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A Review Paper on Plant Disease Detection and Recognition by Using Deep Learning

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Abstract: ***We living being are mostly dependent on plant and animals as well. We don't have much food that can even sustain for even some years for we are not the only consumers on this earth. 29% of the land where the whole living eco-system exists is not apt. to feed such a huge population. Had we no plants eaters' bacteria's or locust, then we might have enough resource that would last for year. My project that is PLANT DISEASE DETECTION AND RECOGNOZATION is all about that. This system will enable us to recognize the type of disease the plants are suffering from and how to diagnose and treat them as well. This system depicts us an appropriate outcome. It will enable us to five a fill depiction of the kind of disease the plant are suffering from. We can even recognize the kind of medication that will be effective in totally eradication of the disease. Plant diseases are one of the foremost important reasons that destroy plants and trees. Detecting those disease at early stages enable us to beat and treat them appropriately. It is quite more important to find the kind of disease first the to treat then unknowingly. The outcomes were 92% accurate and thus we can work on the plant right way to help our plants live even longer. After multiple test, we have come forward with such and initiative that will be a boon for the humankind. Farmers are the backbone of any nation. We cannot survive until they do not get the right price for their yields and our system will play a significant role in that.***
Keywords: Plant disease recognition, deep learning, computervision, convolutional neural network, Food safety

I. INTRODUCTION

As we know Agriculture is the oldest human being work that has been practiced from ancient time. And Plants are important part of our live. As 51% population of INDIAN directly or indirectly dependent on agriculture. But due to various developmental activities, pollution, climate changes etc. cause different type of problem in plant. Just like animals. plants also suffer from varieties of disease. The biological agent the cause diseases to plant are known as pathogens. Humankind will exist in this world until the plant and animals survive. They are not because of us but we are still alive because of them. Ecological impacts have degraded their productivity. Unknown and Strange disease have started to eat them off. It is therefore the need of the hour to detect and diagnose and treat them with our latest designed system. Plants Disease Detection and Recognition will analyses the image of disease from the plants and can give an outline or feature of disease spots in line with colors texture, and other characteristics from a quantitative point of view.

Farmers, being unaware of the kind of disease, often use wrong pesticides or insecticides to cure their plants that have a negative impact on them. They cannot look for an expert as for this they will have to cover miles of distance in lack of communication and transportation as well. Plant diseases have been a nightmare as they cause a big reduction in both quality and quantity of agricultural products thus negatively influence the countries that primarily depend upon agriculture for their economy. Consequently, detection of plant diseases is an important research topic because it may prove useful in monitoring large fields of crops and thus automatically detect the symptoms of diseases as soon as they leave their bad impact on plant leaves. Computer-based image processing technology will help those farmers who in spite of growing food for us end in loss. 16 The proposed approach is image-processing-based and consists of 4 main phases; within the first phase, we create a color transformation structure for the RGB leaf image, and then, we apply device-independent color space transformation for the color transformation structure. Next, within the second phase, the pictures at hand are segmented using the K-Means clustering technique. within the third phase, we calculate the feel features for the segmented infected objects. Finally, within the fourth phase, the extracted features are capable of a pre-trained neural network.

We test our program on five diseases that affect the plants; they're Early scorch, Cottony mold, Ashen mold, late scorch, and tiny whiteness. Using the proposed framework, we could successfully detect and classify the examined diseases with a precision of around 93% on average. The minimum precision value was 80%. This experiment will also enable vegetables to stay fresh for longer.

II. LITERATURE SURVEY

Here we will discuss the progress and research work done in the field of Plant disease detection.

A. *A Comparative Study Of Fine-Tuning Deep Learning Models For Plant Disease Identification - Edna Chebet Tooa, Li Yujiana , Sam Njukia , Liu Yingchun*

In the paper the accurate and quick image identification and demonstration of the image Deep Learning has been seen as a revolution in this field. Convolution neural network has proved to be efficient in the precise and correct evaluation of the plants disease causing organism. The architectures evaluated include VGG 16, Inception V4, ResNet with 50, 101 and 152 layers and DenseNets with 121 layers. The data used for the experiment is 38 different classes including diseased and healthy images of leaf's of 14 plants from plant Village. Out of 38 different plants species both healthy and diseased taken for evaluation of the image 14 plants were from plant village. An accurate and efficient outcome is desired for the quick eradication of the disease for a healthier life of the plants. Thus we can reduce the burden of food loss from the entire nation and food security can be achieved. With the growing number of epochs there has been noticed that DenseNets has been up to the mark in its proper evaluation. It moreover, requires less time and a quick result is always obtained. It has been found that the result is 99.75 % accurate which shows its efficiency. Keras with Theano backend was required fo the evaluation of training of the architecture.

B. *Deep Convolutional Neural Network Based Detection System For Real-Time Corn Plant Disease Recognition -Sumita Mishraa , Rishabh Sachana , Diksha Rajpala*

Corn has been the native food of Indian people and the disease affecting them has been a matter of concern as it will have a tremendous effect on our Indian economy and a threat to food security. Smart use of technology can be a revolution in the proper eradication of such disease so that they can be treated in time and a food security can be achieved as well. This paper presents a real time manner which is primarily based on deep convolution neural network. With the proper adjustment of hyper- parameters and pulling combination on a system with GPU the performance of Deep neural network can be improved. The parameters used in this device is optimized to get a desired result within stipulated time. The pre-trained Deep CNN model was stationed into raspberry pi 3 using Intel Movidius Neural Compute stick consisting dedicated CNN hardware blocks. An accuracy of 88.46% has been achieved in demonstration of the corn leaf disease. It shows the compatibility of this system. This presented model can be used in smart devices like raspberry-pi or smartphones and drones as well for its convenience.

C. *Deep Learning Models For Plant Disease Detection And Diagnosis -Konstantinos P Ferentinos 24*

In this paper, convolutional neural network models Application but it can be used for detection and diagnosis of plant disease by comparison of leaves images of healthy and diseased through deep learning methods Experiment was performed with the use of 87,848 images, containing 25 different plant combination with disease and healthy plants. Many experiments were done with the best one was accuracy reaching 99.535 success for detection the disease of the plant if any. We can say that this experiment shown the significant success of this model which can be used and early ad possible for detecting disease in plants, It will definitely work as a pre harvesting warning tool in the field of agriculture so that the farmers crop produce high yield production.

D. *Using Deep Transfer Learning For Image-Based Plant Disease Identification -Junde Chena , Jinxiu Chena , Defu Zhanga, , Yuandong Sunb , Y.A. Nanehkarana*

In this paper, The author says that the agriculture is an important sector of GDP of India and ensure food security but due to various reasons like population, climate changes, global warming, several plant are harmed by disease impacted not only agriculture producton, but also its quality and quantity. Thus diseases of plants can by identify and detect through various methods in this methods, Deep learning is one of them.

In this work, we study transfer learning of the deep CNN for detection of plant leaf disease and consider massive datasets, and then transfer to the specific task, trained by own data. Two approaches are selected one is VGGNet Pre-trianed and ImageNet and another is Inception module. Instead of starting the training form scratch y randomly initializing the weights, we initialize the weights using the pre-trained network on the large labeled dataset, ImageNet. The above approaches have more accurate performance than the state of the art methods. Recorded validation Accuracy approx. 91.83%. sometimes it even reaches 92.00% for the prediction of rice plant images. The above experiment demonstrate that this method of deep learning is efficient for the plant disease detection.

III. TABLE (COMPARISON OF EXISTING TECHNIQUES)

References	Method	Performance	Advantage	Limitations
[19]	The architectures evaluated include VGG 16, Inception V4, ResNet with 50, 101 and 152 layers and DenseNets with 121 layers	Accuracy = 99.75%	DenseNets has consistently improved with growing number of epochs with no signs of overfitting	DenseNets requires a considerably less number of parameters and reasonable computing timeto achieve state-of-the-art performances
[20]	Intel Movidius Neural Compute Stick consisting dedicated CNN hardware blocks	Accuracy = 88.46%	This model is capable of running on standalone smart devices like raspberry-pi or smartphone and drones	Results are reported for a small dataset
[21]	Several CNN based architecture were trained	Accuracy = 99.53%	High success rate makes the model a very useful advisory or early warning tool in real cultivation conditions	This method suffers from a high computational cost
[22]	The VGGNet pre-trained on ImageNet and Inception module are selected in this approach	Accuracy = 91.83%	More accurate performance than the state of the art methods	This method is suffering from the problem of over-fitting for a large-size dataset
[23]	A framework named k-FLBPCM along with SVM was used for crop disease classification	Accuracy = 98.63%	The work assisted to enhance classification accuracy for plants with similar morphological textures	Detection accuracy degrades for the distorted samples
[24]	The DLQP approach with the SVM classifier was introduced to categorize the various plant diseases	Accuracy = 96.53%	This work is robust to detect the plant leaf disease classification under intense scale and angle variations in input samples	Classification performance needs further improvements
[25]	Harris method was used along with the GLCM approach for features computation while the SVM classifier was employed for tea plant disease classification	Accuracy = 98.5%	The approach is capable of detecting the affected leaves portion from the complex background	This method suffers from a high computational cost

IV. CONCLUSION

The agricultural sector together of the most important sectors on which people around the world rely, where crops are the essential need for food. Early recognition and detection of those diseases are crucial to the agricultural industry. during this paper, we've introduced the basic knowledge of deep learning and presented a comprehensive review of recent research work done in plant leaf disease recognition using deep learning. Provided sufficient data is out there for training, deep learning techniques are capable of recognizing plant leaf diseases with high accuracy.

The importance of collecting large datasets with high variability, data augmentation, transfer learning, and visualization of CNN activation maps in improving classification accuracy, and therefore the importance of small sample plant leaf disease detection and the importance of hyper-spectral imaging for early detection of plant disease have been discussed. At the identical time, there also are some inadequacies. Most of the DL frameworks proposed within the literature have good detection effects on their datasets, but the consequences are not good on other datasets, that's the model has poor robustness. Therefore, better robustness DL models are needed to adapt the various disease datasets.

In most of the researches, the PlantVillage dataset was wont to evaluate the performance of the DL models. Although PlantVillage dataset features a lot of images of various plant species with their diseases, it had been taken in the lab. Therefore, it's expected to establish a large dataset of plant diseases in real conditions. Although some studies are using hyperspectral images of diseased leaves, and a few DL frameworks are used for early detection of plant leaves diseases, problems that affect the widespread use of HSI within the early detection of plant diseases remain to be resolved. That is, for early disease detection, it's difficult to obtain the labeled datasets, and even experienced experts cannot mark where the invisible disease symptoms are, and de_ne purely invisible disease pixels, which is extremely important for HSI to detect plant disease.

This paper gives the survey on different diseases classification techniques which can be used for plant leaf disease detection and an algorithm for image segmentation technique used for automatic detection as well as classification of plant leaf diseases has been described later. Jute, Grape, Paddy, okra are variety of those species on which the algorithms and methods were tested. Therefore, related diseases for these plants were taken for identification. With very less computational efforts the optimum results were obtained which also shows the efficiency of algorithm in recognition and classification of the leaf diseases. Another advantage of using these methods is that the plant diseases are often identified at early stage or the initial stage. to reinforce recognition rate in classification process Artificial Neural Network, Bayes Classifier, mathematical logic and hybrid algorithms can also be used.

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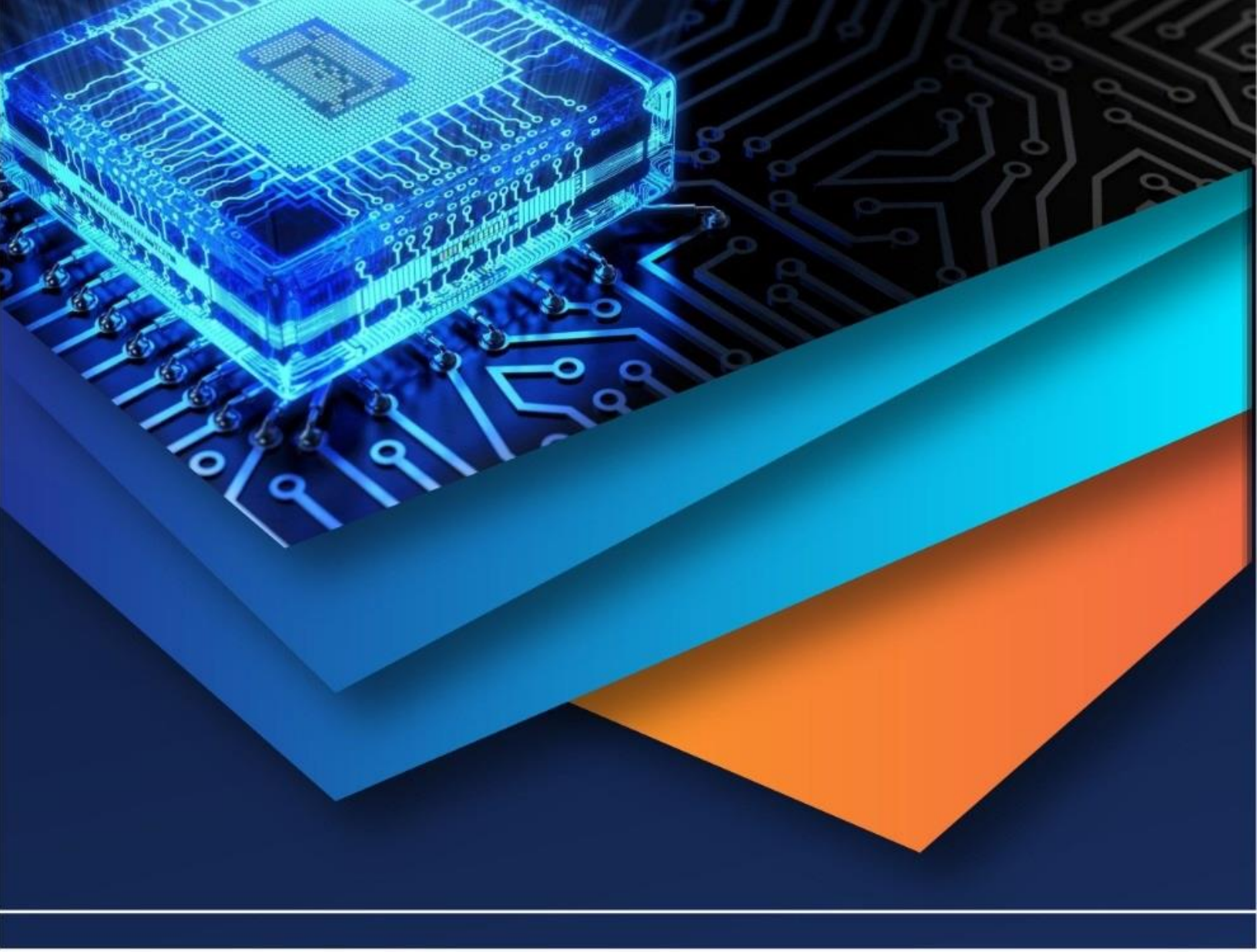

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