Predicting the Rice Leaf diseases using CNN

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ABSTRACT: Crop ailments are a predominant risk to meals security, however their fast identification stays challenging in many components of the world due to the lack of the critical infrastructure. The aggregate of growing world Smartphone penetration and current advances in pc imaginative and prescient made feasible by way of deep studying has paved the way for Smartphone-assisted ailment diagnosis. Using a public dataset of 54,306 photographs of diseased and wholesome plant leaves accrued below managed conditions, we teach a deep convolution neural community to pick out 14 crop species and 26 ailments (or absence thereof). The educated mannequin achieves an accuracy of 99.35% on a held-out check set, demonstrating the feasibility of this approach. Overall, the method of education deep gaining knowledge of fashions on more and more massive and publicly on hand photograph datasets provides a clear route towards Smartphone-assisted crop ailment analysis on a huge world scale. Effective plant boom and yield prediction is an necessary venture for greenhouse growers and for agriculture in general. Developing fashions which can successfully mannequin increase and yield can assist growers enhance the environmental manage for higher production, in shape provide and market demand and decrease costs. Recent traits in computing device studying (ML) and, in particular, deep mastering (DL) can grant effective new analytical tools. The proposed find out about utilises ML and DL strategies to predict yield and plant increase variant throughout two special scenarios, tomato yield forecasting and Ficusbenjamina stem growth, in managed greenhouse environments. We install a new deep recurrent neural network (RNN), the usage of the lengthy temporary reminiscence (LSTM) neuron model, in the prediction formulations. Both the former yield, increase and stem diameter values, as properly as the microclimate conditions, are used by way of the RNN structure to model the centered increase parameters..

KEYWORDS: **Design thinking, Plant disease recognition, deep learning, computer vision, convolution neural network.**

I. INTRODUCTION

Modern applied sciences have given human society the capability to produce sufficient meals to meet the demand of greater than 7 billion people. However, meals protection stays threatened by using a quantity of elements which includes local weather exchange (Tai et al., 2014), the decline in pollinators (Report of the Plenary of the Intergovernmental Science-Policy Platform on Biodiversity Ecosystem and Services on the work of its fourth session, 2016), plant illnesses (Strange and Scott, 2005), and others. Plant illnesses are no longer solely a danger to meals safety at the world scale, however can additionally have disastrous penalties for smallholder farmers whose livelihoods rely on healthful crops. In the growing world, extra than eighty percentage of the agricultural manufacturing is generated by using smallholder farmers (UNEP, 2013), and reviews of yield loss of extra than 50% due to pests and illnesses are frequent (Harvey et al., 2014). Furthermore, the biggest fraction of hungry human beings (50%) stay in smallholder farming households (Sanchez and Swami Nathan, 2005), making smallholder farmers a team this is especially inclined to pathogen-derived disruptions in meals supply.

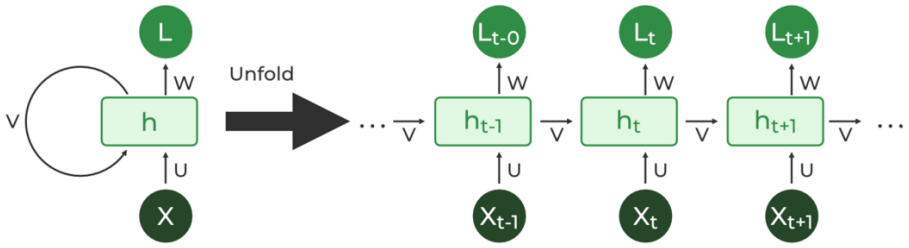
Deep neural networks have these days been efficaciously utilized in many various domains as examples of cease to give up learning. Neural networks grant a mapping between an input—such as an photograph of a diseased plant—to an output—such as a crop ailment pair. The nodes in a neural community are mathematical features that take numerical inputs from the incoming edges, and furnish a numerical output as an outgoing edge. Deep neural networks are truly mapping the enter layer to the output layer over a sequence of stacked layers of nodes. The mission is to create a deep community in such a way that each the shape of the community as properly as the features (nodes) and side weights efficiently map the enter to the output. Deep neural networks are skilled by way of tuning the community parameters in such a way that the mapping improves in the course of the coaching process.

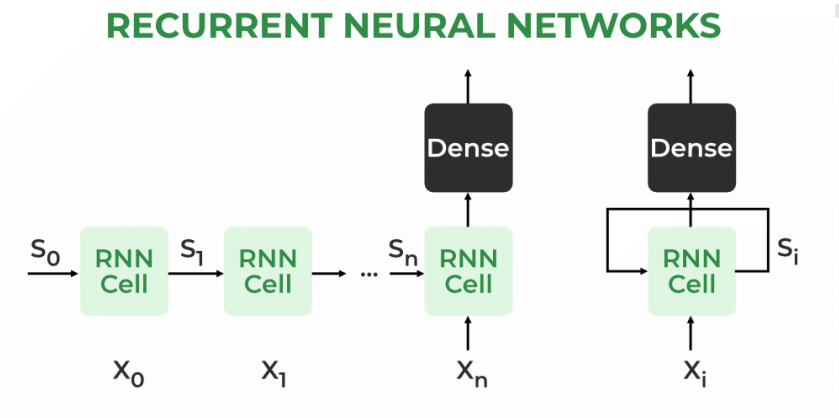
RECURRENT *NEURAL* NETWORK

In this article, we will introduce a new variant of neural community which is the Recurrent Neural Network additionally regarded as (RNN) that works higher than a easy neural community when statistics is sequential like Time-Series information and textual content data.

What is Recurrent Neural Network (RNN)?

Recurrent Neural Network(RNN) is a kind of Neural Network the place the output from the preceding step is fed as enter to the contemporary step. In ordinary neural networks, all the inputs and outputs are unbiased of every other, however in instances when it is required to predict the subsequent phrase of a sentence, the preceding phrases are required and therefore there is a want to be aware the preceding words. Thus RNN got here into existence, which solved this difficulty with the assist of a Hidden Layer. The predominant and most vital characteristic of RNN is its Hidden state, which remembers some statistics about a sequence. The kingdom is additionally referred to as Memory State on the grounds that it remembers the preceding enter to the network. It makes use of the identical parameters for every enter as it performs the identical challenge on all the inputs or hidden layers to produce the output. This reduces the complexity of parameters, in contrast to different neural networks.





Difference* between *RNN and Simple Neural Network

RNN is considered to be the better version of deep neural when the data is sequential. There are significant differences between the RNN and deep neural networks they are listed as:

Recurrent Neural Network	Deep Neural Network
Weights are same across all the layers number of a Recurrent Neural Network	Weights are different for each layer of the network
Recurrent Neural Networks are used when the data is sequential and the number of inputs is not predefined.	A Simple Deep Neural network does not have any special method for sequential data also here the the number of inputs is fixed
The Numbers of parameter in the RNN are higher	The Numbers of Parameter are lower than RNN

than in simple DNN	
Exploding and vanishing gradients isthe the major drawback of RNN	These problems also occur in DNN but these are not the major problem with DNN

II. RELATED WORK

[1] Maliyah, S. R., P V, V., M, N., R, P., N, P. B., N, S., &Heber, R:Crop diseases are a noteworthy risk to sustenance security, however their quick distinguishing proof stays troublesome in numerous parts of the world because of the non-attendance of the important foundation. Emergence of accurate techniques in the field of leaf-based image classification has shown impressive results. This paper makes use of Random Forest in identifying between healthy and diseased leaf from the data sets created. Our proposed paper includes various phases of implementation namely dataset creation, feature extraction, training the classifier and classification. The created datasets of diseased and healthy leaves are collectively trained under Random Forest to classify the diseased and healthy images. For extracting features of an image we use Histogram of an Oriented Gradient (HOG). Overall, using machine learning to train the large data sets available publicly gives us a clear way to detect the disease present in plants in a colossal scale.The agriculturist in provincial regions may think that it's hard to differentiate the malady which may be available in their harvests. It's not moderate for them to go to agribusiness office and discover what the infection may be. Our principal objective is to distinguish the illness introduces in a plant by watching its morphology by picture handling and machine learning.A modern approach such as machine learning and deep learning algorithm has been employed to increase the recognition rate and the accuracy of the results. Various researches have taken place under the field of machine learning for plant disease detection and diagnosis.

[2] Hassan, S. M., Maji, A. K., Jasminka, M., Leibowitz, Z., & Jasminka, E.:The timely identification and early prevention of crop diseases are essential for improving production. In this paper, deep convolutional-neural-network (CNN) models are implemented to identify and diagnose diseases in plants from their leaves, since CNNs have achieved impressive results in the field of machine vision. Standard CNN models require a large number of parameters and higher computation cost. In this paper, we replaced standard convolution with depth=separable convolution, which reduces the parameter number and computation cost. The implemented models were trained with an open dataset consisting of 14 different plant species, and 38 different categorical disease classes and healthy plant leaves. To evaluate the performance of the models, different parameters such as batch size, dropout, and different numbers of epochs were incorporated. The implemented models achieved a disease-classification accuracy rates of 98.42%, 99.11%, 97.02%, and 99.56% using InceptionV3, InceptionResNetV2, MobileNetV2, and EfficientNetB0, respectively, which were greater than that of traditional handcrafted-feature-based approaches. In comparison with other deeplearning models, the implemented model achieved better performance in terms of accuracy and it required less training time. Moreover, the MobileNetV2 architecture is compatible with mobile devices using the optimized parameter. The accuracy results in the identification of diseases showed that the deep CNN model is promising and can greatly impact the efficient identification of the diseases, and may have potential in the detection of diseases in real-time agricultural systems.

[3] Muhammad E.H. Chowdhury, Tawsifur Rahman, AmithKhandakar, Nabil Ibtehaz,:Plants are a major source of food for the world population. Plant diseases contribute to production loss, which can be tackled with continuous monitoring. Manual plant disease monitoring is both laborious and error-prone. Early detection of plant diseases using computer vision and artificial intelligence (AI) can help to reduce the adverse effects of diseases and also helps to overcome the shortcomings of continuous human monitoring. In this study, we have extensively studied the performance of the different state-of-the-art convolutional neural networks (CNNs) classification network architectures i.e. ResNet18, Mobile Net, DenseNet201, and InceptionV3 on 18,162 plain tomato leaf images to classify tomato diseases. The comparative performance of the models for the binary classification (healthy and unhealthy leaves), six-class classification (healthy and various groups of diseased leaves), and ten-class classification. (healthy and various types of unhealthy leaves) are also reported. InceptionV3 showed superior performance for the binary classification using plain leaf images with an accuracy of 99.2%. DenseNet201 also outperform for six-class classification with an accuracy of 97.99%. Finally, DenseNet201 achieved an accuracy of 98.05% for ten-class classification. It can be concluded that deep architectures performed better at classifying the diseases for the three experiments. The performance of each of the experimental studies reported in this work outperforms the existing literature.

[4] Zhang, Y., Song, C., & Zhang., D.To improve the recognition model accuracy of crop disease leaves and locating diseased leaves, this paper proposes an improved Faster RCNN to detect healthy tomato leaves and four diseases: powdery mildew, blight, leaf mold fungus and ToMV. First, we use a depth residual network to replace VGG16 for image feature extraction so we can obtain deeper disease features. Second, the k-means clustering algorithm is used to cluster the bounding boxes. We improve the anchoring according to the clustering results. The improved anchor frame

tends toward the real bounding box of the dataset. Finally, we carry out a k-means experiment with three kinds of different feature extraction networks.

EXISTING SYSTEM

During numerous years, some superior structures are used for rice cultivation, which mechanically can measure the water temperature and water degree of the paddy field. In addition, a cultivation assist device was once proposed to accumulate the talent and understanding of agricultural workers. For example, agricultural employees analyze or manage the accumulated records with their cellular or pill device. In this way, they can minimize the time wanted for water management. Cloud computing can be used to analyze a massive quantity of amassed data. In the future, it will be necessary to increase a frequent database for agricultural records in order to assist advanced services. Nevertheless, there are a lot of problems, such as the physiological prerequisites and developing stipulations in the area of organic informatics. These issues are linked to irregular fitness and have an effect on the fine of crops. The self sustaining rice planter and tractor have been carried out for faraway monitoring by using agricultural workers. For rice crop harvesting, the clever gadget applies straight-line help and object detection and to autonomously go the goal vicinity by means of coordinating Geographic Information System.

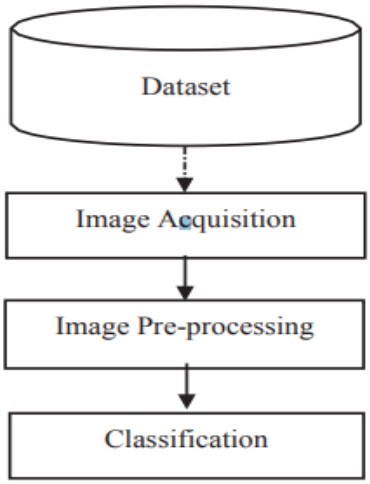
PROPOSED SYSTEM

Identification of the plant ailments is the key to stopping the losses in the yield and extent of the agricultural product. The research of the plant ailments suggest the research of visually observable patterns viewed on the plant. Health monitoring and disorder detection on plant is very necessary for sustainable agriculture. It is very hard to screen the plant ailments manually. It requires awesome quantity of work, expertise in the plant diseases, and additionally require the immoderate processing time. Hence, photograph processing is used for the detection of plant diseases. Disease detection entails the steps like photograph acquisition, photograph pre-processing, photograph segmentation, function extraction and classification. This paper mentioned the techniques used for the detection of plant ailments the use of their leaves images. This paper additionally mentioned some segmentation and function extraction algorithm used in the plant ailment detection.

1. Name of the leaf
2. scientific title of leaf
3. Vitamins current in leaf
4. Name of disease
5. Percentage of sickness affected area
6. Name of remedy used for the disease
7. Name of insect

III. METHODOLOGY

A block diagram presented in Fig. 4 shows the Input Dataset, Image Acquisition, Image pre-processing and Classification.



A. Image Acquisition

Image dataset used for training the model was acquired in the Plant Village repository A matlab script was used to download images of the plant diseases from the repository. The acquired dataset consists of approximately 35,000 images with 32 different classes plant varieties and diseases.

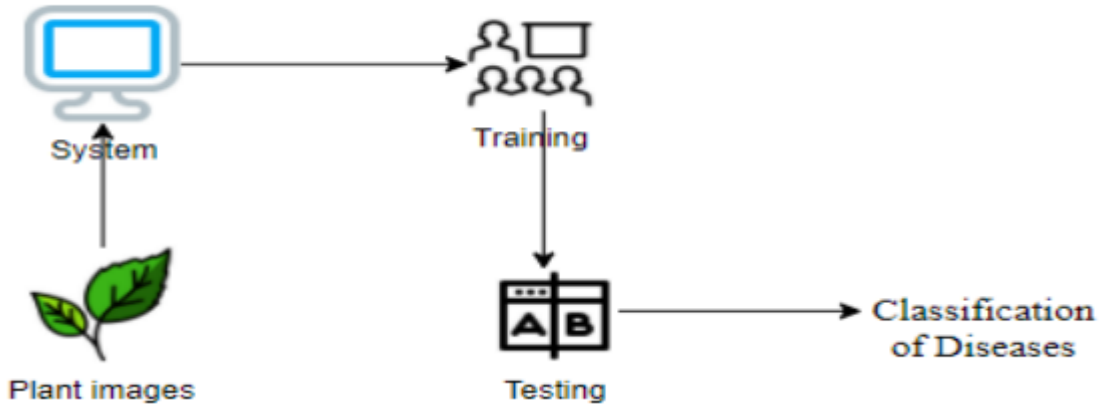
B. Image Pre-processing

Pre-processed images are reduced image size and image crop to a given input. It processes and enhances the image to its needed colour scale. The study uses colored and resized images to 96x96 resolutions for processing.

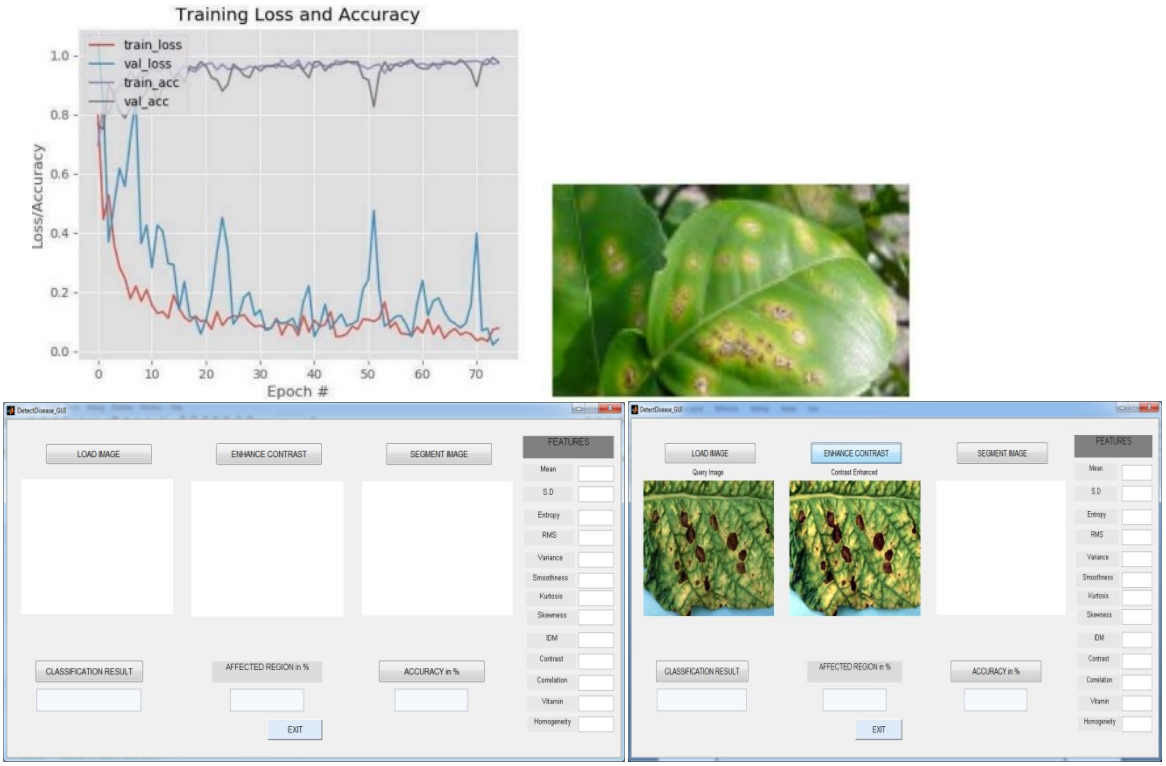
C. Classification

Classification uses fully connected layers and for feature extraction it uses convolution and pooling layers. The classification process classifies the plant leaf if it is infected with the disease or not, identifies the type of plant disease and recognizes the plant variety.

IV. ARCHITECTURE DIAGRAM



V. EXPERIMENTAL RESULTS



VI. CONCLUSION

The precisely detection and classification of the plant diseases very essential for the profitable cultivation of crop and this can be performed the usage of photograph processing. These paper discussedvarious methods to section the ailment section of the plant. This paper also mentioned some Feature extraction and classification methods to extract the elements of contaminated leaf and the classification of plant diseases. The use of RNN methods for classification of sickness in vegetation such as selforganizingfeature map, again propagation algorithm, SVMsetc. can be effectively used. From these methods, we can accurately become aware of and classify a number plant illnesses using image processing techniques.

VII. FEATURE ENHANCEMENT

The evaluation, we located that the following results: For vegetable classification, our coaching records for 300 epochs estimated six sorts of veggies correctly. The accuracy of our mannequin reached 100%. For ailment classification, our coaching records for four hundred epochs expected greater than 96% for potato leaves. For corn leaves, the accuracy of our education statistics of one hundred epochs is greater than 96%. For insect pest classification, the accuracy of corn insect pests is extra than 73%, however the outcomes of unique existence cycles confirmed low classification accuracy, which current a future challenge. In the future work, we will think about extraordinary parameters and extra coaching statistics to enhance the classification accuracy for managing agricultural plants and unique stage of insect pests. In addition, the feature of disorder manages techniques for one of a kind plants will be discussed. We are additionally involved in a couple of area system manipulate functions, due to the fact the agricultural ailments and insect pests have nearby affect on the fields.

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