IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.67
Volume 5, Issue 2, March 2025

Plant Leaf Disease Detection using Machine Learning Algorithms

Shinde Dipali Ramesh[1], Shinde Sanskruti Rajendra[2], Gorgal Onkar Hanumant [3] Prof. Nawale S. K[4]
Students, Department of Computer Engineering[1,2,3]
Guide, Department of Computer Engineering[4]
Samarth Polytechnic College, Bangarwadi, Belhe, Maharashtra, India

Abstract: *Plant diseases significantly impact agricultural productivity, leading to reduced crop yields and economic losses. Early and accurate detection of plant leaf diseases is crucial for effective management and prevention. This project proposes a machine learning-based approach for the detection and classification of plant leaf diseases. By utilizing image processing techniques and machine learning algorithms, the system analyzes leaf images to identify the presence of diseases such as blight, mildew, and rust. Preprocessing techniques, including resizing, normalization, and color space conversion, prepare the images for feature extraction. Convolutional Neural Networks (CNNs) are used for feature learning and classification due to their superior ability to recognize patterns in visual data. The model is trained on a dataset of labeled leaf images and achieves high accuracy in detecting common plant diseases. The proposed system can be deployed as a mobile or web-based application, enabling farmers and agricultural professionals to monitor crop health effectively. This project aims to reduce crop losses, enhance agricultural sustainability, and support precision farming practices.*

Keywords: Plant Leaf Disease, Machine Learning Alogorithms, Detection

I. INTRODUCTION

Agriculture is the backbone of many economies, providing food, raw materials, and employment to millions. However, the sector faces significant challenges, including the threat of plant diseases that can devastate crops and lead to substantial financial losses. Traditional methods of disease detection rely on manual inspection, which is time-consuming, labor-intensive, and often prone to errors due to the need for expert knowledge.

With advancements in technology, machine learning offers a promising solution to automate and enhance the detection of plant leaf diseases. By leveraging image processing and machine learning algorithms, diseases can be identified at an early stage, enabling timely intervention and minimizing crop damage. This project focuses on developing a machine learning-based system that uses image data of plant leaves to detect and classify diseases accurately.

II. LITERATURE SURVEY

In 2015, S. Khirade et Al. tackled the problem of plant disease detection using digital image processing techniques and back propagation neural network (BPNN) [1]. Authors have elaborated different techniques for the detection of plant disease using the images of leaves. They have implemented Otsu's thresholding followed by boundary detection and spot detection algorithm to segment the infected part in leaf. After that they have extracted the features such as color, texture, morphology, edges etc. for classification of plant disease. BPNN is used for classification i.e. to detect the plant disease. Shiroop Madiwalar and Medha Wyawahare analyzed different image processing approaches for plant disease detection in their research [2]. Authors analyzed the colour and texture features for the detection of plant disease. They have experimented their algorithms on the dataset of 110 RGB images. The features extracted for classification were mean and standard deviation of RGB and YCbCr channels, grey level cooccurrence matrix (GLCM) features, the mean and standard deviation of the image convolved with Gabor filter. Support vector machine classifier was used for classification. Authors concluded that GCLM features are effective to detect normal leaves. Whereas colour features and Gabor filter features are considered as best for detecting anthracnose affected leaves and leaf spot respectively. They have achieved highest accuracy of 73.34% using all the extracted features. Peyman Moghadam et Al.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.67
Volume 5, Issue 2, March 2025

demonstrated the application of hyperspectral imaging in plant disease detection task [3]. visible and near-infrared (VNIR) and short- wave infrared (SWIR) spectrums were used in this research. Authors have used k-means clustering algorithm in spectral domain for the segmentation of leaf. They have proposed a novel grid removal algorithm to remove the grid from hyperspectral images.

III. METHODOLOGY

System Architecture / Block Diagram

This web application is a tool for cable operators or service providers, an automated software for bill collectors, and a billing and service management aid. This app is essential for cable service providers to have because of its straightforward user interface and user-friendly, enticing features. According to TRAI, the addressability would be brought by the Subscriber Management System, and subscribers may choose the Services they wanted.

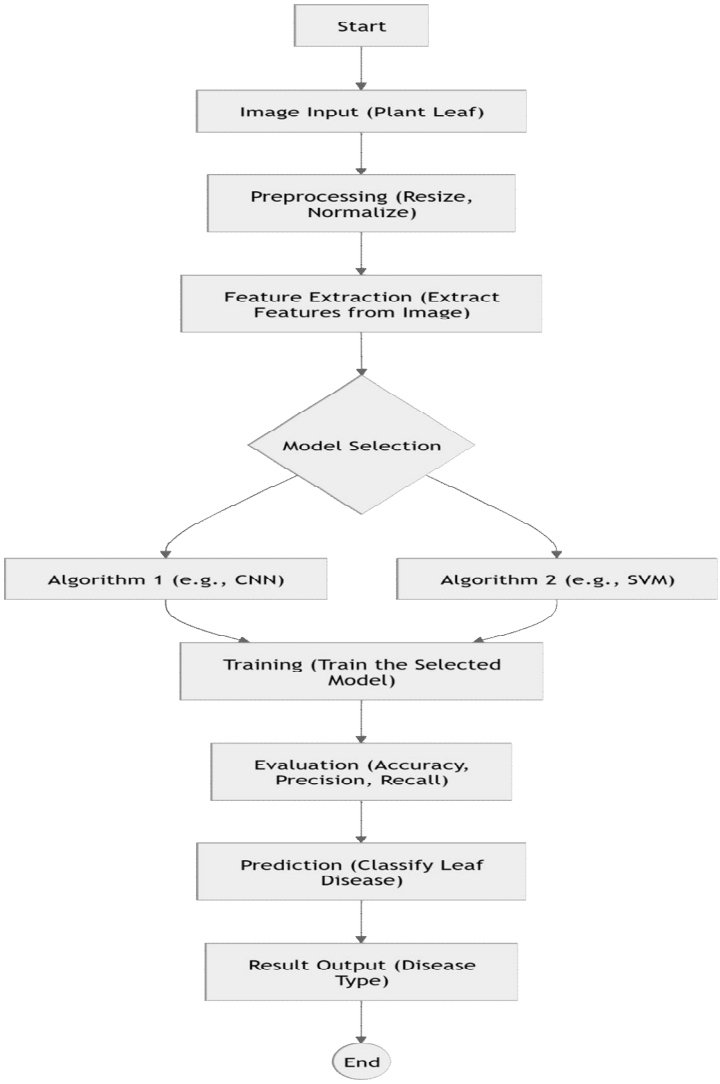

Fig. 1.Architecture Diagram

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.67
Volume 5, Issue 2, March 2025

IV. APPLICATIONS

Agricultural Disease Management:
Early detection of diseases in crops helps farmers take timely preventive measures, reducing crop loss and ensuring higher yields. Machine learning-based detection systems provide accurate diagnoses that improve decision-making in disease management.

Precision Agriculture:
Integrating the system with smart farming technologies enables precise monitoring of crops. Farmers can focus on affected areas, reducing the use of pesticides and fertilizers while optimizing resource utilization.

Research and Development:
Machine learning algorithms help agricultural researchers study the patterns and causes of plant diseases. These insights can lead to the development of disease-resistant crop varieties.

Remote Monitoring and Automation:
Coupled with drones and IoT devices, the system allows remote monitoring of large agricultural fields. Automated disease detection and reporting make large-scale farming more efficient.

Agricultural Advisory Services:
Such systems can be integrated into mobile or web-based advisory platforms, enabling small-scale farmers to diagnose plant diseases without the need for expensive diagnostic services.

Supply Chain Optimization:
By detecting diseases early, the system helps reduce the risk of spreading infections during transport and storage, ensuring better quality in agricultural supply chains.

Environmental Sustainability:
These applications collectively enhance agricultural productivity, sustainability, and resilience, making machine learning a valuable asset in modern agriculture.

V. CONCLUSION

In conclusion, the project "Plant Leaf Disease Detection Using Machine Learning Algorithms" demonstrates the transformative potential of technology in modern agriculture. By leveraging advanced image processing techniques and machine learning algorithms, this system offers an efficient, accurate, and user-friendly solution for detecting plant diseases at an early stage. It empowers farmers and agricultural stakeholders to take timely and informed actions, reducing crop losses and promoting healthier yields.

The integration of this technology into farming practices not only optimizes resource usage but also supports environmentally sustainable agriculture by minimizing the overuse of chemicals and pesticides. Additionally, the system's adaptability ensures its application across diverse crops and regions, making it a scalable solution for global agricultural challenges. This project signifies a step forward in merging technology with agriculture to address critical issues, enhance productivity, and contribute to the overall goal of food security and sustainable farming practices.

REFERENCES

[1]. S. D. Khan, Y. Salih, B. Zafar, and A. Noorwali, "A deep-fusion network for crowd counting in high-density crowded scenes," International Journal of Computational Intelligence Systems, vol. 14, no. 1, pp. 1–12, 2021.

[2]. B. Saleh, K. Sultan Daud, and U. Habib, "Scale driven convolutional neural network model for people counting and localization in crowd scenes," IEEE Access, vol. 7, pp. 71576– 71584, 2019.M.

[3]. Z. Li, C. Peng, G. Yu, X. Zhang, Y. Deng, and J. Sun, "DetNet: a backbone network for object detection," 2018, http://arxiv.org/abs/1804.06215.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.67
Volume 5, Issue 2, March 2025

[4]. Y. Li, X. Zhang, and D. Chen, "CSRNet: dilated convolutional neural networks for understanding the highly congested scenes," in Proceedings of the IEEE conference on computer vision and pattern recognition, pp. 1091–1100, SALT LAKE CITY US, 2018.

[5]. D. Sam Babu, S. Surya, and R. Venkatesh Babu, "Switching convolutional neural network for crowd counting," in Proceedings of the IEEE conference on computer vision and pattern recognition, pp. 5744–5752, Honolulu, Hawaii, 2017.

[6]. Y. Zhang, D. Zhou, S. Chen, S. Gao, and Y. Ma, "Single-image crowd counting via multi- column convolutional neural network," in Proceedings of the IEEE conference on computer vision and pattern recognition, pp. 589–597, LAS VEGAS, US, 2016.

[7]. G. Wilson, D. A. Knowles, and Z. Ghahramani, "Gaussian process regression networks," 2011, http://arxiv.org/abs/1110.4411.

[8]. A G. Wilson, D. A. Knowles, and Z. Ghahramani, "Gaussian process regression networks," 2011, http://arxiv.org/abs/1110.4411.

[9]. T. Peng, Q. Li, and P. Zhu, "Rgb-t crowd counting from drone: a benchmark and MMCCN network," in Proceedings of the Asian Conference on Computer Vision, Singapore, November 1-4 2020.