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Leaf Disease Detection Using Image Processing and ML

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Abstract - *In most nations, agriculture is the primary source of income for farmers, and productivity estimation is a major difficulty for them. Agriculture, together with its linked industries, is indisputably India's major source of income, particularly in the country's vast rural areas. For eons, agriculture has been cultivated in every country. Agriculture encompasses both the technology and the art of nurturing plants. Agriculture performed a major role in the development of human civilization. Agriculture has been done by hand for ages. Because the world is moving toward new technologies and implementations, agriculture must also modernize. The Internet of Things is essential for smart farming. Sensors connected to the internet of things can provide all kinds of information about agricultural landscapes. We can achieve impressive results by implementing deep learning techniques such as CNN. CNN models are used to detect disease in plants via plant leaves, and CNNs have shown to be particularly effective in Machine Vision. Image processing is a technique for performing actions on images in order to improve it and extract features from them. It is a kind of signal processing in which the input is an image and the output is an image or image features.*

Key Words: **Image Processing, Convolution Neural Network**

1. INTRODUCTION

The modern disease detection approach is built on the basis optical inspection by specialists, that provides for the detection and recognition of plant disorders. To do so, an enormous team of professionals, as well as ongoing monitoring by specialists, is required, with prices rising as farms become larger. Around the same time, in some regions, farmers lack proper facilities or the knowledge that they'll need to seek expertise. As a result, even though consulting specialists demand a significant fee, they also are time - consuming process. Plant diseases impair agricultural production volume and quality. Plant disease compromises the integrity of the leaf, fruit, stem, vegetable, and its products. This has a big effect on productivity, which has a big influence on cost. In recent years, machine learning has gained popularity as a beneficial technique in agriculture. The concept is essential when it comes to producing, monitoring, managing, and enhancing productions. Deep learning is a type of machine learning that uses multiple layers to transform input into information. It is also used to handle a variety of complex issues such as image classification, pattern analysis, and feature extraction. Deep learning allows you to identify illnesses using many different feature sets. Of these, the traditional handmade approach and DL features are the most popular feature sets. For efficiently extracting features, pre-processing such as picture enhancement, colors modification, and segmentation is required. Classifiers are applied after feature extraction. KNN, SVM, decision tree, RF, ANNs, and Deep CNN are amongst the most widely known classifiers.

2. Proposed Work Objective

The intention of this proposed methodology is by using a plant leaves image to predict the type of disease. CNN, is fully unsupervised methodology, is applied to predict the outcome. This research aims to apply CNN to verify plant leaf disease. The goal of this study is to use image recognition to detect unhealthy plant leaf areas and categorize plant diseases. One of the most important uses of image processing is picture recognition, which is an important tool for early diagnosing in crop production.

3. MOTIVATION OF WORK

Farmers tend to judge diseases simply examining at them through their naked eyes. However, that's not always the right strategy. Many times, a farmer should approach specialists for detection of diseases, which is time-consuming in farmlands. Several applications have been developed using digital image processing techniques in various industries such as industrial inspection, medical imaging, remote sensing, agricultural processing, and so on.

4. RELATED WORK

Sr. No.	Title of Paper and Year	Methodology	Findings
1.	Multilayer CNN for the classification of Mango leaves infected by Anthracnose Disease.	CNN, Image Processing and Plant Pathology	Comparing results with the other state approaches PSO, SVM, and RBFNN
2.	Mellowness Detection of dragon fruit using DL strategy.	Mellowness detection in dragon fruit using deep convolution neural network.	The proposed method had higher learning accuracies.
3.	A survey on the implementation of deep dictionary learning and coding network for plant disease detection in the agriculture field.	Dictionary learning, DDLCN, Haar Wavelet algorithm.	The algorithm's concept is to compare past data with upcoming data.
4.	Tomato leaf disease detection using DL technique	Automatic disease detection, deep learning, CNN.	When compared to other architectures, DenseNet201 was found to be better at extracting features from images.
5.	Plant Disease Detection using image processing.	Pre-processing segmentation, SVM Classifier	This paper proposed using a combination of form, texture, and gray level to detect illness in leaves.

Uday Pratap Singh, Siddharth Singh Chouhan – Multilayer Convolution Neural Network for the Classification of Mango Leaves Infected by Anthracnose Disease || March 27, 2019.

Mango trees, specifically the fruits and the leaves are highly affected by the fungal disease named Anthracnose. The main goal of this work is to develop appropriate and effective methods for diagnosing the disease and its symptoms, and thus advocate the appropriate system.

Dr. T. Vijayakumar, Mr. R. Vinothkanna – Mellowness Detection of Dragon Fruit Using Deep Learning Strategy || April 9, 2021.

They use RESNET 152, a deep learning convolutional neural network, to identify dragon fruit maturity, and this proposed system identifies dragon fruit maturity and harvest time. They trained the model using Python and TensorFlow. The developed structure was trained with images of dragon fruit at various stages of maturity and tested for convergence range and misclassification using 100 new data points.

Snehal A. Lale, Dr. V. K. Shandilya – A Survey on Implementation of Deep Dictionary Learning and Coding Network for Plant Disease Detection in Agricultural Field. || May 2021.

Here, the concepts of deep learning and dictionary learning are combined. The advantages of dictionary learning and deep learning methods are combined in the DDLCN framework proposed for deep learning. This dictionary learning and coding layer can fill the convolutional layer of a standard deep learning architecture.

Muhammad E. H. Chowdhury, Tawsifur Rahmen, Amit Khandakar – Tomato Leaf Disease Detection Using Deep Learning Technique || April 30, 2021.

The overall methodology of the tomato leaf disease detection is to classify healthy and unhealthy leaves of tomato plants the classification is done using pre-trained networks like- ResNet18, MobilenetV2, InceptionV3, and DenseNet201.

Ashwini C, Anusha B, Divyashree B. R, Impana V – Plant Leaf Disease Detection Using Image Processing || 2020.

In the proposed system, they use image processing to identify the color features of the leaves for detecting diseases, viruses and also provides prevention to the particular disease.

5. PROPOSED SYSTEM APPROACH

i. PROBLEM STATEMENT

India is mainly an agricultural country. 70% of the rural population is still dependent on agriculture and 82% of the farmers are subsistence farmers. However, leaf infections cause significant crop loss. Leaf infections can occur due to environmental conditions such as heavy rains, rapid temperature changes, improper care, and heavy pesticide use. Automatic detection of plant diseases is an important research theme that enables early detection of diseases and viruses.

ii. SYSTEM ARCHITECTURE

The act of obtaining an image from a source, usually a physical equipment such as a camera, is known as visual acquisition. Image preprocessing turns image data in such a way that Deep Learning algorithms can solve. After that, the image is split into subgroups to help minimize the image's complexity and make subsequent operations easier. The database includes a huge number of sample image files that include both disease and non-disease photos. The features will be removed based on Picture feature extraction techniques recommendations, and the image file will be stored in database.

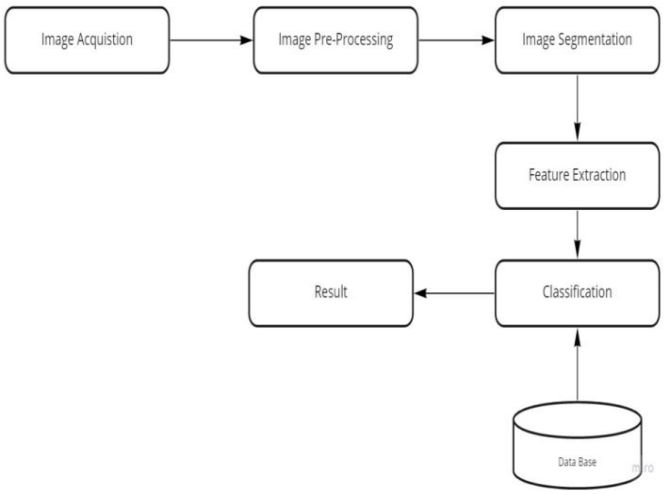

Fig.1 System Architecture of Proposed System

6. MATHEMATICAL MODEL

Let 'S' be the system.

- Where,
  S = I, O, P, Fs, Ss
  Where,
- Set of input Set of Output
- *P* = Set of technical process
- *Fs* = Set of Failure State
- *Ss* = Set of Success State
- Identify the input data I1, I2,…… In
  I = Input Data
- Identify the Process as *P*
  P = Image Processing, Segmentation, Feature Extraction, Classification
- Identify the Failure state as *Fs*
  Fs = If data is not clear, not successfully loaded, If not predicted, or it take more time that it should
- Identify the Success State as *Ss*
  P = Accurate prediction within given time.

7. ALGORITHM

On this Proposed system, the CNN set of rules is employed. A Convolution Neural Network is a deep learningtechnology which makes use of trainable weights and biases to offer trainable weights and biases to various factors in apicture, permitting it to characterise amongst them. The variety of pre-processing achieved via way of means of a ConvNet ismuch much less than that required via way of means of different category techniques. A ConvNet`s structure is motivated via way of means of thevisual cortex's shape and is comparable to the human brain's connecting community of neurons. Individual neuronscan best react to stimuli with in receptive field, that's a constrained region of the visible field. To span the wholevisual field, some of equal fields may be layered on pinnacle of 1 another

8. CONCLUSIONS

The use of convolutional neural networks to predict plant diseases is the focus of this proposed system. This technology helps reduce the time and cost of manual forecasting. Based on the results, we can conclude that the convolutional neural network has a high level of accuracy in perturbation detection. You can extend this task to create real-time applications that can recognize multiple plant species instead of just one. To segment the leaf area, certain systems use scaling and gauss filtering for image preprocessing, followed by a CNN classification algorithm to detect leaf disease.

REFERENCES

[1] Challa Karthik, Nagul Ulaganathan - Application for Plant's Leaf Disease Detection using Deep Learning Techniques || volume: 07 Issue: 08 | Aug 2020

[2] Saraswathi. E, and Usha Kiruthika - Study on stages of diseases detection in a plant using Deep Convolutional Neural Network (CNN) in Agriculture || 20 April 2021

[3] Ashwini C, Anusha B, Divyashree B R, Impana V, Nisarga S P -Plant Disease Detection using Image Processing || ISSN: 2278-0181 || 2020

[4] Uday Pratap Singh Siddharth Singh - Multilayer Convolution Neural Network for the Classification of Mango Leaves Infected by Anthracnose Disease || March 27, 2019

[5] Snehal A. Lale, Dr. V. K. Shandilya- A survey on implementation of deep learning dictionary learning and coding network for plant disease detection || May 2021

[6] Punam Bedi, Pushkar Gole- plant disease detection using hybrid model based on convolution autoencoder and convolution neural network. || 8 May 2021

[7] Sethy, P.K.; Barpanda, N.K; Rath, A.K.; Behra, S.K- Deep feature-based rice leaf disease identification using support vector machine || 2020

[8] Kamlesh Golhani a, Siva K. Balasundram – A review of neural networks in plant disease detection using hyperspectral data || May 2018

[9] Badge S, Patil S, Patil P- Artificial neural network-based plant leaf disease detection || 2015

[10] Patil, J.K, & Kumar – Advances in image processing for detection of plant disease. Journal of advanced bioinformatics application and research 2 || 2011

[11] Chen, J; Chen, J; Zhao, Zhang – Using deep transfer learning for image-based plant disease identification || 2020

[12] Zeng, W.; Li, M – Crop leaf disease recognition based on self-attention convolutional neural network || 2020

[13] Asifullah Khan, Anabia Sohail, Umme Zahoora – A survey of the recent architectures of deep convolutional neural networks.

[14] Ahmed k, Shahidi, Irfanul Alam – Rice leaf disease detection using machine learning techniques. || 2019

[15] Ramesh, S., Vydeki, D – Recognition, and classification of paddy leaf disease using optimized deep neural network with Jaya algorithm. || 2020

[16] Sanga, S.L., Machuve, D., Jomanga – Mobile-based deep learning models for Banana disease detection. || 2020

[17] Tewari, V.K., Pareek, C.M., Lal – Image processing based real-time variable-rate chemical spraying system for disease control in paddy crop. || 2020

[18] Tiwari, D., Ashish, M., Gangwar, N., Sharma, A., Patel – Potato leaf disease detection using deep learning. || 2020

[19] J. G. M. Esgario, R. A. Krohling, and J. A. Ventura – Deep learning for classification and severity estimation of coffee leaf biotic stress. || July 2020

[20] Shima Ramesh, Mr. Ramachandra Hebbar, Nivenditha M, Pooja R, Prasad Bhat – Plant disease detection using Machine Learning. || April 2018

[21] Hao Tang, Hong Liu, Wei Xiao, and Nicu Sebe – When dictionary learning meets deep learning: Deep Dictionary Learning and coding network for Image Recognition with a limited date. || 2020