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A Comprehensive Review of Plant Disease Diagnosis and Classification Models: A Deep Learning Perspective

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ABSTRACT

In recent years, automatic identification of disease by plant images is a highly crucial and major problem for significant farming and received the consideration of investigators. So far, the presented technique is slighted in their opportunity and completely based on DL modules. The efficiency of CNN is developing as an effective device for diagnosing and predicting the infection from crop images. The presented research has studied various NN methods that are utilized for processing image data with significance on identifying crop diseases. Initially, an analysis of data acquisition source, DL methods or frameworks, and distinct image processing methods are utilized for processing the given imaging data. Next, the research emphasized the outcomes attained from the assessment of several present DL modules and lastly stated the upcoming possibility for data analyses. The training of this study is to permit upcoming investigation for learning huge abilities of DL when identifying plant diseases via enhancing accuracy and performance of the system.

Keywords: Plant images, Disease detection, Image processing, Deep Learning, Machine Learning

I. INTRODUCTION

In agricultural crops, leaf performs a major part in providing data regarding the quantity and nature of horticultural yield. Various features influence food production like occurrence of weed, soil infertility, and climate change. Besides, leaf/plant disease is a worldwide threat to the development of various agricultural products and a cause for economic loss [1]. The failure for diagnosing infection or bacteria or viruses in plants results in subsequent inadequate fungicide or pesticide utilization. Thus, plant diseases were mainly assumed in the research, with concentrate on the biological feature of diseases. Accuracy farming utilizes innovative techniques for optimizing problem solving. The visual examinations by professionals and biological analysis are commonly executed via plant detecting if needed. However, this technique is usually cost ineffective and time consuming. For addressing these problems, it is essential to identify plant disease by innovative and smart technologies. To execute the agricultural operation, traditional ML method was employed in various researches. But, lately, DL as a subset of ML, was efficient for practical object recognition, classification, and detection determinations. Hence, agricultural studies have been stimulating DL based resolutions. The DL methods were established an advanced outcome for performing agricultural functions like plant recognition, weed or crop discernment, and fruit harvesting. Likewise, current research also concentrates on other significant agricultural problems of plant disease detection. Various DL methods were employed for performing plant disease classification by utilizing familiar DL frameworks. Furthermore, few studies of DL method is to enhance the efficiency of the disease classification in many plant species. Some researchers are emphasized in this work. For instance, a current study introduces relative analyses of various DL and CNN optimizations for attaining improved outcomes of plant disease classifications. Research presented CNN module for classifying disease in tea leaves. Alternative research was accompanied for proposing 2 studied forms of MobileNet modules for classifying various plant diseases. A current study proposed 2 DL frameworks depending upon residual learning and attention approaches to categorize tomato leave disease and attained completely high accurateness. Alternative CNN based framework has been presented for classifying disease in the Plant Village dataset, and it executed well compared to the familiar DL techniques involving ResNet, VGG-16, AlexNet, and Inception-v3. The latest study introduces CNN based method to classify groundnut disease. Likewise, several researches concentrate on state-of-the-art trained methods; for instance, to estimate the efficiency of GoogLeNet and AlexNet training from TL and scratch methods. Relative research was accompanied to display the connotation of fine tuning method by relating advanced DL frameworks for classifying plant disease. For addressing the object detection task, the localization and classification of objects are executed in an individual architecture by utilizing DL Meta framework. Regarding this various DL, methods were established.

The presented research has studied various NN methods that are utilized for processing image data with significance on identifying crop diseases. Initially, an analysis of data acquisition source, DL

methods or frameworks, and distinct image processing methods are utilized for processing the given imaging data. Next, the research emphasized the outcomes attained from the assessment of several present DL modules and lastly stated the upcoming possibility for data analyses. The training of this study is to permit upcoming investigation for learning huge abilities of DL when identifying plant diseases via enhancing accuracy and performance of the system.

II. REVIEW OF PLANT DISEASE DIAGNOSIS MODELS

The study is focused on a novel method for the improvement of plant disease recognition module that is depending upon leave image classification, using DCNN method [2]. Innovative training and the method assist an easy and quick execution in real time. The established module can identify thirteen distinct kinds of plant disease from healthier leaves, with the capability to differentiate plant leaves from their environments. Based on this knowledge, an approach for detecting plant disease was introduced. [3] recently the study on plant disease and pest recognition depending DL from 3 features of segmentation, detection, and classification networks, and the disadvantages and advantages of every method are outlined. Popular datasets are presented, and the efficiency of present research is related. Based on this research deliberates significant problems in real time applications. Additionally, probable solutions and study topics are presented for the problems and various recommendations are provided.

[4] proposed research by using DL based method for detecting diseased plants by leaf images via TL method. This research utilizes NASNet framework for the CNN approach. The module is later tested and trained by a publicly available Plant Village project dataset which comprises various images of plant leaves with many differences in infection status and location in the plants. By this module, an accurateness rate of 93.82% was attained. The aim of this study is to improve an advanced architecture for detecting disease depending upon DCNN via TL method. In [5], primarily, they gathered a dataset which comprises images of 1,014 Betelvine leaves with healthier and diseased classifications in the cultivated betel vine crops and noted manually for training. The Mask RCNN instance segmentation module is accepted to detect effective Betelvine diseased leaves.

[6] the study executed the difficult process of classification and localization in plant leaf disease. Regarding this, 3 DL Meta framework includes Region based RFCN, Single Shot MultiBox Detector (SSD), and Faster Region based RCNN) have been employed by the TensorFlow object detecting architecture. Every DL module has been tested or trained on controllable dataset platform for recognizing plant species disease. Furthermore, development in mean average accuracy of optimally attained DL framework is tried via advanced DL optimizer. [7] examine TL of DCNN for identifying plant leaf disease and deliberate by the pre-trained module learned from huge datasets, and later transmit to the certain process trained by their individual information. The VGGNet pre-trained on ImageNet and Inception model are chosen in this method. Rather than initializing the training from scratch by arbitrarily initiating the weight, they initiate the weight by utilizing pre-trained network on huge labeled dataset and ImageNet.

[8] proposed a probabilistic programming method for detecting plant disease by advanced Bayesian DL methods and uncertainty as misclassification measurement. The outcomes demonstrate that Bayesian inference attains classifiers efficiency that is similar to the standard optimization process for fine tuning DL modules. Simultaneously, the presented technique estimates the subsequent density for detecting plant disease challenges and measure the uncertainty of prediction for sample instances. [9] in this study, they are relating the efficiency of ML (SVM, RF, SGD) and DL (VGG-19, VGG-16, Inception-v3) based on citrus plant disease recognition. The disease CA is obtained by research is attractive as DL approach executes well compared to other ML approaches.

[10] developed a DL based rice disease detection method that comprises an ML application on smartphones and cloud servers. The smartphone application function is to take the rice plant leaf images, transmit them to the cloud server application, and obtain classification outcomes through the data on plant disease types. The outcomes displayed that the smartphone based rice plant disease detection application is well function that is capable of detecting rice plant disease. [11] proposed an effective solution that offers farmers a technique to facilitate appropriate crop management. They presented 2 effective methods depending upon DL method for recognizing plant disease. The initial technique presents real time solution according to deep Meta architecture and features extractor for detecting plant disease and position in the image. The next technique tackles the issues of class imbalance and false positive by presenting a refinement function named Filter Bank. They authenticate the efficiency of this approach in tomato plant disease and pest dataset.

III. CONCLUSION

The presented has been studied various NN methods that are utilized for processing image data with significance on identifying crop diseases. Initially, an analysis of data acquisition source, DL methods or frameworks, and distinct image processing methods are utilized for processing the given imaging data. Next, the research emphasized the outcomes attained from the assessment of several present DL modules and lastly stated the upcoming possibility for data analyses. The training of this study is to permit upcoming investigation for learning huge abilities of DL when identifying plant diseases via enhancing accuracy and performance of the system.

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