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Plant Disease Detection Using Deep Learning

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Abstract

Agriculture is extremely important in human life. Almost 60% of the population is engaged in some kind of agriculture, either directly or indirectly. There are no technologies in the traditional system to detect diseases in various crops in an agricultural environment, which is why farmers are not interested in increasing their agricultural productivity day by day. Crop diseases have an impact on the growth of their respective species, so early detection is critical. Many Machine Learning (ML) models have been used to detect and classify crop diseases, but with recent advances in a subset of ML, Deep Learning (DL), this area of research appears to have a lot of promise in terms of improved accuracy. The proposed method uses a convolutional neural network and a Deep Neural Network to identify and recognise crop disease symptoms effectively and accurately. Furthermore, multiple efficiency metrics are used to assess these strategies. This article offers a thorough description of the DL models that are used to visualise crop diseases. Furthermore, several research gaps are identified from which greater transparency for detecting diseases in plants can be obtained, even before symptoms occur. The proposed methodology aims to develop a convolution neural network-based strategy for detecting plant leaf disease.

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

1. Introduction

India is a rapidly developing nation, and agriculture is the backbone of the country's early growth. Agriculture is struggling to meet its needs as the global population grows at a rapid rate. Furthermore, knowledge of the importance of cultivation must be instilled in the minds of the younger generation. Climate change, pollinator decline, crop pests, lack of irrigation, and other factors continue to pose a threat to food security. Crop disease reduces both the quantity and quality of food produced.Crop diseases not only has an effect on global food security, but they also have a negative impact on small-scale farmers whose livelihood is dependent on safe 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 crops. These are the kinds of issues that require farmers to take preventative steps in order to boost productivity. This research aids in concentrating on the visually targeted quality of crop. Artificial intelligence advances have made it possible to identify plant diseases automatically from raw

images. Deep learning is a learning system based on neural networks. One of the benefits of deep learning is that it can automatically extract features from photos. During preparation, the neural network learns how to extract features. The famous deep learning model is CNN, which is a multi-layer feed-forward neural network.[1-6]

2. Problem statement

Agriculture is an integral part of the Indian economy. 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 susceptible to diseases that inhibit plant development, which has an effect on the farmer's ecology. 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.[5-8]

3. Existing system

The current approach for detecting plant disease is simple naked eye observation by plant 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 that they can contact experts. As a result, consulting experts is not only more expensive but also more time consuming. In those circumstances, the suggested technique for tracking a large number of plants would be useful.[9-11]

3.1 Disadvantages of Existing System

- Only humans are capable of predicting diseases.
- The procedure is extremely slow.
- Consumption of time and space is also very high.
- The price is also high.

4. Proposed solution

This study is focused on the identification of plant diseases. The 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 framework. This paper proposes a framework that employs low-cost, open-source software to achieve the task of reliably detecting plant disease.

4.1 Advantages

- Detects related images with a low-cost camera and open cv.
- Opencv aids in the efficient analysis of images and videos.

5. List of modules

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

5.1 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.bmp,.jpg, and.gif. The camera feeds the real-time images directly. Since most leaves colour varies from red to green for exact segmentation, a white background is provided for further study, proper visibility, and easy image analysis. Cotton images are captured using an image capturing system in this process. The picture is taken in such a way that any distortion is avoided. The photo was not taken in direct sunlight because it would distort the picture.

5.2 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 analysing the image with a specific algorithm. We use a similar approach for image processing and detection with a specific algorithm. The image quality is critical in this process; we can't use the algorithm if the image isn't clear.

Fig.1. Infected plant

5.3 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:

- Histogram Equalization.
- Noise removal using filters.
- Unsharp mask filtering.
- Decorrelation stretch etc.

5.4 Image Segmentations:

The method of segmenting a digital image into multiple segments is known as image segmentation (sets of pixels, also known as image objects). Image segmentation is used to make image identification and analysis simpler by dividing the image into several segments and analysing each segment individually. Color, texture, and intensity are all common characteristics among the various segments.

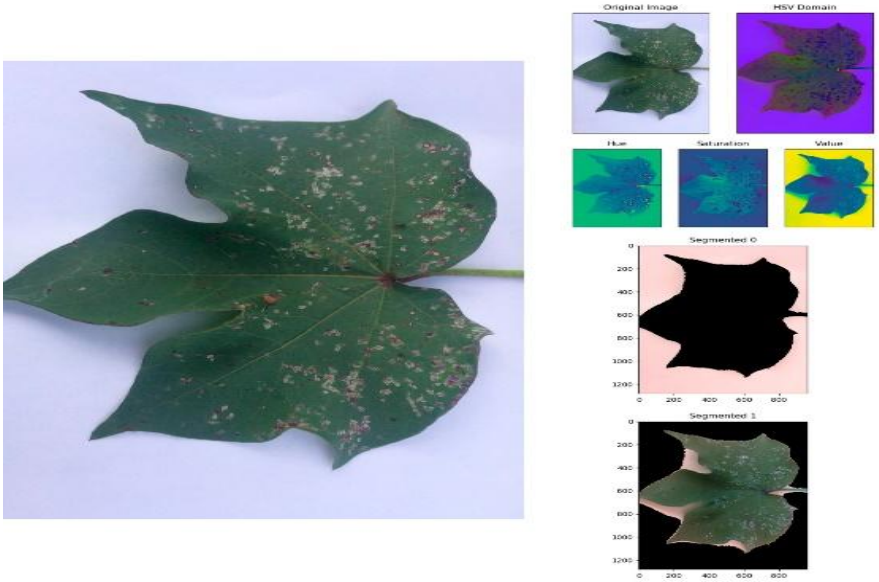

Fig.2. Image Segmentation of a leaf

5.5 Image analysis

In this step, image segmentation is used to locate the region of interest. The technique used in segmentation is region-based segmentation, which uses the colour of the leaf to distinguish between healthy and diseased regions of the plant leaf.

5.6 Feature Extraction:

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

5.7 Disease Classifications:

It is the method of using our qualified deep learning model to recognise plant disease. A digital camera or equivalent system should be used to take an image of the contaminated plant's leaf. Opencv was used to scan the image. Then it determines what kind of plant it is. It determines what kind of disease the plant has after finding it.

Conclusions

The proposed system tracks the cultivated field on a regular basis. The CNN and DNN algorithms are used to identify crop diseases at an early stage. Machine learning methods are used to train the model, which aids in making appropriate disease decisions. To contain infected diseases, the farmer is advised to use pesticides as a cure. 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..This paper presents a review of various disease classification strategies for crop disease detection, as well as an algorithm for image segmentation that can be used for automated detection and classification of plant leaf diseases in the future. Some of the organisms on which the proposed algorithm is evaluated include banana, beans, jackfruit, lemon, mango, potato, tomato, and sapota. As a result, similar diseases for these plants were investigated. The best results were obtained with very little computational effort, demonstrating the efficacy of the proposed algorithm in recognising and classifying crop diseases. Another benefit of this approach is that plant diseases can be detected at an early stage, or even at the beginning. Convolution neural network and Deep neural network algorithms may be used to increase recognition rates in the classification process.

References

Journals

[1]. Gaurav Verma, CharuTaluja, Abhishek Kumar Saxena “Vision Based Detection and Classification of Disease on Rice Crops Using Convolutional Neural Network” ,2019

[2]. Nikhil Shah1, Sarika Jain2 “Detection of Disease in Cotton Leaf using Artificial Neural Network”,2019

[3]. Ch. Usha Kumari “Leaf Disease Detection: Feature Extraction with K-means clustering and Classification with ANN”,2019

[4]. MelikeSardogan, AdemTuncer, YunusOzen “Plant Leaf Disease Detection and Classification Based on CNN with LVQ Algorithm”, 2020

[5]. H. Al-Hiary, S. Bani-Ahmad, M. Reyalat, M. Braik and Z. ALRahamneh “Fast and Accurate Detection and Classification of Plant Diseases”, 2011

[6]. André S. Abade, Paulo Afonso Ferreira and Flávio de Barros Vidal “Plant diseases recognition on images using convolutional neural networks: a systematic review” ,2020

[7]. Guo, X., Zhang, M., & Dai, Y.,” Image of Plant Disease Segmentation Model Based on Pulse Coupled Neural Network with Shuffle Frog Leap Algorithm.”,2018.

[8]. Chouhan, S. S., Kaul, A., & Singh, “A deep learning approach for the classification of diseased plant leaf images.”,2019.

[9]. Kumar, M., Gupta, P., Madhav, P., & Sachin, “Disease Detection in Coffee Plants Using Convolutional Neural Network”,2020

[10]. Francis, J., AntoSahayaDhas D, & Anoop B K.,” Identification of leaf diseases in pepper plants using soft computing techniques.”,2016

[11]. Ganesan, P., Sajiv, G., & Leo, L. M.” CIELuvcolor space for identification and segmentation of disease affected plant leaves using fuzzy based approach.”,2017.