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CNN for the Detection of Leaf Disease

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Abstract

Leaf diseases are typically because of pests, insects, pathogens and decrease the Productiveness to a big scale if not controlled in time. Horticulturists are dealing with loss due to various leaf diseases. The objective of proposed machine is the early detection of ailment earlier than it spreads to the opposite leaves of the plant. Solution is to check and stumble on the leaf illnesses the usage of TensorFlow, an open supply and reliable software program for device mastering applications which gives excessive accuracy, that is its Important advantage. This device works in phases: the primary section deals with schooling the dataset The use of convolutional neural network algorithm. This includes schooling both wholesome as nicely as diseased leaves. The second section deals with checking the leaves with the check dataset and thereby figuring out the disease.

Keywords: Deep learning, CNN, tensor flow, dataset, Horticulture.

1. Introdction

Horticulture has played a critical role in the development of civilization. India is an agrarian country, and its economy relies heavily on Horticulture production. To meet the growing needs of its citizens, Horticulture must undergo significant technological advancement in order to remain competitive. In order to achieve optimal yields, plants need to be healthy – which requires some innovative diagnostic methods. Leaf diseases are one of the major factors which influence a reduction in both quality and quantity of horticultural products. A number of pesticides are available to control these diseases, but it is difficult to find the most current disease, and then use an appropriate pesticide to effectively control that infection. This process requires expert advice, takes time, and can be expensive.

For identifying plant diseases traditionally, humans rely on visual inspection. Moreover, recent technological advances and plummeting costs for digital image acquisition have allowed for the use of a variety of image-based diagnosis methods at an affordable level. However, as the computer's acquired image is dense with information that is difficult for a machine to process on its own, it requires a pre-processing step in order to extract a specific feature (such as colour and shape) that has been predetermined by experts. In these situations, deep learning typically helps because it allows the computer to learn how best to accomplish this task without human input.

1.1 Deep learning

Deep learning is a sub-category of machine learning that uses artificial neural networks (ANNs). These networks are designed to learn from data by "training" on large amounts of relevant data. This training process can be supervised, semi-supervised or unsupervised.

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Deep-learning architectures, such as deep neural networks, deep belief networks, deep reinforcement learning methods, recurrent neural nets, convolutional neural networks and Transformers have been successfully applied in a number of fields including computer vision, speech recognition, natural language processing, machine translation, bioinformatics, drugs.

Artificial neural networks (ANNs) were modelled after the workings of information processing and communication nodes within biological systems. ANNs are typically static and symbolic, while biological brains are more dynamic (plastic) and analog.

In deep learning, the use of multiple layers in a network is referred to as "deep." Early work showed that a linear perceptron (a computer program designed to make decisions based on simple input data) could not be used for all tasks, but that an artificial neural network with one hidden layer and no limit to its width can. Deep learning is a modern variation of machine learning focused on networks with an unbounded number of layers of bounded size, which makes it more practical and optimized for implementation while still retaining theoretical universality under mild conditions.

1.2 Project Definition

Splint condition are generally encased by pests, insects, pathogens, and drop the productivity to large scale if not controlled within time. Horticulturists are facing lose due to colourful splint conditions. It becomes tedious to the tillers to cover the leaves regularly when the cultivated area is huge that's in acres. Splint complaint is one of the major factor which laterally impact the significant reduction of both quality and volume of horticultural products . A number of kinds of fungicides are available to control conditions and increase the product.

1.3 Project Features

- Diseased leaf will be detected early before spreads to the other leaves of that plant and neighbourhood plants.
- Nature of beauty will be increased.
- Maintaining cost will be reduced.
- Growth of the product will be increased.

2. Literature Survey

Title	Authors	methodology	Drawback	Result
[1] Leaf disease detection using CNN	1.Reshmi A.M 2.Prameeja prasidhan	Convolutional neural network (CNN)	Lack of focused on diversifying Training datasets	Demonstrating how CNN applied to empower farmers in theirs fight against leaf disease.
[2] plant disease detection using CNN	1. Sumit Kumar 2.Veerendra Chaudary,3. Ms. Supriya Khaita	Neural network: Faster Region-based Convolution Neural Network (Faster R-CNN), Region-based Fully CNN(R-CNN) and Single shot Multibook Detector	Detect the diseased plant with 94%.	show that managing plant diseases can help increase yields by about 50%.
[3]Green leaf disease detection using cnn	NagaveniB. Nimbal, AnushreeS.G	CNN algorithm	less of accuracy	The developed system can detect disease in plant and also provide theremedy that

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				can be taken against the disease
[4]Plant Disease Detection Using CNN	Nishant Shelar1 , Suraj Shinde2 , Shubham Sawant3 , Shreyash Dhumal4 , and Kausar Fakir	image processing with a convolutional neural network	lack of accuracy	successfully deployed these model on the android app and are trying to increase the accuracy of the android app as well as the model.
[5]Plant Disease Detection and Classification using CNN	Rinu R, Manjula S H	deep learning approach called CNN	predict the diseases correctly for almost all the images with few anomalies	identified and recognized plant leaf disease
[6]Green leaf disease detection and identification using Raspberry Pi	Supriya S, Dr. Aravinda H L	raspberry pi, convolutional neural network	less of accuracy	proposed system detect the health and unhealthy banana plants
[7]Green Leaf Disease Detection Using Raspberry Pi	Prakruthi. G.H, Mahesh Kumar. K, Venugopal. R	raspberry Pi and for image analysis they used CNN	less accuracy	The point of this work is to identify, group leaf ailments Utilizing picture Preparing instruments and send all data about the sickness through the Raspberry Pi
[8] Real- Time Detection of Apple Leaf Diseases Using Deep Learning Approach Based on Improved Convolutional Neural Networks.	Peng Jiang, Yuehan Chen, Bin Liu, Dongjian He, And Chunquan Liang.	INAR-SSD model (convolutional neural network)	78.8% accuracy	The proposed model is fully capable of real-time detection of apple leaf diseases.
[9] Deep Learning Convolutional Neural Network for Apple Leaves	Saaransh Baranwal, Siddhant Khandelwal, Anuja Arora	Convolutional neural network algorithm	Dataset is small (2561) images	They detected diseases in apple trees via the images of its leaves

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Disease Detection				
[10]ToLeD: Tomato Leaf Disease Detection using Convolution Neural Network	Mohit Agarwal, Abishek Singh, Siddhartha Arjaria, Amit Sinha, Suneet Gupta	CNN based model	Lack of accuracy, dataset with less number of images	Developed a CNN based model to detect the disease in tomato crop.
[11] Identification of Apple Leaf Diseases Based On Deep Convolutional Neural Networks	Bin Liu, Yun Zhang, Dongjian He, Yuxiang Li	Convolutional Neural Networks	Dataset is small (13,689 images)	Proposed disease identification approach based on the convolutional neural network achieves an overall accuracy of 97.62%
[12] Analysis of Tomato Leaf Disease Identification Techniques.	Gaurav Chopra, Pawan Whig	Convolutional Neural Networks with back propagation algorithms	less accuracy	In this paper simplest and cost effective method to visualize layers is Grad-CAM.
[13] Potato Leaf Diseases Detection Using Deep Learning	Divyansh Tiwari, Mritunjay Ashish, Nitish Gangwar, Abhishek Sharma, Suhanshu Patel, Dr. Suyash Bharadwaj	VGG19 model	It predict the disease name only but not give any remedies.	Developed an automated system to diagnose and classify with the accuracy of 97.8%.
[14] A deep learning based approach for the detection of diseases in pepper and potato leaves	Eser Sert	Faster R-CNN Object Detection Approach with GoogLeNet Classifier using image stitching.	less accuracy	Proposed Faster R-CNN-GC approach displayed a higher performance of leaf disease detection compared to other approaches
[15] A novel framework for potato leaf disease detection using an efficient deep learning model.	Rabbia Mahum, Haris Munir, Zaib-Un-Nisa Mughal, Muhammad Awais, Falak Sher khan,	DenseNet-201 architecture.	Dataset is small (2526 for training and validation, 1326 for testing)	Proposed algorithm achieves 97.2% accuracy and is computationally fast due to usage of preprocessed

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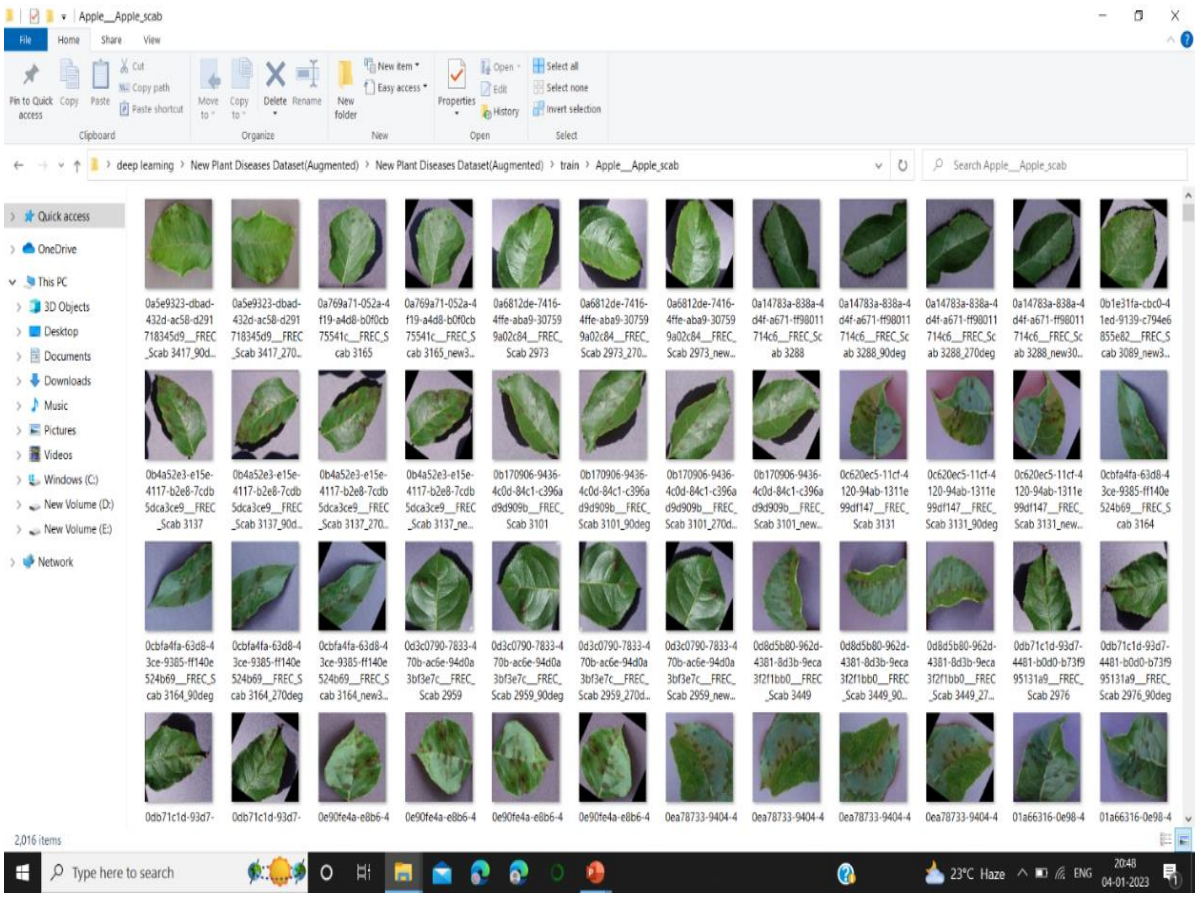
	Muhammad Saqlain, Saipunidzam Mahamad & Iskander Tlili			images and an additional transition layer.

3.Proposed Methodology

Plant illnesses are generally because of pests, bugs, pathogens and reduce the productiveness to large scale if no longer managed inside time. So, the proposed device affords a solution for the early detection of sickness before it spreads to the opposite leaves of the plant. This gadget worksvia utilising Convolutional Neural network. The pre-processing in ConvNet is a good deal decrease compared to different classification al gorithms. The role of ConvNet is to lessen the pics right into a form which is simpler to system, without dropping functions which are vital for getting an awesome prediction. This system affords more accuracy compared to the present gadget.

3.1.1 Data Set

This is a set of images for specific purposes. We use a dataset of plant leaves, each split for pre-processing and classification. The leaf dataset consists of 87,000 images of different plants. It contains both healthy and diseased leaves. The class of diseased leaves contains the name of each disease and provides means to overcome the deficiency. Here we train the large dataset and detect the disease present on each leaf.



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3.1.1.Pre-processing

Pre-processing, when both the input and output are intensity images, refers to operations on images at their most fundamental level. The original data the sensor captured matches the type of these well-known images, with an intensity picture often being represented by a matrix of picture function values (brightness's). The objective of pre-processing is an improvement of the image data that suppresses unintentional distortions or enhances some image features essential for further processing, even though geometric transformations of images (such as rotation, scaling, and translation) are categorised here as pre-processing methods because similar techniques are used.

3.2 Algorithm

- Because CNNs can recognise patterns and interpret them, our approach to image recognition has been fundamentally altered. As a result of the high level of accuracy in their results, they are regarded as the most effective architecture for image classification, retrieval, and detection tasks.
- They have several uses in practical exams, where they deliver high-quality outcomes and effectively locate and identify objects in images, such as people, cars, birds, etc. They are now the preferred technique for predictions using any image as an input due to this characteristic.
- The capacity of CNNs to accomplish "spatial invariance," which denotes that they can learn to recognise and extract visual information from any location in the image, is a crucial quality. Since CNNs automatically learn features from the image/data and carry out extraction from images, manual extraction is not required. As a result, CNNs are an effective Deep Learning technique for producing precise findings.
- The goal of the pooling layers, according to a work published in "Neural Computation," is to lower the spatial resolution of the feature maps and achieve spatial invariance to input distortions and translations. The pooling layer decreases the number of parameters required to process a picture, speeding up the process while also lowering memory usage and computational expense.
- Although CNNs have traditionally been utilised for image analysis, they can also be employed for other data analysis and classification issues. Because of this, they can be used in a variety of industries to produce accurate results, covering crucial areas including face identification, video classification, street/traffic sign recognition, classification of galaxies, and interpretation and diagnosis/analysis of medical images, among others.

Training and Testing Algorithm:

Input: providing an image of leaves localization.

Output: classification of a review into healthy or diseased, it is diseased provides the remedies for overcoming the deficiency.

Step1: Start

Step2: prepare a database (healthy or diseased)

Step 3: pre-processing normalization

Step4: Train CNN

Step5: real images from dataset

Step6: pre-processing

Step7: test network

Step8: if the probability of healthy > probability of unhealthy display a healthy leaf, otherwise display a diseased leaf.

Step9: go to the fourth step

Step10: stop

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4. Results

Fig 4.1 analysed image on the GUI

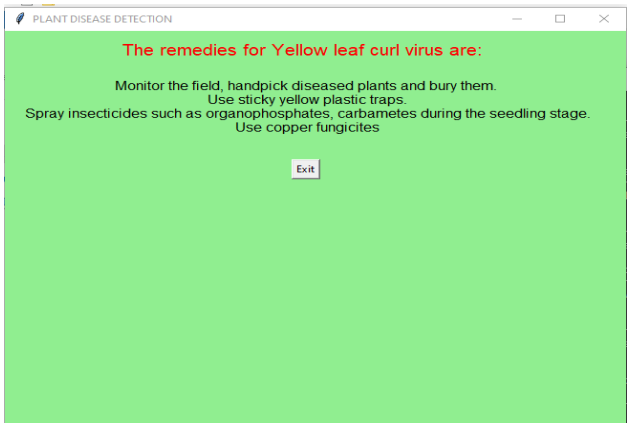

Fig 4.2 displayed remedies on GUI

Fig 4.1 shows that the leaf is unhealthy after tested that image, and the predicted disease called as yellow leaf curi virus on the GUI (Graphical user interface) and it displays an option called click below for remedies, if we will click on that option the remedies will display to cure the leaf disease.

Fig 4.2 Shows That The remedies for leaf disease named as yellow leaf curi virus displayed on the GUI, such remedies to cure the disease are monitor the field, handpick diseased plants and bury them. Spray insecticides such as organophosphates, carbamate during the seed stage and finally use copper remedies

Fig 4 shows that the analysing image status is healthy and it displays on the Interface named as Graphical User Interface (GUI).

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Fig 4.3 Analysing image 2 on GUI

5.Conclusion

The biggest cause of yield loss in horticulture fields is widespread disease. Most often, a disease's discovery and identification occur once it has reached a severe stage. Consequently, there will be a yield, time, and financial loss.

Because it drastically lowers food quality, leaf disease has long been considered one of the main dangers to food security. Disease diagnosis has proven to be a considerable problem in terms of accuracy and precision. The suggested approach has the ability to identify the disease as soon as it appears on the leaf and at an earlier stage. As a result, it is possible to partially reduce reliance on the expert and partially save the loss. For someone with little knowledge of the ailment, it can be helpful. According to these objectives We must extract the characteristics of the disease-related aspects.

6. Future Enhancement

- The ability to change user information.
- Provide a user interface that will be more interactive.
- may create a mobile application.

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