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Plant Disease Detection and Classification Using Deep Learning

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Abstract: ***Agriculture is the backbone of every country in the world. In India, most of the rural population still depends on agriculture. The agricultural sector provides major employment in rural areas. Furthermore, it contributes a significant amount to India's gross domestic product (GDP). Therefore, protecting and enhancing the agricultural sector helps in the development of India's economy. In this work, a real-time decision support system integrated with a camera sensor module was designed and developed for the identification of plant disease. This research proposes an intelligent method for plant disease classification using image processing techniques. The proposed method aims to assist farmers and experts in identifying and diagnosing plant diseases efficiently and accurately. The system first obtains images of the plant leaves from different perspectives and then pre-processes the images to enhance the quality and remove noise. The preprocessed images are then subjected to feature extraction using a deep convolutional neural network (CNN) model. The features extracted from the CNN are then fed into a classifier for the classification of plant diseases. The proposed method is evaluated using a dataset of plant images with three different types of diseases. The results obtained show that the proposed method achieves high accuracy in the classification of plant diseases, making it a useful tool for plant disease diagnosis and control. The proposed method can be integrated into a mobile application or web based platform for use by farmers and botanists.***

Keywords: Plant Disease Detection, Deep Learning, Convolution Neural Network, OpenCV

I. INTRODUCTION

In the field of agricultural production, ignoring the early signs of plant diseases may lead to losses in food crops, which could eventually affect world's economy [1]. This section presents an in-depth survey of state-of-the-art research in the field of leaf disease identification. A CNN-based deep learning model was proposed for the accurate classification of plant disease in [2], and the model was trained using a publicly available dataset with 87,000 RGB images. Initially, pre-processing was undertaken, followed by segmentation. For classification, a CNN was used. Although this model reached an accuracy of 94%, it failed to classify some classes, leading to confusion with the classes in subsequent stages. Further, the performance of the model deteriorated due to the limited availability of data. However, to improve recognition accuracy, proposing a hybrid convolutional neural network to classify banana plant disease. In their approach, the input image was pre-processed without altering any default information, and the standard image dimensions were maintained using a median filter. This approach used a fusion SVM along with a CNN. A multiclass SVM was used in the testing phase to identify the type of infection or disease in infected banana leaves, whereas the SVM was used in phase 1 to classify whether the potato leaves were healthy or infected. The classified CNN output was fetched as an input to the support vector machine, attaining a classification accuracy of 99%. The previous work stated that CNN had better accuracy outcomes than traditional methods but this approach lacked diversity. Crop disease reduces both the quantity and quality of food produced. Crop diseases not only have an effect on global food security, but they also have a negative impact on small-scale farmers whose livelihood is dependent on cultivation. The benefit is that crop diseases can be monitored by detecting them as soon as they appear on the crops. It has been possible to provide an effective solution to this problem thanks to the advent of the internet and the field of computer vision. A mistaken diagnosis of plant disease results in a significant loss of production, time, resources, and product quality. Identifying the state of the plant is critical for effective cultivation. Different types of environmental anomalies, such as fungi, water shortages, insects, and weeds, have an effect on crop. These are issues that require farmers to take defensive steps to boost productivity. This research aids in concentrating on the visually targeted quality of the crop. Artificial intelligence advances have made it possible to identify plant diseases automatically from images. Deep learning is a learning system based on neural networks. One of the benefits of deep learning is that it can extract features from photos. During preparation, the neural network learns how to extract features. The deep learning model is CNN, which is a multi-layer feed-forward neural network.

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Fig.1. Infected plant

II. PROBLEM STATEMENT

The Indian agriculture sector employs nearly half of the country's workforce. India is the largest producer of pulses, rice, wheat, spices, and spice products in the world. Farmers' economic growth is determined by the quality of the goods they make, which is dependent on plant growth and yield. As a result, in the field of agriculture, disease identification in plants is important. Plants are highly prone to diseases that inhibit plant development. The use of an automated disease detection technique is advantageous in detecting a plant disease at an early stage. Plant diseases manifest themselves in various parts of the plant, such as the leaves. It takes a long time to manually diagnose plant disease using leaf photographs. As a result, computational methods must be developed to automate the process of disease detection and classification using leaf images.

III. EXISTING SYSTEM

The current approach for detecting plant disease is simple eye observation by experts, which can be used to detect and identify plant diseases. In these circumstances, the suggested technique is useful for tracking vast fields of crops..Furthermore, in some nations, farmers lack adequate facilities or are unaware then, As a result, on those circumstances, the suggested technique for tracking a large number of plants would be useful.

A. Disadvantages of the Existing System

1) The procedure is slow.
2) Consumption of time and space is also very high.
3) Not economically friendly.

IV. PROPOSED SOLUTION

This study is focused on implementing a web application and identification of plant diseases. Segmentation feature extraction and classification techniques are used to detect plant diseases. Photos of leaves from various plants are taken with a digital camera or similar unit, and the images are used to classify the affected region in the leaves.
To detect plant disease, we use a Convolution neural network and a deep neural network in the proposed methodology. This paper proposes a framework that employs low-cost, open-source software to achieve the task of reliably detecting plant disease.

A. It is capable

Advantages to detect images with a cost-effective camera and open cv.
Open CV helps in the efficient analysis of sources such as images and videos.
It does not require any high-resolution images.

V. LIST OF MODULES

Image acquisition Image pre-processing Image enhancement Image segmentation Image analysis Feature extraction Disease classification

A. Image Acquisition

The first step is to gather data from a publicly accessible repository. The picture is used as the input for further processing. We've chosen the most common image domains so that we can accept any format as input to our method, including.jpg The camera feeds the real-time images directly.

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Since most leaves' color differs from red to green for exact segmentation, a white background is provided for further study, proper visibility, and easy image analysis Images are captured using an image capturing system in this process.

B. Image Pre-processing

The use of computer algorithms to perform image processing on digital images is known as image pre-processing. We can detect the plant by analyzing the image with a specific algorithm. We use a similar approach for image processing and detection with an algorithm. The image quality is critical in this process.

C. Image Enhancement

The process of modifying digital images so that the effects are more appropriate for display or further image processing is known as image enhancement. Any of the following can be used to improve an image:

1) Model optimization

2) Noise removal using filters. Decorrelation etc.

The method of segmenting a digital image into multiple segments is known as image segmentation. Used to make image identification and analysis simpler by dividing the image into segments and analyzing each segment individually. Color, texture, and intensity are all features among the various segments.

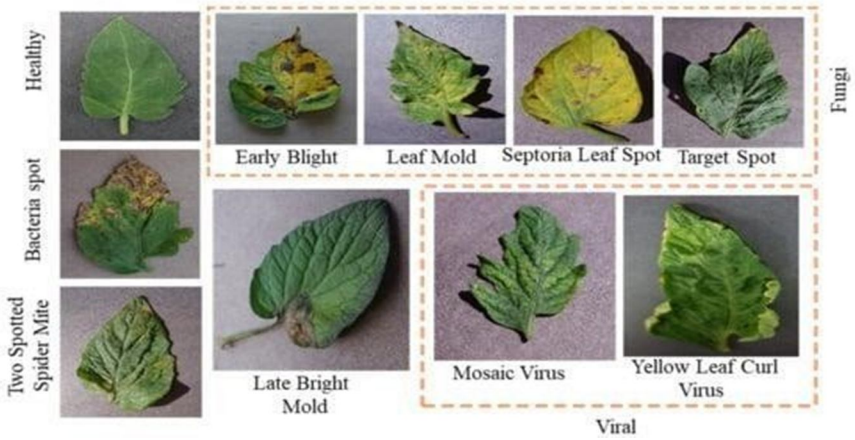

Fig.2 image segmentation of leaf

D. Image Analysis

In this process, image segmentation is used to locate the region of concern. The technique used in segmentation is region-based segmentation, which uses the color of the leaf to distinguish between healthy and diseased areas of the leaf.

E. Feature Extraction

Feature extraction is a part of the dimensional reduction method in machine learning, which divides and reduces a large set of raw data into smaller classes. This step is needed when we have a large amount of data and need to minimize the number of resources while avoiding errors. As a result, function extraction aids in the extraction of the best feature from data sets by selecting and combining variables into functions.

F. Disease Classifications

It is the method of using our qualified deep learning model to recognize plant disease. A digital camera or equivalent system should be used to take an image of the contaminated plant's leaf. Open CV was used to scan the image. Then it determines what category of plant it is.

VI. CONCLUSIONS

The proposed system tracks the cultivated field on a regular basis. The CNN algorithm is used to identify crop diseases at an early stage. Machine learning methods are used to train the model, which helps in making appropriate disease decisions. To contain infected diseases, the farmer is advised to use pesticides as a cure.

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In the future, the proposed scheme could be expanded to provide additional facilities such as nearby government markets, pesticide price lists, and a nearby open market, among others. Some of the organisms on which the proposed algorithm is evaluated include bananas and jackfruit. To prevent losses, smallholder farmers are dependent on a timely diagnosis. In this study a pre-trained CNN was fine-tuned and the model was developed online, with very less computational effort the optimum results were obtained which shows the efficiency of proposed algorithm a merit of using this method is that the plant disease can be identified in a very early stage. We proposed a CNN based on Deep learning for plant disease classification eliminating possible hazards. Convolution neural network and Deep neural network algorithms may be used to increase accuracies in the classification process.

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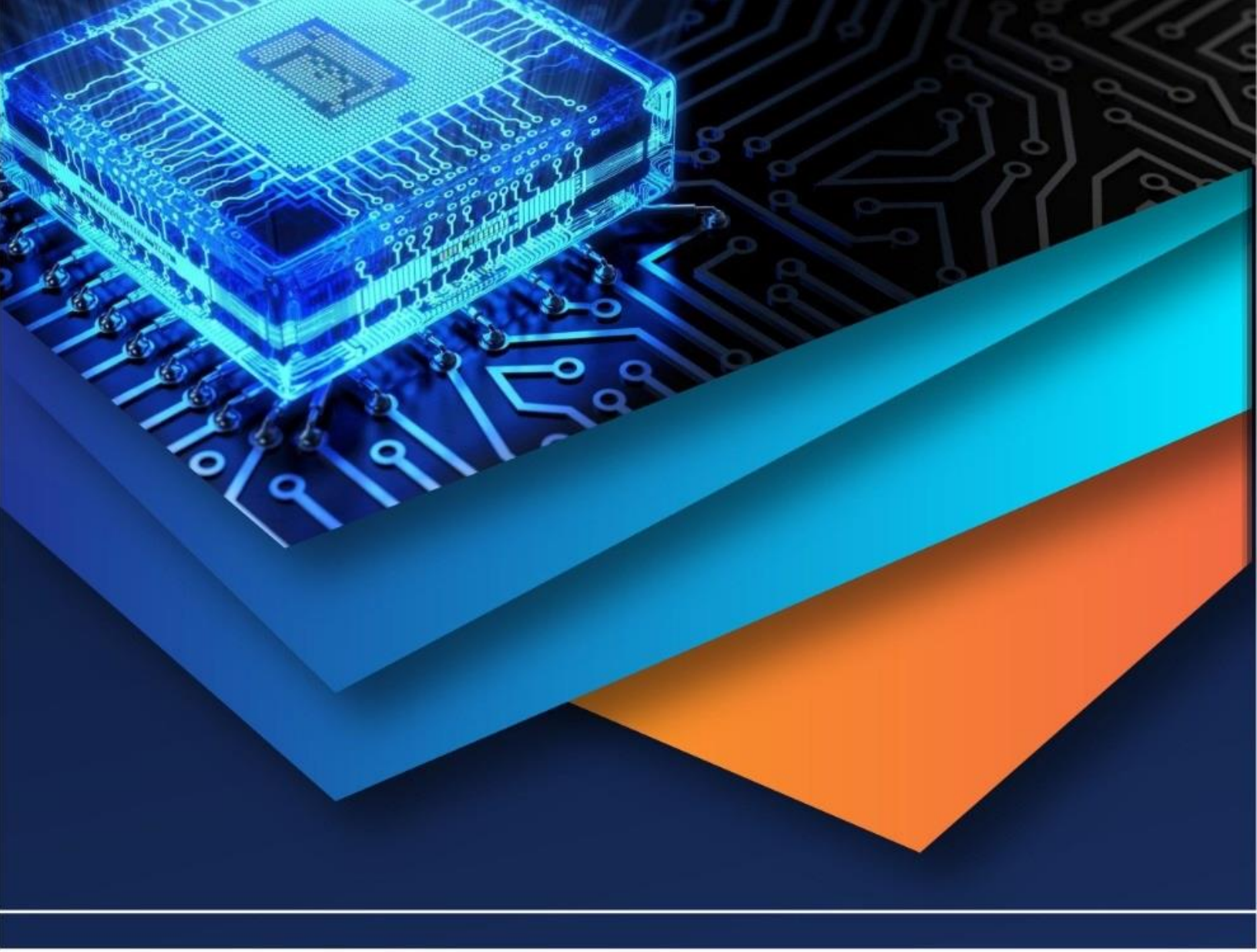

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