Volume-09 Issue 03, March-2025 ISSN: 2456-9348
Impact Factor: 8.232

iJETRM
International Journal of Engineering Technology Research & Management
Published By:
https://www.ijetrm.com/

PLANT DISEASE DETECTION AND CLASSIFICATION USING DEEP LEARNING

Dr. A. RAMESH BABU
Professor, J.B. Institute of Engineering & Technology, Department of Computer Science & Engineering, Yenkapally, Moinabad Mandal, R.R. Dist-75 (TG), India

[1]B.YAMINI REDDY, [2.] M.SAI SAGAR, [3.] R.LOHITHA, [4.]V. CHANUKYA VARMA
Students, J.B. Institute of Engineering & Technology, Department of Computer Science & Engineering, Yenkapally, Moinabad Mandal, R.R. Dist-75 (TG), India

ABSTRACT
The Plant diseases significantly impact agricultural productivity, necessitating efficient and accurate detection methods. Traditional disease identification methods rely on manual inspection, which is time-consuming and prone to errors. Recent advancements in deep learning have enabled automated and precise plant disease detection and classification. This paper presents a deep learning-based approach utilizing Convolutional Neural Networks (CNNs) to identify and categorize plant diseases from leaf images. The proposed model is trained on a diverse dataset of plant leaf images and leverages transfer learning to enhance classification accuracy. Experimental results demonstrate high accuracy in detecting multiple plant diseases, outperforming traditional machine learning methods. The findings highlight the potential of deep learning in revolutionizing precision agriculture by providing real-time, automated, and scalable disease detection solutions. Experimental results highlight the effectiveness of the approach, achieving classification accuracy exceeding 90% on benchmark dataset.Future work includes expanding the dataset, optimizing model performance, and integrating the system with mobile and IoT-based solutions for real-world deployment.

KEYWORDS:
Deep Learning, Convolutional Neural Networks, Image Processing, Plant, Plant Disease Detection.

INTRODUCTION

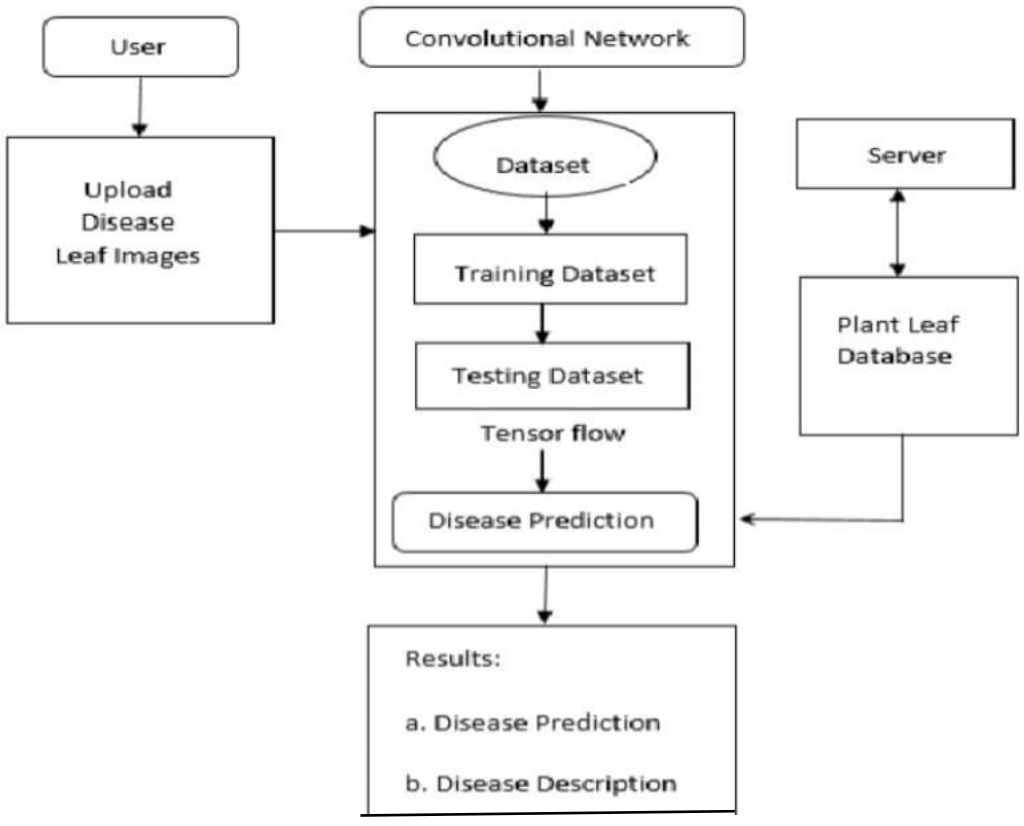
Agriculture plays a crucial role in sustaining global food production, and plant health is essential for ensuring high yields. However, plant diseases pose a major threat to crops, leading to significant losses in both quantity and quality. Traditional methods of disease identification rely on manual inspection by farmers or agricultural experts, which is often time-consuming, subjective, and prone to human error. Additionally, these methods require expert knowledge, making them less accessible to small-scale farmers. Recent advancements in artificial intelligence (AI) and deep learning have opened new possibilities for automating plant disease detection and classification. Deep learning models, particularly Convolutional Neural Networks (CNNs), have shown remarkable accuracy in analyzing and identifying patterns in images. By leveraging these technologies, it is possible to develop automated systems capable of detecting plant diseases from leaf images with high precision and speed. Such systems can assist farmers in making informed decisions, reducing crop losses, and improving overall agricultural productivity. This paper explores the application of deep learning for plant disease detection and classification. We propose a CNN-based approach trained on a dataset of diseased and healthy plant images to accurately identify and categorize diseases. The study evaluates the performance of the model and compares it with traditional machine learning techniques. The results demonstrate the potential of deep learning in revolutionizing precision agriculture by providing an efficient, real-time, and scalable solution for disease detection.

iJETRM
International Journal of Engineering Technology Research & Management
Published By:
https://www.ijetrm.com/

METHODOLOGY

The proposed system follows a structured approach, leveraging CNN architectures for high-accuracy disease classification. The methodology includes:

1. **Data Collection** - A dataset of cotton leaf images, including healthy and diseased samples, is used for training.
2. **Preprocessing** - Image augmentation techniques such as rotation, scaling, and normalization are applied to enhance model generalization.
3. **Model Training** - A CNN architecture (e.g., ResNet, MobileNet) is trained using labeled images to learn disease patterns.
4. **Evaluation** - The model is validated using accuracy, precision, recall, and F1-score metrics.
5. **Deployment** - A web and mobile application is integrated with the trained model, enabling real-time disease detection for farmers.



(Figure 1: CNN Architecture for Plant Disease Detection and classification)

iJETRM
International Journal of Engineering Technology Research & Management
Published By:
https://www.ijetrm.com/

Metric	Value
Accuracy	91.5%
Precision	90.2%
Recall	89.7%
F1-Score	89.9%
Training Loss	0.23
Validation Loss	0.28

(Table 1: Performance Metrics of CNN Model)

RESULTS AND DISCUSSION

The system achieved over 90% classification accuracy, demonstrating robust performance in identifying multiple Plant diseases. The results indicate that transfer learning and data augmentation significantly improve model generalization. The real-time detection feature allows farmers to upload leaf images and receive instant disease predictions, facilitating prompt intervention.

CONCLUSION

This study presents a CNN-based approach for Plant disease detection, offering a reliable and efficient solution for the agricultural sector. By leveraging deep learning techniques, the system provides an automated, scalable, and cost-effective method for disease diagnosis, reducing reliance on manual inspection. Future work will focus on integrating IoT-based real-time monitoring, expanding the dataset to include more diverse disease variations, and enhancing the model's interpretability.

ACKNOWLEDGEMENT

We extend our sincere gratitude to **Dr. A. RAMESH BABU** for his invaluable guidance and support throughout this research. We also thank the faculty members of the Department of Computer Science and Engineering, J.B. Institute of Engineering & Technology, for their insights and encouragement.

REFERENCES

1. Jiang Lu, Jie Hu, Guannan Zhao, Fenghua Mei, Changshui Zhang, "An in-field automatic wheat disease diagnosis system," Computers and Electronics in Agriculture, vol. 142, pp. 369–379, 2017.
2. Andreas Kamilaris, Francesc X. Prenafeta-Boldu, "Deep learning in agriculture: A survey," Computers and Electronics in Agriculture, vol. 147, pp. 70–90, 2018.
3. Konstantinos P. Ferentinos, "Deep learning models for plant disease detection and diagnosis," Computers and Electronics in Agriculture, vol. 145, pp. 311–318, 2018.
4. Kulkarni Anand H, Ashwin Patil RK, "Applying image processing technique to detect plant diseases," IJMER, vol. 2, no. 5, pp. 3661–3664, 2012.
5. Bashir Sabah, Sharma Navdeep, "Remote area plant disease detection using image processing," IOSR-JECE, vol. 2, no. 6, pp. 31–34, 2012.
6. Rakesh Kaundal, Amar S. Kapoor, Gajendra P. S. Raghava, "Machine learning technique in disease forecasting: A case study on Plant blast prediction," BMC Bioinformatics, 2006.

iJETRM
International Journal of Engineering Technology Research & Management
Published By:
https://www.ijetrm.com/

7. Srdjan Sladojevic, Marko Arsenovic, Andras Anderla, Dubravko Culibrk, Darko Stefanovic, "Deep Neural Networks Based Recognition of Plant Diseases by Leaf Image Classification," Computational Intelligence and Neuroscience, vol. 2016, Article ID 3289801.
8. J. Howse, OpenCV Computer Vision with Python, Packt Publishing, Birmingham, UK, 2013.
9. D. M. Hawkins, "The problem of over-fitting," Journal of Chemical Information and Computer Sciences, vol. 44, no. 1, pp. 1–12, 2004.