DEEP LEARNING MODEL BASED EARLY PLANT DISEASE DETECTION

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Abstract :

Early plant leaf disease detection is a major challenge in agriculture field. The easiest way, to control the plant leaf disease infection is an Challenging task But the excessive use of plant leaf disease are harmful to plants, animals as well as human beings. Integrated plant leaf disease management combines biological and physical methods to prevent plant leaf disease infection. The techniques of machine vision and digital image Processing are extensively applied to agricultural science and it have great perspective especially in the plant protection field, which ultimately leads to plant leafs management. This paper deals with a new type of early detection of plant leaf diseases system. Images of the leaves affected by plant leaf diseases are acquired by using a digital camera. The leaves with plant leaf disease images are processed for getting a gray colored image and then using feature extraction, image classification techniques to detect plant leaf diseases on leaves. The images are acquired by using a digital camera . The images are then transferred to a PC and represented in python software. The RGB image is then converted into gray scale image and the feature extraction techniques are applied on that image. The Support Vector Machine classifier is used to classify the plant leaf disease types. Here in this paper we implement the deep learning and machine learning approach for identification of plat leaf disease and we found that deep learning apporch using Bidrectional CNN gives the better performace in term of accuracy

Index Term: - svm,cnn,opencv,plant leaf disease,image processing

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1. INTRODUCTION

Agrarian India is a nation. Agriculture is the primary source of income for 70% of the population. Therefore, boosting plant leaf yield is a crucial issue right now. The majority of scientists are conducting study in this area. This is quite simple to do by utilising their innovative approaches and realistic applications. But "plant leaf disease infection" on plants is currently one of the most significant issues. The major subject of this essay is leaves from greenhouse plants. There are different plant leafs cultivated under greenhouse. for instance, fruits and vegetables like cucumber, potato, and tomato, as well as rose and jasmine bushes. Whiteflies, aphids, and thrips are the most prevalent plant leaf diseases that will attack the leaves of this indoor plant. Utilizing plant leaf diseaseicides is one method of preventing the spread of plant leaf disease. Specific types of plant leaf diseases will be controlled by plant leaf diseaseicides. The use of plant leaf diseaseicides harms the environment and has a significant negative impact on eco systems. Overuse of plant leaf diseaseicides will contaminate the land, water, and air. Plant leaf diseaseicide fluids that are carried by the wind contaminate other places. In this work, we emphasise the early diagnosis of plant leaf diseases. This suggests that the plants should be regularly observed. Cameras are used to capture images. The acquired image must then be analysed using image processing techniques to decipher its information. The interpretation of images for the identification of plant leaf disease is the main topic of this essay. The neural networks (NN) used by the underlying AI algorithms comprise layers of neurons and a connection layout that is modelled after the visual cortex. To achieve high accuracy of image classification on new, unseen images, these networks are "trained" on a huge set of previously identified, "labelled," images. Deep Convolutional Neural Networks (CNNs) have consistently been the best architecture for computer vision and image processing since 2012, when "AlexNet" won the ImageNet competition [3]. The development in processing power, the availability of big picture data sets, and improved NN algorithms have all contributed to the breakthrough in CNN capabilities. With open source platforms like TensorFlow, AI has advanced and improved in addition to becoming more economical and available [4]. Our project's prior art comprises initiatives. utilising open source tools like TensorFlow [4]. Efforts to collect healthy and sick crop photos [5], image analysis employing feature extraction [6], RGB images [7], spectral patterns [8], and fluorescence imaging spectroscopy [9] are examples of prior art that are relevant to our study. In the past, neural networks have been used to detect plant diseases, but the method involved locating texture features. In order to provide an end-to-end crop diagnosis system that simulates the knowledge ("intelligence") of plant pathologists and makes it available to farmers, our proposal makes use of the development of mobile, cloud, and AI. In order to increase the NN classification accuracy and track epidemics, it also offers a collaborative approach to continue expanding the illness database and requesting expert opinion when necessary.

2 LITERATURE SURVEY

In this section we will discuss some methods which are presently used for the early detection of plant leaf diseases in greenhouse plant leafs along with their advantages and disadvantages. The methods are explained below with their features and drawbacks. This work blends knowledge-based methodologies and image processing methods[1]. It will only pick up whiteflies. In comparison to manual approaches, this technology produces results that are more dependable and accurate. This system incorporates various sorts of technology, including computer vision, artificial intelligence, image processing, etc. It is actually a multidisciplinary cognitive vision system. In this project, they selected white fly as the plant leaf and rose plant as the testing plant leaf. illness for examination. It was challenging to detect anything in the early stages. They decided on adult flies. However, there were some issues with identifying adults as well. The adult could take off while the photo is being taken. So they decided to scan the rose leaves when the flies were dormant. Future research will focus on early detection of whiteflies. The purpose of Detection of Insects by a Video Camera Network[2] is to use video analysis to find the presence of plant leaf disease infection on leaves. The detection and counting of plant leaf diseases will take longer using the conventional procedures. They have created an automated system based on video analysis for this purpose. In the greenhouse, they employed 5 wireless cameras. They selected a rose leaf for testing. In this work, sticky traps are utilised. Sticky traps are nothing more than a sticky substance with added colours to draw plant leaf diseases. They employed video segmentation algorithms with learning and adaptive strategies for the detection of insects. Any weather can be used with the adaptable system. The potential scope Lalit P. Saxena and Leisa J. ArmstrongNumerous techniques have been demonstrated for computer technologies to increase agricultural output. Image processing is one method that is starting to be recognised as a useful tool. This article provides a brief overview of the use of image processing tools to help scientists and farmers develop better agricultural practises. Precision farming techniques, weed and pesticide technology, monitoring plant development, and management of plant nutrition have all benefited from image processing. This study emphasises the potential of image processing in many agricultural business scenarios in the future. Krizhevsky, I. Sutskever and G. E. Hinton, To categorise the 1.2 million high-resolution photographs entered in the ImageNet LSVRC-2010 contest into the 1000 separate classes, we trained a sizable, deep convolutional neural network. Our top-1 and top-5 error rates on the test data were 37.5% and 17.0%, respectively, which is significantly better than the prior state-of-the-art. The neural network consists of five convolutional layers, some of which are followed by max-pooling layers, three fully connected layers, and a final 1000-way softmax. It includes 60 million parameters and 650,000 neurons. We employed non-saturating neurons and a very effective GPU version of the convolution process to speed up training. We used the "dropout" regularisation technique, a recently developed regularisation technique, to significantly reduce overriding in the fully connected layers. D. L. Hernández-Rabadán, F. Ramos-Quintana and J. Guerrero Juk, This study presents a method for segmenting diseased plants that grow in uncontrolled environments, such as greenhouses, where the lack of control over lighting and the presence of background pose significant challenges. The method combines a supervised learning approach (a Bayesian classifier) with a nonsupervised learning approach (self-organizing map, or SOM). Two SOMs are used during the training phase: one that divides images into colour groups, which are then divided into two groups using K-means and labelled as vegetation and nonvegetation by using rules, and a second SOM that fixes classification mistakes made by the first SOM. The two colour classes are utilised to create two colour histograms, which are then used to calculate the Bayesian classifier's conditional probabilities. An input image is segmented Christian Szegedy, Vincent Vanhoucke, Sergey Ioffe, Jonathon Shlens, Zbigniew Wojna, Most cutting-edge computer vision solutions for a range of tasks are built around convolutional networks. Very deep convolutional networks have gained significant ground in a number of benchmarks since 2014, when they first became popular. As long as there is enough labelled data available for training, increased model size and computational cost typically result in immediate quality improvements for the majority of tasks. However, computational efficiency and low parameter count are still enabling factors for a variety of use cases, including mobile vision and big-data scenarios. Here, we investigate how to scale up networks by appropriately factorising convolutions and using aggressive regularisation to make the most of the additional computing. We compare our techniques using the validation set for the ILSVRC 2012 classification challenge.

3. IMPLEMENTATION STUDY

The best method for identifying plant leaf diseases from plant leaves is automatic detection, which employs image processing techniques and classification algorithms to categorise them based on the many characteristics of the images. For this study, photographs of leaves from plant leaf fields were obtained, and they were subsequently processed using a variety of methods. Threshold approach was used to distinguish background from plant leaf diseases in images of leaves in order to detect plant leaf diseases. This method is very straightforward and effective for identifying plant leaf diseases from photographs. In order to categorise photos with and without disease, several features of the images are collected and can be utilised as input for support vector machines (SVM).

The more labor-intensive task of training the neural network and creating the deep CNN model, which is employed by the classifier to classify photos into the appropriate illness classes, is completed by this programme. Every time the quantity of new photos added to the Training Database exceeds a set threshold, this application is launched asynchronously (without interfering with the Classifier). The deep CNN model utilised by the Classifier to classify diseases more accurately is progressively improved by consecutive runs of this training application, which utilise a larger training dataset. Python-based software programmes called the Disease Classifier and the Deep CNN Trainer exist.

3.1 PROPOSED METHODOLOGY

3.2 METHODOLOGY AND ALOGRITHAMS

1) Upload Plant leaf disease Dataset:
using this module we will upload dataset to application
2) Preprocess Dataset:
using this module we will acquire images from dataset and then filter images to grey colour and then normalize images and then split dataset into train and test part where application use 80% images for training and 20% for testing
3) Run SVM and CNN Algorithm:
process images will be input to SVM algorithm for training and then calculate its prediction accuracy.
4) We then implement the Bidirectional cnn approach for for traning and detection
5) Check for Effected from Test Image:
using this module we will upload test image and then SVM and CNN will predict type of plant leaf disease as Aphid, White fly or Uneffected.

3.3 PROPOSED CNN MODEL

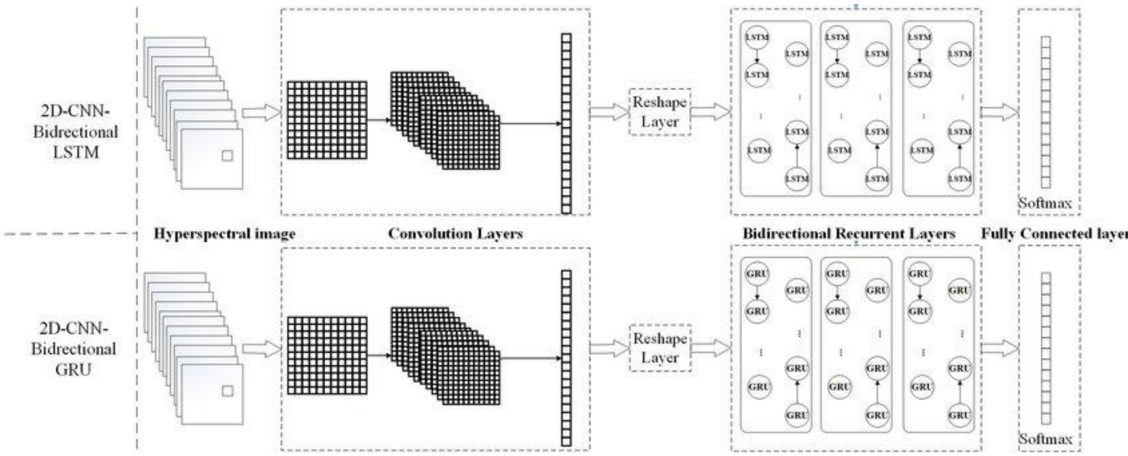

Fig 2:- Proposed CNN model

In the proposed architecture where feature maps are initially collected from a specific convolutional layer of a pre-trained CNN from an image of a contaminated plant. Then, in a "snaking" sliding motion, they are cut into multiple patches. The patches are then fed into Recurrent Units, which update an internal model of plant disease by bidirectionally sharing, combining, and retaining pertinent information. To infer distinguishing local traits, a soft attention method is applied. (A) The overall design. (B) A mechanism for soft attention. To improve accuracy and lower computational complexity, updated convolutional layers and additional batch normalisation were used2. Following the CNN's training on the job of classifying diseases, we took CNN features with a size of 14*14 256 from the convolutional layer Inception 4d and divided them with a stride of 1 into regional patches with a size of H′ = W′ = 8 each to feed the BiDirectional CNN. Tensorflow is utilised to train the CNN . We employ the ADAM optimizer with the parameters = 1e 08, 1 = 0.9, and 2 = 0.999 (Kingma and Ba, 2014). With the penalty multiplier set to 1 104 and the dropout ratio set to 0.5, respectively, we applied the weight decay L2.

4 RESULTS AND EVOLUTION METRICS

Layer (type)	Output Shape	Param
Conv2d_1 (Conv2D)	(None, 62, 62, 32)	896
max_pooling2d_1 (MaxPooling2	(None, 31, 31, 32)	0
Conv2d_1 (Conv2D)	(None, 29, 29, 32)	9248
max_pooling2d_2 (MaxPooling2	(None, 14,14, 32)	0
flatten_1 (Flatten)	(None, 6272)	0
dense_1 (Dense)	(None, 256)	1605888
dense_2 (Dense)	(None, 108)	27756

Table :- parameters used in the cnn for traning

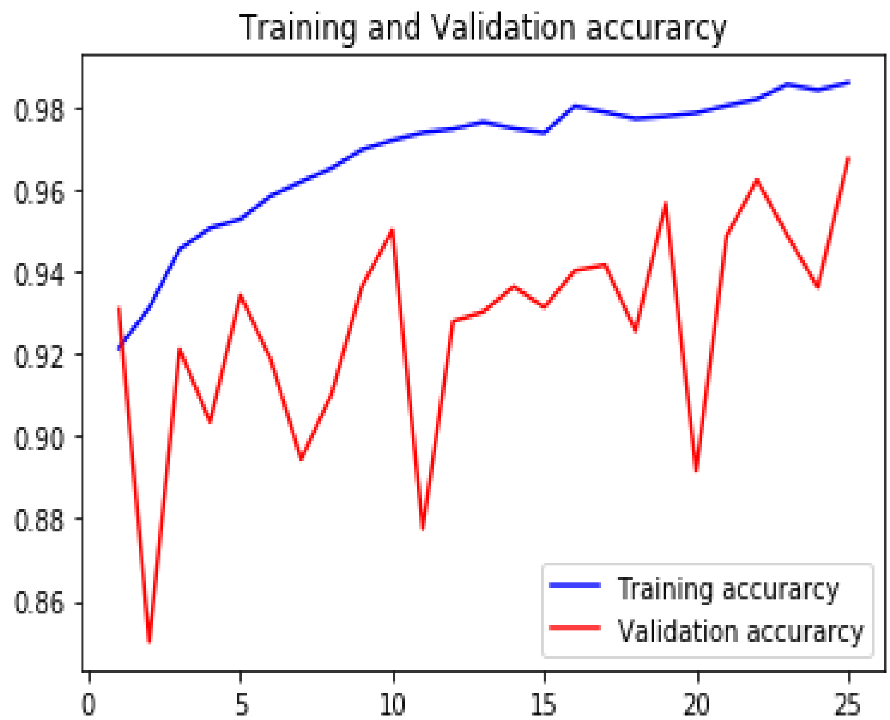

Fig 4: training and validation accuracy graph for 25 epcos Train accuracy was 98.4 and validation accuracy achived was 96.1%

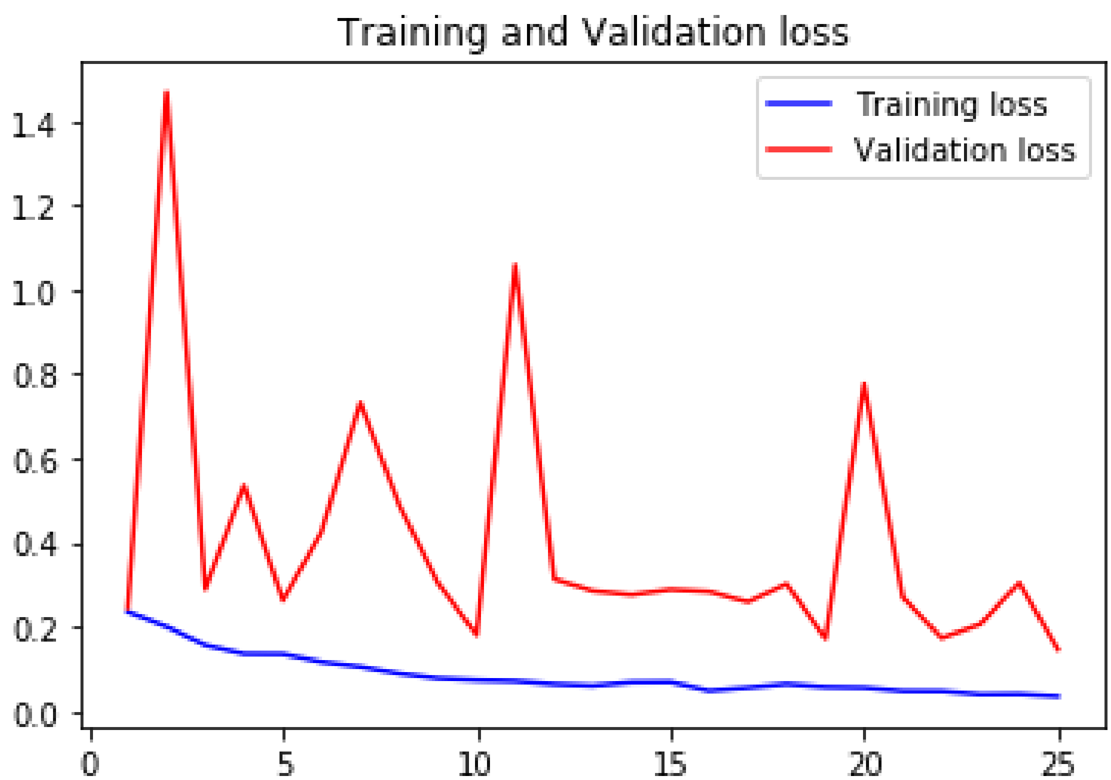

Fig 5:- training and validation loss graph training loss Achived was 0.2 and validation loss was 0.3

5 CONCLUSION

The use of image processing techniques is crucial for identifying plant leaf diseases. Finding whiteflies, aphids, and thrips on greenhouse plant leaves is our initial goal. We suggest a brand-new method for spotting plant leaf diseases early on. We utilise a pan-tilt camera with zoom to find items. We can therefore snap the image without harming the plant or causing any leaf illnesses. It serves as an example of how complementing disciplines and methodologies could be combined to create a strong, automated system. The prototype method was effective at quickly identifying plant leaf diseases. It has a similar performance level to a traditional manual approach and is rather easy to use. Early detection of plant leaf diseases is what we aim to achieve.

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