Plant disease detection and classification using deep learning: An overview

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***Abstract*: In this paper various techniques investigation of plant disease are available. Plant disease is a persistent problem for farmers, and it is one of the most serious risks to income and food security. This initiative aims to enhance the quality and quantity of agricultural output in the nation by classifying plant leaves into sick and healthy leaf types. The smart farming system is an innovative technology that aids in the improvement of agricultural quality and quantity. Deep learning using Convolutional Neural Networks (CNNs) has successfully classified various plant leaf diseases. It represents a contemporary technique that offers cost-effective disease diagnosis.CNN presents a simplified version of a much broader image. In this research, we proposed a hybrid deep learning model to detect plant diseases using mixed deep learning techniques. The CNN and Recurrent Neural network (RNN) have been used for feature extraction and classification. Some real-time plant images used for experimental analysis with leaf and fruit objects.**

***Index Terms*: CNN, Plant disease, Neural Networks, RNN**

I. INTRODUCTION (HEADING 1)

The Indian economy is based on agriculture. It supports over 70% of the population and accounts for a significant portion of the GDP. India is the greatest producer of pulses, rice, wheat, spices, and spice products globally. Any country's agriculture is dependent on the quality and quantity of agricultural goods, particularly plants. Numerous researchers used image processing, machine learning, and deep learning approaches to identify plant illness (i.e., aberrant growth or malfunction) to make this challenging work easier. Plant and tree health monitoring and disease detection are crucial for long-term agriculture. Plant diseases and pests pose a significant threat to agriculture. Plant diseases generate considerable productivity and economic losses in the agricultural business across the globe. One of the most important objectives in overall crop disease management is to identify plant illnesses at an earlier stage to avert a larger loss. Plant disease diagnosis entails a large amount of intricacy, which is accomplished by visual inspection of symptoms on plant leaves. Even skilled agronomists and plant pathologists often fail to detect particular illnesses due to this intricacy and the enormous number of farmed plants and their current issues, leading to incorrect conclusions and treatments. According to the findings, climatic change may affect pathogen growth stages and rates and host resistance, resulting in physiological alterations in host-pathogen interactions. The problem is made even more difficult because illnesses are now more readily transmitted internationally than ever before. New diseases may emerge in regions where they have never been seen before and where there is, by definition, no local competence to fight them. One of the foundations of precision agriculture is the timely and precise identification of plant diseases [1]. By solving the long-term pathogen resistance development problem and avoiding the negative repercussions of climate change, it is vital to minimize inefficient waste of financial and other resources, resulting in healthier output. Plant diseases may be identified through a number of approaches. Some diseases have no evident signs, or the harm becomes apparent too late to intervene, demanding a comprehensive study. However, as most illnesses present themselves in the visible spectrum, a qualified professional's naked eye examination is the most prevalent way for diagnosing plant diseases in practice. A plant pathologist must have great observation abilities to notice specific indicators to diagnose plant diseases properly [2[[3].

Plant disease symptoms may be noticed in different areas of the plant. However, leaves are the most typically encountered component for identifying illness. As a consequence, researchers have worked to automate identifying and categorizing plant illnesses using leaf photographs. Artificial intelligence, machine learning, deep learning, image processing, and Graphics Processing Units (GPUs) may all aid to expand and increase plant protection and growth. The usage of artificial neural network topologies with multiple processing layers is referred to as deep learning. Convolutional Neural Networks are the principal deep learning technique utilised in this research (CNNs) (CNNs). CNNs are among the most effective algorithms for simulating intricate processes and performing pattern identification in applications that involve a massive number of data, such as pictures recognition.

II. Literature Survey

We have surveyed several recent trends in this file and tabulated the techniques, datasets used in Table 1

Title	Architecture	Dataset	Results
1.Banana leaf	LeNet	Plantvillage	CA(98.61%) FI(98.64%)
2.Tomato	AlexNet, ResNet, GoogLeNet	Plantvillage	CA by ResNet which gave the best value (97.28%)
3.banana, cabbage, cassava, cantaloupe, celery, cherry	AlexNet, ALexNetOWTBn, GoogLeNet, Overfeat, VGG	Plantvillage and in-field images	Success rate of VGG (99.53%) which is the best among all
4.Apple black root,Blackberry healthy,Grapes Leaf Healthy	AlexNet, GoogLeNet	Plant Village choice of dataset type:color,grayscale,leaf	AlexNet gives the 99.34%
5.Grapes	LeNet	Real environment	CA(95.8%)
6. Leaf images from plant	VGG-19	Plant Village	Testing accuracy 98.3%
7. Leaf images from plant	VGGNet	Plant Village	Testing accuracy 99.5%
8. Leaf images from crop	GoogLeNet	Plant Village	Testing accuracy 99.3%
9.Potato leaf	ResNet-50 + SVM	Plant Village	Testing accuracy 98%
10.Tomato,Potato,Maize Leaf	VGG-19 + Logistic Regression	Plant Village	Testing accuracy 97.8%
11.Tea Leaf	LeNet,SVM,MLP	Images taken from real field	Testing accuracy 86.78%
12.Maize	CNN	Plant Village	CA (92.85%)

III. Gap Analysis

- Leaf image database for a specific culture having complete acquisition is difficult to obtain. Less than 10% of works have used large size databases. Even Testing through real field images is also a concern.
- Many classification algorithms have over-fitting and high error rates.
- Many systems focus only on leaf datasets and do not consider the entire region of the plant, in such cases hard to achieve reasonable accuracy.
- Pre-processing techniques are not being focused on much, and no standardization of procedures is yet to be achieved.
- In-depth exploration of Deep learning architecture generates high time complexity issues.
- The hybrid and adaptable system with variable needs is needed.

IV. Conclusion

I have want to investigate specialized Model were developed using deep learning, traditional machine learning algorithms using image processing, for identification of plant diseases using healthy and infected images of leaves. This can help the farmer for proper production of good quality crops. It is eventually proportional to National Economic Growth.Based on high-level performance, it becomes evident that Deep Learning CNN are highly suitable. Deep Learning is recent research technique for image processing and pattern recognition.

References

[1] Amara, J.; Bouaziz, B.; Algergawy, A. A deep learning-based approach for banana leaf diseases classification. In Datenbanksysteme für Business, Technology und Web (BTW 2017)-Workshopband; German Informatics Society: Bonn, Germany, 2017.
[2] Wang, G.; Sun, Y.; Wang, J. Automatic image-based plant disease severity estimation using deep learning. Comput. Intell. Neurosci. 2017, 2017, 2917536.
[3] Mohanty, S.P.; Hughes, D.P.; Salathé, M. Using deep learning for image-based plant disease detection. Front. Plant Sci. 2016, 7, 1–10.
[4] Sladojevic, S.; Arsenovic, M.; Anderla, A.; Culibrk, D.; Stefanovic, D. Deep neural networks based recognition of plant diseases by leaf image classification. Comput. Intell. Neurosci. 2016, 2016, 3289801.
[5] Mohanty, S.P., Hughes, D.P., Salathé, M., 2016. Using deep learning for image-based plant disease detection. Front. Plant Sci. 7, 1–10.
[6] Chohan, M., Khan, A., Katper, S., Mahar, M., 2020. Plant disease detection using deep learning. Int. J. Recent Technol. Eng. 9 (1), 909–914
[7] Ferentinos, K.P., 2018. Deep learning models for plant disease detection and diagnosis. Comput. Electron. Agric. 145, 311–318.

[8] Mohameth, F., Bingcai, C., Sada, K.A., 2020. Plant disease detection with deep learning and feature extraction using Plant Village. J. Comp. Commun. 8 (6), 10–22

[9] Khamparia, A., Saini, G., Gupta, D., Khanna, A., Tiwari, S., de Albuquerque, V.H.C., 2020.Seasonal crops disease prediction and classification using deep convolutional encoder network. Circ. Syst. Sign. Proc. 39, 818–836

[10] Krithika, N., Selvarani, A.G., 2017. An individual grape leaf disease identification using leaf skeletons and KNN classification. 2017 International Conference on Innovations in Information, Embedded and Communication Systems(ICIIECS). IEEE, Coimbatore, India, pp. 1–5

[11] 56. Sibiya M., Sumbwanyambe M. A Computational Procedure for the Recognition and Classification of Maize Leaf Diseases Out of Healthy Leaves Using Convolutional Neural Networks. AgriEngineering. 2019;1:119–131. doi: 10.3390/agriengineering1010009.

[12] DeChant C., Wiesner-Hanks T., Chen S., Stewart E.L., Yosinski J., Gore M.A., Nelson R.J., Lipson H. Automated identification of northern leaf blight-infected maize plants from field imagery using deep learning. Phytopathology. 2017;107:1426–1432. doi: 10.1094/PHYTO-11-16-0417-R.