSION

The Leaf Disease Advisory Expert System using image processing and deep learning has the potential to revolutionize the field of agriculture by

providing disease detection and treatment recommendations for plant leaves. By using the large dataset and training the algorithm such as CNN, the expert system can accurately classify various types of plant diseases and recommend appropriate treatments.

Overall, the system has the potential to significantly improve crop yields and reduce the use of harmful pesticides by allowing farmers to quickly and accurately diagnose plant disease and apply appropriate treatments.

VI. FUTURE SCOPE

Image-based leaf disease detection has a lot of potential for future development and application. Here are some possible directions:

Improved accuracy: As with any machine learning application, there is always room for improving accuracy. Researchers can continue to refine the algorithms and training methods to improve the detection rates of various diseases.

Expanding the range of diseases: Currently, image-based leaf disease detection is limited to a relatively small number of diseases. Researchers can work on expanding the range of diseases that can be detected using image-based methods.

Real-time detection: Currently, most image-based detection systems require a significant amount of processing time before results are available. Researchers can work on developing real-time detection systems that can quickly identify diseases as they appear.

Integration with precision agriculture: Image-based leaf disease detection can be integrated with precision agriculture techniques to develop targeted treatment plans for diseased plants. This can help reduce the use of pesticides and other treatments, which can be costly and harmful to the environment.

Mobile application: Developing a mobile application that can take images of plants and provide real-time disease detection and recommendations for treatment can be very useful for farmers and gardeners. This can help them identify diseases quickly and take appropriate action to prevent the spread of disease.

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