International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 08 Issue: 04 | April - 2024 SJIF Rating: 8.448 ISSN: 2582-3930

Automated Leaf Disease Diagnosis with Deep Learning

Sakshi Abhale[1], Shrutika Bhavsar[2], Kadambari Ghadge[3], Akash Sale[4]

[1] Electronics & Telecommunication, Sinhgad Institute of Technology and Science, Narhe, Pune
[2]Electronics & Telecommunication, Sinhgad Institute of Technology and Science, Narhe, Pune
[3]Electronics & Telecommunication, Sinhgad Institute of Technology and Science, Narhe, Pune
[4]Electronics & Telecommunication, Sinhgad Institute of Technology and Science, Narhe, Pune

---

Abstract - Agriculture is crucial for India's economy, but one problem is identifying plant diseases, especially in remote areas where contacting experts is difficult. Wrong disease identification can lead to crop loss. Even government agriculture departments sometimes give incorrect advice to farmers. To tackle this, a dataset of apple crop images has been created to help identify healthy and diseased leaves accurately. These images come from different angles and directly from apple fields. The early disease detection in agriculture, particularly focusing on diseases affecting apple crops. Specifically, it mentions diseases like early blight, late blight, black scurf, common scab that can affect apple plants. It discusses using automatic methods like Convolutional Neural Networks (CNN) to detect and classify these diseases based on a dataset. The approach involves automatic feature extraction and classification using colur information.

1.INTRODUCTION

The " Automated Leaf Disease Diagnosis with Deep Learning" project utilizes smart technology, specifically Convolutional Neural Networks (CNN), to accurately distinguish between healthy and diseased apple leaves. By analyzing images from plots, the CNN algorithm detects diseases reliably, allowing farmers to take timely action to protect their plants. This approach not only assists in disease identification but also reduces farming costs by preventing further damage to crops. Project that helps farmers detect diseases in apple crops using smart technology. They use a computer program called a Convolutional Neural Network (CNN) to analyze images of apple leaves and accurately identify any diseases. This helps farmers take quick action to protect their plants, reducing costs and promoting healthier harvests. Ultimately, the project aims to enhance farming practices, promote sustainable agriculture, and contribute to global food security by leveraging advanced technology for automated disease identification in apple crops.

2. Literature Review

Paper No	Technology Used	Methodology	Accuracy
[1]	Machine Learning	They used a DL approach based on the Google Net Inception structure and the rainbow concatenation for apple leaf disease detection. They generated a custom dataset of 2,029 images of diseased apple leaves and trained their algorithm to detect five common apple leaf diseases: Alternaria leaf spot, brown spot, mosaic, grey spot, and rust.[1]	78.80%
[2]	Machine Learning	The goal of Huang et al was to develop a decision support system for spraying machines that could identify Helminthosporium leaf spots in wheat fields using remote sensing data from a UAV. The dataset was divided into four categories based on disease severity: normal, light, medium, and heavy. In the preprocessing step, they extracted 100 × 100 samples from the images.[2]	91.43%
[3]	Deep Learning	Karlekar and Seal proposed a computer vision method to	98.14%

		identify and categorize leaf diseases present in soybean crops. The proposed approach separates the leaf section by removing the complex background from the entire image. Following this, a deep learning Convolutional Neural Network (CNN) known as Soy Net, trained on a 16-class dataset called PDDB.[3]	
[4]	Deep Learning	Mohanty et al trained Alex Net and Google Net for detecting 26 diseases on 14 crop species using the Plant Village dataset with 54, 306 images. In the preprocessing step, they downsized images to 256 × 256. They also experimented with the original Plant Village dataset, with a grey-scaled version of this dataset, and a version in which the leaves were segmented.[4]	99%
[5]	Deep Learning	P Vishnu, K Sangeetha ,Ninisa B A ,Samiksha , Sanjutha et.al, examined the problem of plant disease detection, which is done visually for identification of plant disease. Compared to other forms of photographic photos, plant disease images are more likely to feature randomly spread lesions, variable symptoms, and complicated backdrops, making discriminative in-formation difficult to capture. Plant Village Dataset, which contains 20,000 photos divided into 15 classifications, is used to help with plant disease recognition study.[5]	96.63%
[6]	Deep Learning	Oppenheim and Shani [20] used a CNN based on VGG [21] to classify potatoes into five classes, four diseased ones and a healthy potato class. They acquired 400 images of contaminated potatoes using three simple digital cameras and augmented data by flipping and cropping the images. In the preprocessing step, they downsized images to 224 × 224 and converted to grayscale.[6]	96%
[7]	Machine Learning	Khalili et al. [68] experimented with six different ML algorithms, namely MLP, Gradient Tree Boosting (GBT), L1 regularization (LR-L1), L2 regularization (LR-L2), SVM, and RF in order to forecast charcoal rot disease in soybean on a custom dataset [69] of 2,000 healthy and diseased plants.[7]	96.79%
[8]	Machine Learning	Author introduced a CNN model with eight hidden layers that is lightweight and designed for classifying nine types of diseases in tomato crops. The model outperformed traditional ML techniques and pre-trained models with an accuracy of 98.4% on the publicly available Plant Village dataset, which had 200–1400 images in different	98.4%

		classes.[8]	
[9]	Deep Learning	Wang et al trained and fine-tuned four CNN models, for detecting apple leaf black rot. The authors utilized the Plant Village dataset, which contained two classes of images: healthy apple leaves and apple leaf black rot. The images were further categorized by botanists into four stages: healthy, early stage, middle stage, and end stage.[9]	90.4%
[10]	Deep Learning	Author introduced a multi-stage CNN architecture that was based on AlexNet, aimed at identifying diseases in rice plants. They preprocessed the images by resizing them to 512×512 pixels and then applied the ZCAWhitening technique to remove the correlation between data.[10]	

Problem Statement:

To develop an advanced deep learning system that can accurately detect and diagnose plant leaf diseases by leveraging cutting-edge computer vision techniques and deep neural networks for early disease identification to enhance plant health and agricultural productivity.

Experimentation Platform:

The experiment was done using Google Collab, which is an online platform for coding, and a dataset that had pictures of apple leaves with five types of diseases, plus some pictures of healthy leaves.
Language: Python
Algorithm: CNN
Library: Matplotlib, NumPy, Pandas, Tensor Flow

Summary

This project helps farmers by improving crop yields and managing diseases. It identifies problems early on, which helps increase productivity. In the future, it can detect diseases in multiple crops and use data to predict and prevent diseases. Farmers can access this through easy-to-use apps, making it simpler to identify and address plant diseases.

REFERENCES

1 P. Jiang, Y. Chen, B. Liu, D. He, and C. Liang, ‘‘Real-time detection of apple leaf diseases using deep learning approach based on improved convolutional neural networks,’’ IEEE Access, vol. 7, pp. 59069–59080, 2019.[1]
2. H. Huang, J. Deng, Y. Lan, A. Yang, L. Zhang, S. Wen, H. Zhang, Y. Zhang, and Y. Deng, ‘‘Detection of helminthosporium leaf blotch disease based on UAV imagery,’’ Appl. Sci., vol. 9, no. 3, p. 558, Feb. 2019.[2]
3. A. Karlekar and A. Seal, ‘‘SoyNet: Soybean leaf diseases classification,’’ Comput. Electron. Agricult., vol. 172, May 2020, Art. no. 105342.[3]
4. S.P. Mohanty, D. P. Hughes, and M. Salathe, ‘‘Using deep learning for image-based plant disease detection,’’ Frontiers Plant Sci., vol. 7, p. 1419, Sep. 2016.[4]
5. P. V. Raja, K. Sangeetha, N. B A, S. M and S. S S, ”Convolutional Neural Networks based Classification and Detection of Plant Disease,” 2022 6th International Conference on 1488.[5]
6. D. Oppenheim and G. Shani, ‘‘Potato disease classification using convolution neural networks,’’ Adv. Animal Biosci., vol. 8, no. 2, pp. 244–249, 2017.[6]
7. E.Khalili, S. Kouchaki, S. Ramazi, and F. Ghanati, ‘‘Machine learning techniques for soybean charcoal rot disease prediction,’’ Frontiers Plant Sci., vol. 11, Dec. 2020, Art. no. 590529 .[7]
8. M. Agarwal, S. K. Gupta, and K. K. Biswas, ‘‘Development of efficient CNN model for tomato crop disease identification,’’ Sustain. Comput., Informat. Syst., vol. 28, Dec. 2020, Art. no. 100407. [8]
9. G. Wang, Y. Sun, and J. Wang, ‘‘Automatic image-based plant disease severity estimation using deep learning,’’ Comput. Intell. Neurosci., vol. 2017, pp. 1–8, Jul. 2017. [9]
10. Y. Lu, S. Yi, N. Zeng, Y. Liu, and Y. Zhang, ‘‘Identification of rice diseases using deep convolutional neural networks,’’ Neurocomputing, vol. 267, pp. 378–384, Dec. 2017. [10]