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Plant Disease Detection and Proposing Solution Using Image Processing and Deep Learning with IOT

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ABSTRACT: Farmers are often concerned about plant disease since it can greatly affect crop productivity and quality. Expert manual inspection is required in traditional techniques of identifying plant diseases, which can be time- and money-consuming. Deep learning algorithms have made automated plant disease detection systems more practical. Convolutional neural networks (CNNs) are used in our proposed deep learning-based technique for the diagnosis of plant diseases. The suggested system uses plant photos as input to determine the presence of illnesses in the plants and then provides treatment recommendations. The CNN can learn the visual patterns connected to various diseases because it is trained using a sizable dataset of photos of healthy and diseased plants. This system also includes IOT so that after the result is acquired, it will communicate via IOT. Several publicly accessible datasets of plant photos were used in our studies to gauge the performance of the suggested approach. The experimental results show that the suggested approach detects several plant diseases, such as tomato bacterial spot, potato early blight, and apple black rot, with high accuracy. Overall, our approach shows the promise of deep learning methods for automatically detecting plant diseases, which can assist farmers in identifying and treating plant diseases more quickly and successfully.

KEYWORDS: IoT, leaf pathology, deep learning, and transfer learning for leaves.

I. INTRODUCTION

A wide range of diseases have an impact on yields, especially in tropical, subtropical, and temperate regions of the world. Composite relationships between the host plant, the infection, and its vector are included in plant infections. Environmental change has a fundamental impact on local atmospheric variables like humidity, temperature, and precipitation, which act as a vector for pathogens, infections, and illnesses that can destroy a crop. This sets the stage for immediate effects on the populace like impacts on finances, wellbeing, and employment. These days, a previous diagnosis of infection is a moving methodology that requires special care. The focus of the research has been on the observable evidence and recognition of infections that affect tomato, banana, maize, sugarcane, and rice plants. Convolutional Neural Network technology is thus used for research in order to predict plant diseases from their symptoms in plant leaves. Convolutional neural networks are designed to process information using several layers of clusters. Applications like face recognition and photo recognition make use of these neural systems. The most obvious difference between CNN and other typical neural systems is that CNN accepts input as a two-dimensional cluster and controls directly on the images rather than focusing on highlight production like other neural systems do. Convolutional Neural Networks (CNN) or CNN use pooling layers, which are the layers located as stated by CNN.

II. LITERATURE REVIEW

J., A.; Eunice, J.; Popescu, D.E.; Chowdary, M.K.; Hemanth, [1] focused on optimising the hyperparameters of well-known pre-trained models, such as DenseNet-121, ResNet-50, VGG-16, and Inception V4, and utilised convolutional neural network (CNN)-based pre-trained models for effective plant disease identification. Robert G. de Luna, Elmer P. Dadios, Argel A. Bandala

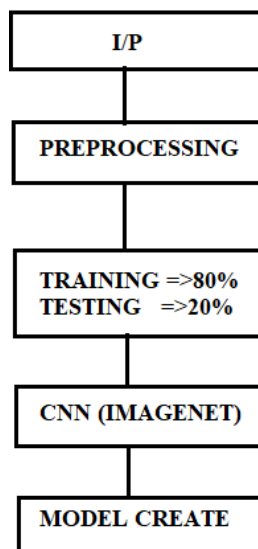
[2] created the ground-breaking remedy that effectively detects sickness in tomato plants. To identify and diagnose leaf diseases, a motor-controlled image-capture box was created to take images of all four sides of each tomato plant. Vellanki Krishna Vamsi. [3] developed a project that uses image processing techniques to monitor the identification of unhealthy leaves. For this, leaves from the ladiesfinger plant are selected and inspected to look for early signs of several illnesses including yellow mosaic vein, leaf spot, powdery mildew, etc. To determine if a leaf is healthy or diseased,



photos are taken, processed, segmented, features are retrieved, and the images are categorised. Balakrishna K Mahesh Rao.[4] employed two techniques to distinguish between healthy and sick tomato leaves. In the first method, the KNN strategy is used to categorise the tomato leaf as healthy or unhealthy. Later, in the second method, they use PNN and the KNN methodology to categorise the sick tomato leaf. Masum Aliyu Muhammad Abdu. [5] presented a colour homogeneity thresholding-based automatic extended region of interest (EROI) segmentation to cover some healthy tissue in the border region in order to incorporate symptom progression information. Adedamola Adedoja. [6] presented a study on the application of a deep learning-based method to identify ailing plants using photographs of their leaves. Prajwala TM, Alla Pranathi. [7] Methodology that is suggested with the goal of effectively identifying and classifying diseases in tomato crops. Additionally, it provides protection against several of the most prevalent ailments that affect tomato plants, including bacterial leaf spot, septorial leaf spot, yellow leaf curl, and many others. Sunku Rohan [8] focused on plant disease detection using image processing techniques by accessing open dataset images that consist of 5000 images of healthy and diseased plant leaves, and they used semi-supervised techniques for crop types and to detect the disease of four classes. Bin Liu, Peng Jiang, Yuehan Chen.[9] used deep learning techniques to improve convolutional neural networks (CNNs) for detection in apple leaf diseases.

III. PROPOSED METHODOLOGY

TRAINING



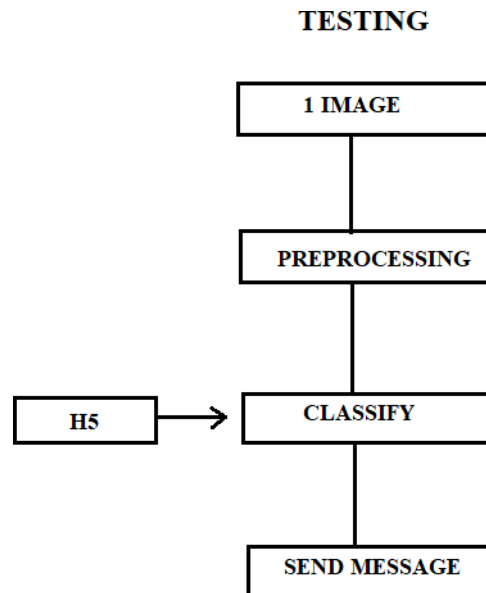


Figure 1: Schematic Representation of the Proposed system

To identify and classify diseases in plant leaves, methodology is a multidisciplinary approach that blends computer vision, machine learning, and IoT technologies. Following is a succinct summary of the general methodology for plant leaf disease detection utilising image processing, deep learning, and IoT:

Data collection: Using a digital camera or a smartphone equipped with a camera, high-quality photographs of both healthy and sick plant leaves are gathered. The dataset used to train and test the deep learning model consists of these photos.

Pre-processing of the photographs: The pre-processed images are resized to a constant size, noise is removed, and the lighting is normalised. To enhance the quality of the photos and make them appropriate for additional analysis, image enhancement techniques may also be used.

Deep Learning Model Training: Using the pre-processed photos and their accompanying labels (i.e., healthy or diseased), a CNN, a form of deep learning model that is particularly successful for image classification tasks, is trained. In order to automatically identify pertinent information from the photos and base its predictions on those features, CNN learns. **Model Validation and Optimisation:** To assess the trained deep learning model's accuracy, sensitivity, specificity, and other performance metrics, it is validated using a distinct collection of test images. To further increase the model's performance, hyperparameters can be adjusted, the architecture can be changed, or transfer learning techniques can be used.

IoT Integration: The deep learning model is deployed on edge devices like the Raspberry Pi or other microcontrollers after being incorporated into an IoT system. These edge devices can use cameras or sensors to take real-time pictures of plant leaves, and the trained model can be applied locally on the device to make inferences.

Disease Detection and Diagnosis: Using the deep learning model that has been installed, the IoT system can continually monitor plant leaves for symptoms of disease in real time. The trained model can examine an image and determine the type of disease when a leaf is thought to be ill. Farmers or other key stakeholders can then receive alerts or notifications from the IoT system to take further action, such as applying the proper treatments or interventions.

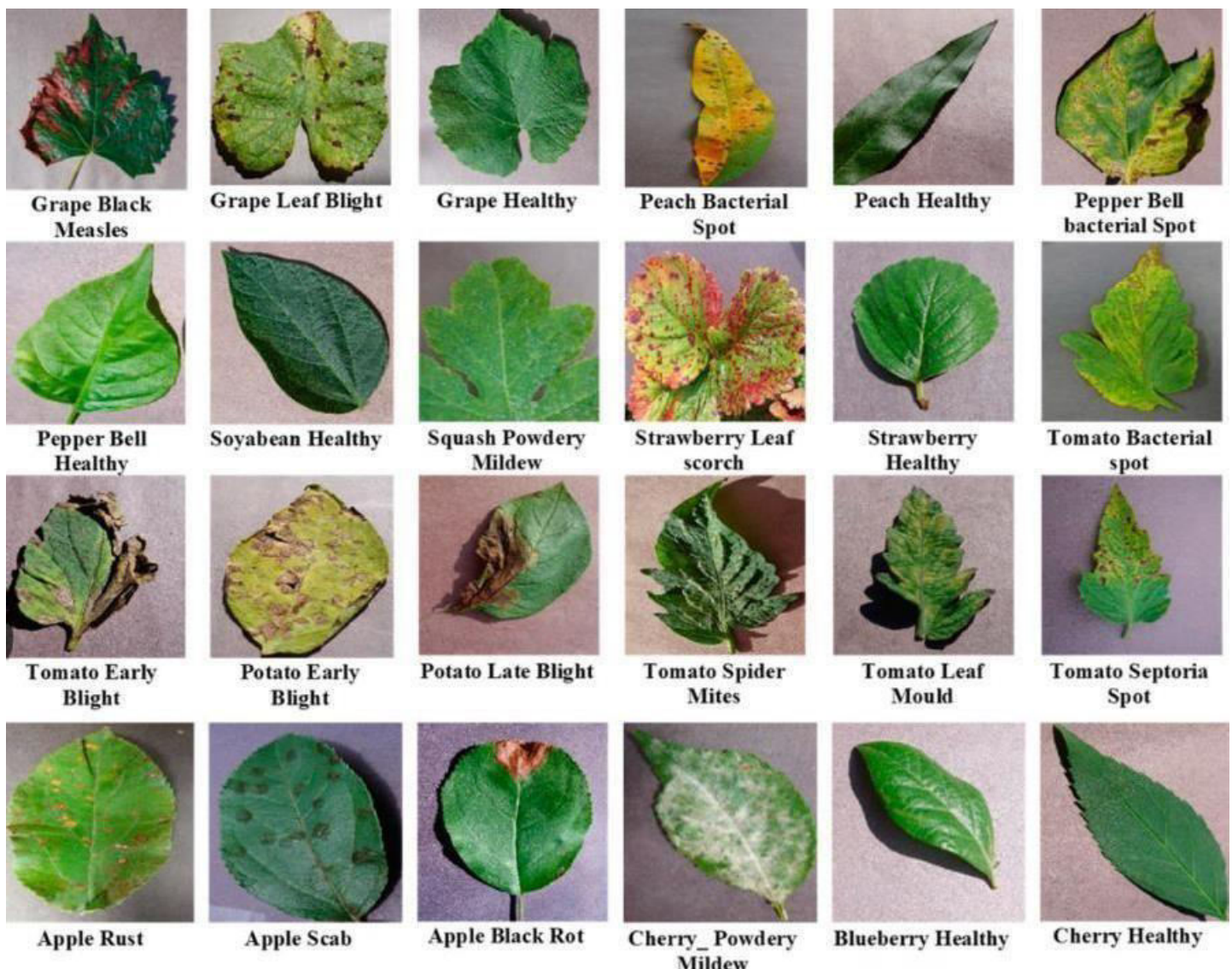


Monitoring and upkeep: The IoT system may also gather and analyse information on environmental variables, such as temperature, humidity, and soil moisture, to provide light on potential triggers for the spread of plant diseases. This data can be utilised to make decisions about farming practises as well as continuing monitoring and management of plant health.

In conclusion, data collection, image pre-processing, feature extraction, deep learning model training, model validation and optimisation, IoT integration, disease detection and diagnosis, and monitoring and maintenance are all components of the methodology for plant leaf disease detection using image processing, deep learning, and IoT. This strategy could greatly enhance the effectiveness and precision of plant disease detection and diagnosis, resulting in better crop management techniques and higher crop yields.

V. EXPERIMENTAL RESULT

Dataset:





VI. CONCLUSION

Deep learning-based plant disease identification is a promising strategy with the potential to completely change the agriculture sector. We can effectively and accurately identify plant diseases by utilising deep learning models, allowing farmers to take preventative action to safeguard their crops. The data collection, preprocessing, model selection, training, evaluation, and deployment steps are included in the suggested technique for deep learning-based plant disease diagnosis. These procedures aid in ensuring that the model can readily be included into agricultural practises and can detect plant diseases effectively. Overall, the application of deep learning to plant disease detection shows significant promise for enhancing agricultural productivity, lowering financial losses, and ensuring global food security. We may anticipate even more cutting-edge methods of plant disease identification that make use of deep learning and other cutting-edge technologies as technology develops.

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