e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:07/Issue:03/March-2025 Impact Factor- 8.187 www.irjmets.com

PLANT SPECIES AND DISEASE DETECTION

Ritika Chavan*1, Sanchita Gangawane*2

*1,2Department Of Information Technology, B K Birla College Kalyan, Mumbai, India.

ABSTRACT

The proposed research consists in applying machine learning approaches to the task of identifying plant diseases and species. Plants health is very important to food security and the overall production of crops hence there is need to identify plant diseases as early as possible. This study aims at applying machine learning algorithms identify to diseases identify on plant leaves. species Thus, and the model is trained on a dataset of different plant species and the diseases that affect them, with the aim of differentiating between healthy and diseased leaves. Several machine learning models such as Convolutional Neural Networks (CNNs) have been used in order to improve the efficiency of detection. The outcomes indicate how machine learning can help in identification making of quick, diseases automatic which and if correct treated in time can help in preventing crop damage and supporting the concept of sustainable agriculture.

I. INTRODUCTION

Plants play a vital role in our lives, supporting human health and well-being in ways. The relationship between human beings and plants are also very close. In addition, plants are important means of circumstances and production of human beings. Thus understanding and protecting plant diversity is essential for maintaining a balanced ecosystem and ensuring our well-being. It is very necessary to set up a database for plant protection. We believe that the first step is to teach a computer how to classify plants.

Plant species and disease detection are crucial tasks in agriculture and forestry management, as they help prevent crop losses, maintain high yields, and promote sustainable agriculture. Accurate identification of plant species helps in understanding their specific needs and vulnerabilities, while disease detection enables early intervention to prevent the spread of pathogens. Traditional methods of plant species and disease detection are often time-consuming, labour-intensive, and expensive. With the emergence of machine learning (ML) and computer vision techniques, there have been several attempts to automate this process. This paper aims to provide an overview of the current methods and Research in plant species and disease detection using ML. Researchers have used ML techniques to classify plant species based on leaf shape, texture, and color. CNNs have been particularly effective in this area, enabling accurate classification of plant species from images.

Some studies have also explored the use of plant phenotyping, which involves the analysis of plant traits such as leaf Area, height, and volume, to distinguish between plant species. Additionally, researchers have developed automated plant species identification systems based on plant DNA analysis, enabling more accurate and reliable identification of plant species.

- Role of Agriculture: Emphasizes agriculture's importance for global food security and economic stability.
- Impact of Plant Diseases: Highlights how diseases threaten crop yield and quality, leading to economic losses.
- Technological Innovations: Introduces advancements like remote sensing, machine learning, and image processing for disease detection.
- Detection Challenges: Notes issues such as symptom variability and the need for rapid assessment in diverse plant species.
- Study Objectives: Aims to develop a reliable application for early disease detection and identification of affected species.
- Research Gaps: Identifies existing gaps in literature that the study will address.
- Broader Implications: Discusses potential benefits, including improved resource management, reduced pesticide use, and enhanced sustainability.

II. METHODOLOGY

Recent advancements in plant species and disease detection have leveraged a combination of traditional and

e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:07/Issue:03/March-2025 Impact Factor- 8.187 www.irjmets.com

modern techniques. Machine learning (ML) and deep learning (DL) models, particularly Convolutional Neural Networks (CNNs), have shown significant promise in analyzing plant images to detect diseases. These models can classify, detect, and segment diseased areas within images. Image processing techniques, including digital image processing and machine vision, further enhance disease detection by using algorithms to process plant images. Despite these advancements, challenges such as data availability, imaging quality, and differentiation between similar symptoms persist, highlighting the need for continued research and development in this field.

This dataset contains a comprehensive collection of images and corresponding labels of various plant diseases. It is designed to support the development and testing of machine learning models, particularly for tasks related to image classification and disease detection in plants. The dataset is structured with images categorized by plant species and disease type, including healthy plant samples.

Plant species and disease detection aims at gather extensive datasets from platforms like Kaggle and Hugging Face to create a comprehensive collection of images depicting various crops and plants, with the goal of detecting diseases. This dataset will be stored in a repository, such as Train Valid, and will include well-known datasets like ILSVRC/Imagenet-1k. By leveraging machine learning and deep learning techniques, you aim to train models that can accurately identify and classify plant diseases. This approach will help in early detection and management of plant diseases, potentially improving crop yields and reducing losses.

Data Dictionary and ER Diagram

A data dictionary is essential for defining and organizing the data elements used in the project. Below is a sample data dictionary tailored for the plant species and disease detection project, which includes various fields related to environmental factors and plant health:

Data-processed/fertilizer.csv.

1		Crop	N	P	K	pH	soil_moisture
2	0	rice	80	40	40	5.5	30
3	3	maize	80	40	20	5.5	50
4	5	chickpea	40	60	80	5.5	60
5	12	kidneybeans	20	60	20	5.5	45
6	13	pigeonpeas	20	60	20	5.5	45
7	14	mothbeans	20	40	20	5.5	30
8	15	mungbean	20	40	20	5.5	80
9	18	blackgram	40	60	20	5	60
10	24	lentil	20	60	20	5.5	90
11	60	pomegranate	20	10	40	5.5	30
12	61	banana	100	75	50	6.5	40
13	62	mango	20	20	30	5	15
14	63	grapes	20	125	200	4	60
15	66	watermelon	100	10	50	5.5	70

The logo of the project is set as the following:

e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:07/Issue:03/March-2025 Impact Factor- 8.187 www.irjmets.com

ER Diagram

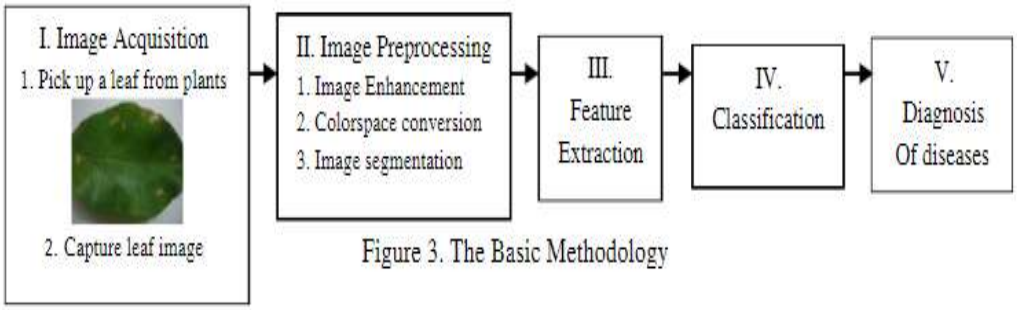
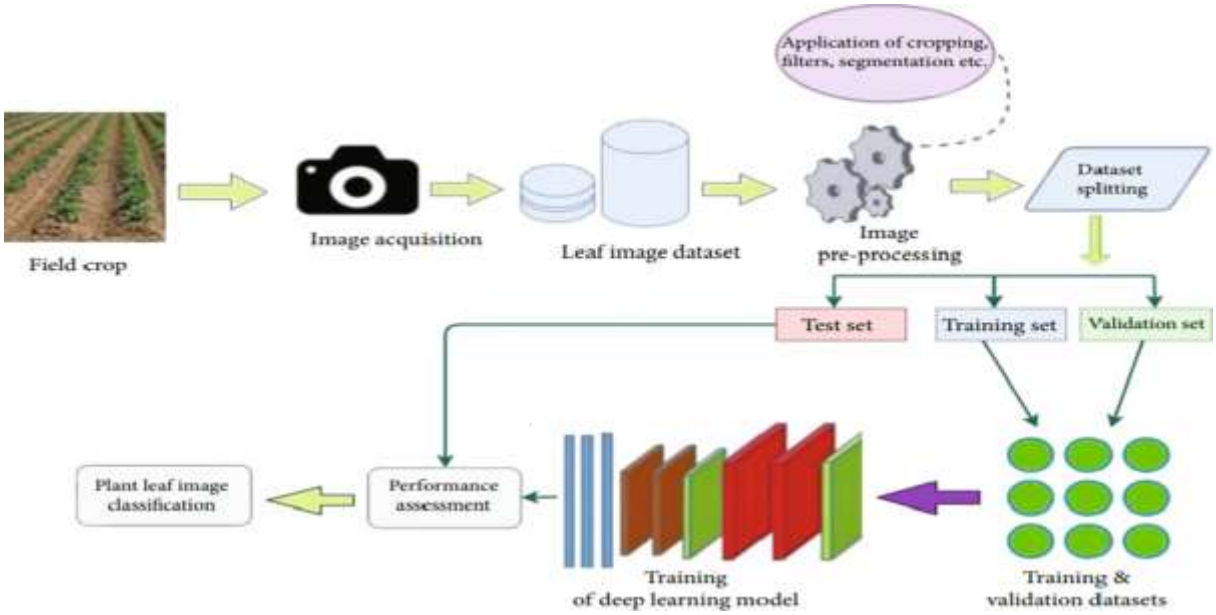


Figure 3. The Basic Methodology

Computer vision based techniques for plant species and disease detection



Different images from other datasets showing healthy and diseased plant leaves

III. CONCLUSION

ResNets perform significantly well for image classification when some of the parameters are tweaked and techniques like scheduling learning rate, gradient clipping and weight decay are applied. The model is able to predict every image in test set perfectly without any errors !!!!

This review highlighted various deep learning (DL) approaches for detecting plant diseases, along with visualization techniques to identify disease symptoms. While significant progress has been made in recent years, several research gaps remain. Many studies rely on the PlantVillage dataset, which features images with simple backgrounds, making it less applicable to real-world conditions. Emerging technology should be integrated with DL models for early disease detection. Additionally, improved visualization of disease spots can reduce unnecessary pesticide use. Since disease severity changes over time, DL models must evolve to track diseases throughout their lifecycle. Lastly, DL models should be optimized for different lighting and field conditions, requiring datasets that reflect diverse real-world scenarios.

IV. REFERENCE

[1] https://www.ijert.org/deep-learning-for-smart-agriculture

[2] https://www.sciencedirect.com/science/article/pii/S2667318521000106#:~:text=In%20pre%2Dharvesting%20machine%20learning,the%20overall%20losses%20in%20production

[3] https://www.iflexion.com/blog/machine-learning-agriculture

[4] https://www.hindawi.com/journals/jfq/2022/4721547/