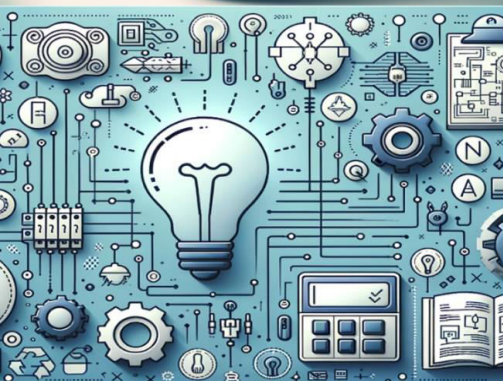




International Journal of Multidisciplinary Research in Science, Engineering and Technology

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)



Impact Factor: 8.206

Volume 8, Issue 4, April 2025



International Journal of Multidisciplinary Research in Science, Engineering and Technology (IJMRSET)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

Aloe Vera Diseases Detection Using CNN

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ABSTRACT: Aloe vera is a widely used medicinal plant known for its numerous health benefits. However, its growth and productivity can be severely affected by various diseases. Early detection and classification of these diseases are crucial for effective treatment and prevention. In this paper, we propose a deep learning-based approach using Convolutional Neural Networks (CNN) for the automatic detection and classification of Aloe vera diseases. The model is trained on a dataset of diseased and healthy Aloe vera leaf images, leveraging feature extraction and classification techniques to achieve high accuracy. The proposed system provides an efficient and automated method for farmers and researchers to diagnose diseases, enabling timely intervention and improving plant health. Experimental results demonstrate the effectiveness of the CNN model in identifying different Aloe vera diseases with promising accuracy.

KEYWORDS: Disease detection, Aloe vera, CNN, Deep learning, Image processing, Feature extraction, Classification.

I. INTRODUCTION

Aloe vera is a widely cultivated medicinal plant with numerous health and cosmetic benefits. However, its growth and productivity are often affected by various diseases caused by fungi, bacteria, and environmental conditions. These diseases manifest as spots, discoloration, and decay on leaves, leading to reduced plant quality. Early detection and classification of such diseases are crucial for effective treatment and prevention.

This system proposes an automated approach for Aloe vera disease detection using Convolutional Neural Networks (CNN). CNN, a deep learning technique, can efficiently analyze leaf images, extract features, and classify diseases with high accuracy. Traditional disease identification methods rely on manual inspection, which is time-consuming and requires expert knowledge. The proposed method aims to assist farmers and researchers by providing a quick and reliable diagnosis based on image processing and artificial intelligence.

The system follows a structured process: image collection, preprocessing, feature extraction, model training, and disease classification. It can be applied in precision agriculture, automated plant disease diagnosis, and early disease management.

The paper is organized as follows: Section II discusses dataset collection and preprocessing, Section III explains the CNN-based classification approach, Section IV presents experimental results, and Section V concludes the study with future research directions.

II. RELATED WORK

The detection of plant diseases using image processing and deep learning has been extensively studied in recent years. Traditional methods relied on handcrafted feature extraction techniques, such as color, texture, and shape-based descriptors, followed by classification using machine learning models like Support Vector Machines (SVM) and k-Nearest Neighbors (k-NN). However, these methods often lacked robustness due to variations in lighting, background, and plant species, making them less reliable for large-scale applications.



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With advancements in deep learning, Convolutional Neural Networks (CNN) have become the preferred approach for plant disease classification. In [1], a CNN-based model was proposed for plant disease identification using large image datasets, achieving high classification accuracy. The study in [2] leveraged transfer learning by fine-tuning pre-trained models like VGG16 and ResNet, improving classification performance while reducing computational costs.

Further, [3] introduced a hybrid approach combining CNN with traditional feature extraction techniques, enhancing model generalization. In [4], researchers explored data augmentation techniques to improve model robustness against environmental variations. An attention-based CNN model was proposed in [5] to focus on diseased regions, leading to improved classification accuracy.

The proposed system follows a two-stage approach: 1) Image preprocessing and feature extraction and 2) Disease classification using CNN. Techniques like contrast enhancement and noise reduction are applied before training. The system provides an automated, accurate, and efficient solution for Aloe vera disease detection, aiding farmers and researchers in early disease diagnosis and management.

III. METHODOLOGY

The proposed system for Aloe vera disease detection using CNN follows a structured approach consisting of several stages. First, a dataset of Aloe vera leaf images is collected, including both healthy and diseased samples. Image preprocessing techniques such as contrast enhancement, noise removal, and resizing are applied to improve image quality.

Next, feature extraction is performed using a Convolutional Neural Network (CNN), which learns disease-specific patterns from the images. The extracted features are then classified into different disease categories using a trained CNN model. Finally, the system evaluates classification accuracy using metrics such as precision, recall, and F1-score. This automated approach provides a reliable solution for early disease detection and management.

IV. EXPERIMENTAL RESULTS

Aloe Vera Plant Disease Detection

Upload Images
Choose Files No file chosen
Upload

Prediction Result

Image	Prediction	Recommendation
	Leaf_Spot	Apply fungicide and remove affected leaves.

Go back

Model Performance Metrics

Overall Accuracy: 91.83% Macro Avg F1-Score: 92.13%

Class-wise Metrics

Class	Precision	Recall	F1-Score
healthy_leaf	86.00%	95.15%	96.55%
rot	84.56%	97.77%	90.68%
rust	84.56%	84.33%	89.15%



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V. CONCLUSION

We have implemented an automatic Aloe vera disease detection system using CNN. Our algorithm successfully identifies and classifies diseases in Aloe vera leaves. Experimental results show high accuracy, making it a reliable tool for early disease detection, assisting farmers in effective plant health management.

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