IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

LEAF DISEASE DETECTION OF MULTIPLE PLANTS USING DEEP LEARNING

[1]Neha Sameera,[2]Asst.Prof.Akkanagamma,

[1]Student,[2]Assistant Professor

[1]Artificial Intelligence and Data Science,

[1]Sharnbasva University, Kalaburagi,Karnataka,India

Abstract: This paper presents Leaf Disease Detection Of Multiple Plants Using Deep Learning. The system employs a 15-layer Convolutional Neural Network (CNN) algorithm to accurately identify diseases from leaf images. Upon detection, appropriate pesticides are recommended based on the identified disease. The proposed method offers several additional features, including the provision of pesticide supplier information tailored to specific geographic areas. Furthermore, the system provides comprehensive details about the detected leaf disease, including its name, complete accuracy, time of detection, and relevant weather forecasting information.The dataset used in this study encompasses a variety of plants, including apple, pomegranate, banana, chicku, and mango. Leveraging image processing techniques, our system not only detects the name of the leaf disease but also identifies various phases of the disease progression. Additionally, it furnishes essential information such as the plant's name, required soil type, suitable growth areas, optimal temperature and weather conditions, and, in case of disease, the specific type of disease, its causes, and the recommended pesticides for treatment.This innovative approach facilitates precise disease diagnosis in plant leaves, thereby enabling prompt intervention measures to mitigate crop losses. By integrating CNN-based technology with comprehensive data analysis and information dissemination, our system offers a valuable tool for enhancing agricultural productivity and sustainability.

Index Terms – Disease Detection, Plant Leaves, CNN Algorithm, Pesticide Recommendation, Image Processing, Agricultural Productivity

I. Introduction

Early detection of plant diseases is paramount for ensuring efficient crop yield and safeguarding agricultural productivity. Diseases such as black measles, black rot, and bacterial spot not only impede plant growth and compromise crop quality but also inflict substantial economic losses on the agriculture industry. Traditionally, farmers resort to costly measures and the application of pesticides to mitigate the impact of these diseases. However, chemical interventions often lead to collateral damage to plants and the environment, exacerbating production costs and causing significant financial strain on farmers.Recognizing diseases in their nascent stages is critical for effective disease management. Manual disease detection, reliant on human expertise, has long been the norm in agriculture. However, with advancements in technology, automated detection of plant diseases using computer vision and artificial intelligence has become feasible. Sk Mahmudul Hassan et al. proposed a novel deep learning model leveraging the inception layer and residual connections, augmented by depth-wise separable convolution to reduce parameter count. Their model outperformed existing deep learning models in accuracy while employing fewer parameters, demonstrating its efficacy in disease detection.Similarly, Xin Li and Laxmisha Rai focused on the detection and classification of leaf diseases, particularly in apple trees. They utilized datasets comprising apple grey-spot disease, black star disease, cedar rust disease, and healthy leaves. Employing image segmentation, support vector machine (SVM) classifier, and ResNet and VGG convolutional neural network models, they achieved remarkable results. Notably, ResNet-18, with its streamlined architecture, attained an impressive accuracy rate of 98.5%, underscoring its superiority in disease recognition.These research endeavors underscore the growing significance of intelligent agricultural systems and the imperative for accurate disease identification. By harnessing the power of advanced technologies such as deep learning and convolutional neural networks, we can revolutionize disease detection in plant leaves, empowering farmers with timely interventions to safeguard their crops and livelihoods.

II. RELATED WORKS

Article [1] T.Vijaykanth Reddy, et.al. “Deep Leaf Disease Prediction (DLDPF) with Transfer Learning for Automatic Leaf Disease Detection”, 2021 Fifth International Conference on Computing Methodologies and Communication (ICCMC 2021), Agriculture in India plays vital role in the economy and growth of the country. However, technology driven innovation in this field known as Precision Agriculture (PA) is still in its infancy. Nevertheless, there are significant improvements with technology innovations. With the emergence of deep learning as element of Artificial Intelligence (AI), it is made possible to bring about technology into agriculture activities. One of the activities that can be automated is leaf disease detection. With scalable access to cloud computing resources, this area of the research has attracted many academia and researchers. The existing approaches with Convolutional Neural Network (CNN) exhibited shortcomings in terms of adaptation and reuse of learned outcomes. This paper has used CNN with pre-trained deep models with transfer learning to fill this gap. A framework known as Deep Leaf Disease Prediction Framework (DLDPF) has been proposed by integrating CNN with AlexNet and GoogLeNet cascade inception. The underlying algorithm is known as Cascade Inception based Deep CNN with Transfer Learning (CIDCNN-TL). Keras and TensorFlow along with Python data science platform are used for implementation of the proposed framework. The proposed framework DLDPF is compared with many deep learning models such as AlexNet, GoogLeNet, VGGNet-16 and ResNet-20. Apple leafs datasets is use for empirical study. The experimental outcome exposed that the DLDPF outperforms the shape of the art deep learning model for automated prediction of lead diseases.
Article [2] Roy, Arunabha M.,et.al. "A Deep Learning Enabled Multi Disease Detection Model Based on Computer Vision" 413-428. In this paper, a deep learning enabled object detection model for multi-class plant disease has been proposed based on a state-of-the-art computer vision algorithm. While most existing models are limited to disease detection on a large scale, the current model addresses the accurate detection of fine-grained, multi-scale early disease detection. The proposed model has been improved to optimize for both detection speed and accuracy and applied to multi-class apple plant disease detection in the real environment. The mean average precision (mAP) and F1-score of the detection model reached up to 91.2%91.2% and 95.9%95.9%, respectively, at a detection rate of 56.9 FPS. The overall detection result demonstrates that the current algorithm significantly outperforms the state-of-the-art detection model with a 9.05%9.05% increase in precision and 7.6%7.6% increase in F1-score. The proposed model can be employed as an effective and efficient method to detect different apple plant diseases under complex orchard scenarios.
Article [3] Sardoğan, Melike, et.al. “Plant Leaf Disease Detection and Classification Based on CNN with LVQ Algorithm.” International Conference on Computer Science and Engineering (UBMK) (2018), pp. 382-385. In the era of artificial systems, disease detection is becoming easier. For detecting disease, monitoring the plants 24 hours, visiting the agricultural office, or asking for help from a specialist seem difficult. This situation demands a user-friendly plant disease detection system, which allows people to detect whether the plant is diseased or not in an easier way. If the plant is diseased, a treatment plan will also be notified. In this way, people can easily save time, money, and, most importantly, plants. In this study, the researchers have collected data of vegetables from a field and applied multiple diversified Neural Network Algorithms such as CNN, MCNN, FRCNN, and, along with that, also proposed a new modified neural network architecture (ModCNN), which has produced 97.69% accuracy. The authors have also classified the bean leaf diseases into four categories according to their symptoms, which will help to identify diseases accurately.
Article [4] N. Goel, et. al. "Prediction Model for Automated Leaf Disease Detection & Analysis," 2018 IEEE 8th International Advance Computing Conference (IACC), 2018, pp. 360 10.1109/IADCC.2018.8692116 Owing to changing climatic conditions, crops often get affected, as a result of which agricultural yield decreases drastically. If the condition gets worse, crops may get vulnerable towards infections caused by fungal, bacterial, virus, etc. diseases causing agents. The method that can be adopted to prevent plant loss can be carried out by real-time identification of plant diseases. Our proposed model provides an automatic method to determine leaf disease in a plant using a trained dataset of pomegranate leaf images. The test set is used to check whether an image entered into the system contains disease or not. If not, it is considered to be healthy,

otherwise the disease if that leaf is predicted and the prevention of plant disease is proposed automatically. Further, the rodent causing disease is also identified with image analysis performed on the image certified by biologists and scientists. This model provides an accuracy of the results generated using different cluster sizes, optimized experimentally, with image segmentation. Our model provides useful estimation and prediction of disease causing agent with necessary precautions.

III. PROBLEM STATEMENT

The problem of plant diseases presents a substantial challenge due to the harm they inflict on agricultural output, impacting both its quality and quantity. Prompt detection of these diseases is imperative to address the issue effectively. Automated identification of plant illnesses emerges as a crucial area of study, given the potential benefits of promptly spotting signs of trouble on plant leaves. This proposed system tackles the challenge by offering an automated software solution for diagnosing plant leaf diseases. By leveraging advanced image processing techniques, the system aims to provide farmers with timely and accurate problem diagnosis, facilitating prompt intervention measures for optimal crop health and yield.

IV. OBJECTIVES

The objective of this research is to devise a system capable of accurately detecting agricultural diseases and pests. To achieve this goal, we will apply the Convolutional Neural Network (CNN) algorithm to a carefully curated dataset and generate a robust model for predictive analysis. This model will enable the system to effectively identify plant sickness from given input images and visually display the detected disease. Additionally, the system will employ classification techniques to categorize images of leaves into specific diseased categories based on the distinct patterns of the observed defects. Through these objectives, our aim is to develop a comprehensive and reliable tool for precise disease diagnosis in agricultural settings, thereby aiding farmers in implementing timely and targeted intervention strategies to safeguard crop health and yield.

V. ALGORITHM

Convolutional Neural Network

In the context of project, Convolutional Neural Networks (CNNs) serve as the cornerstone of our disease detection system. CNNs are a class of deep learning neural networks particularly adept at processing visual data, making them well-suited for tasks such as image recognition and classification. These networks consist of multiple layers, including convolutional layers, pooling layers, and fully connected layers, each playing a distinct role in extracting features and making predictions from input images.The CNN algorithm operates by passing input images through a series of convolutional layers, where filters scan the images to detect various features and patterns. Pooling layers then downsample the feature maps generated by the convolutional layers, reducing their dimensionality while retaining important information. Finally, fully connected layers analyze the pooled features to make predictions about the presence of diseases in the input images.By training the CNN model on a diverse dataset comprising images of healthy and diseased plant leaves, we aim to leverage its ability to learn intricate patterns and nuances in the data, thereby enabling accurate and efficient detection of plant diseases. Through the utilization of CNN-based techniques, our system endeavors to provide farmers with a reliable tool for early diagnosis and management of agricultural diseases, ultimately contributing to enhanced crop health and productivity.

VI. SYSTEM ARCHITECTURE

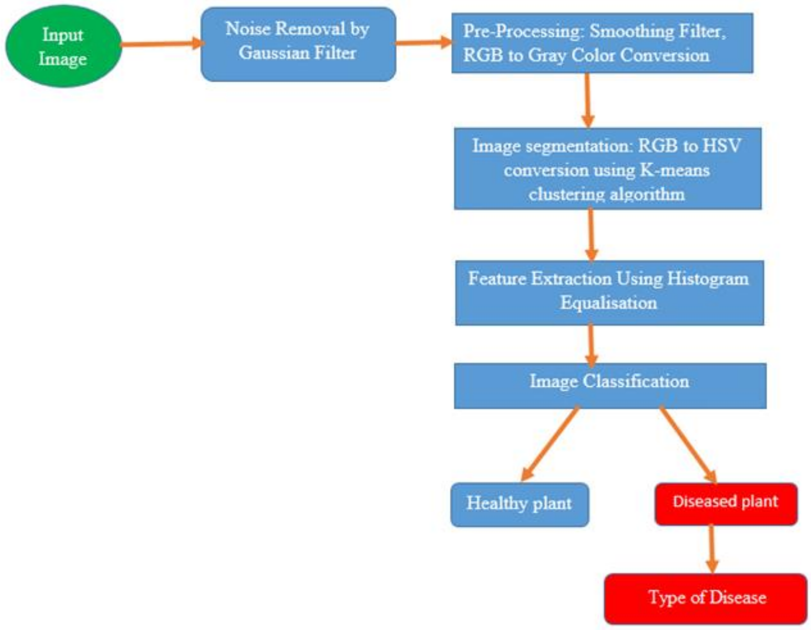

Fig 1:System Architecture

1)Input Image: The process starts with an input image of a plant.
2)Noise Removal by Gaussian Filter: The input image undergoes noise removal using a Gaussian filter to improve the signal-to-noise ratio.
3)Pre-Processing: Smoothing Filter and RGB to Gray Color Conversion: The image is preprocessed by applying a smoothing filter and converting the color image from RGB to grayscale.
4)Image Segmentation: RGB to HSV Conversion Using K-Means Clustering Algorithm: The preprocessed grayscale image is then segmented using a K-means clustering algorithm, which converts the image from RGB to the HSV color space.
5)Feature Extraction Using Histogram Equalization: Features are extracted from the segmented image using histogram equalization, which enhances the contrast and highlights the relevant information.
6)Image Classification: The extracted features are then used to classify the image into two categories: "Healthy plant" or "Diseased plant".
7)Type of Disease: If the plant is classified as diseased, the system will further identify the type of disease affecting the plant.

VII. METHODOLOGY

1)Data Collection and Preprocessing: We gather a diverse dataset comprising images of plant leaves affected by various diseases as well as healthy leaves. These images serve as the basis for training and testing our CNN model. Preprocessing techniques such as resizing, normalization, and augmentation may be applied to the images to enhance the quality and diversity of the dataset.

2)Model Selection and Training: We select an appropriate CNN architecture for our task, considering factors such as model complexity, computational efficiency, and performance metrics. Common architectures like VGG, ResNet, or custom-designed networks may be considered. The selected model is then trained on the prepared dataset using techniques like gradient descent and backpropagation to optimize its parameters for disease detection.

3)Validation and Fine-Tuning: The trained model is evaluated on a separate validation dataset to assess its performance and identify areas for improvement. Fine-tuning may be performed by adjusting hyperparameters, optimizing the learning rate, or incorporating regularization techniques to enhance the model's generalization capabilities.

4)Testing and Evaluation: The finalized model is tested on an independent test dataset to evaluate its effectiveness in detecting plant diseases accurately. Performance metrics such as accuracy, precision, recall, and F1 score are computed to assess the model's overall performance and reliability.

5)Integration and Deployment: Once the model demonstrates satisfactory performance, it is integrated into the proposed system for automated disease detection in plant leaves. The system's user interface is designed to accept input images, process them using the trained CNN model, and display the detected diseases along with relevant information and recommendations for treatment.

6)Validation and User Feedback: The deployed system undergoes validation and feedback from users, including farmers and agricultural experts, to assess its usability, effectiveness, and practicality in real-world scenarios. Feedback is used to iteratively refine and improve the system's performance and user experience.

VIII. EXPERIMENTAL RESULTS

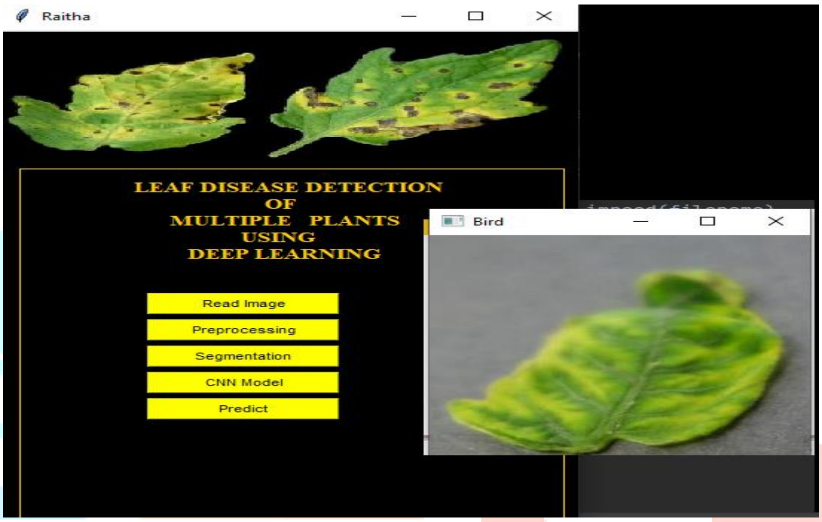

Fig 2: Read image

Fig 3:Preprocessing

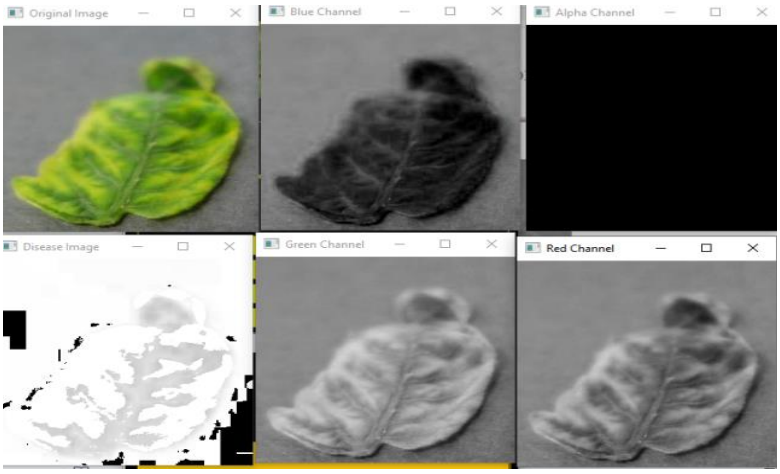

Fig 4: Converts to different channel

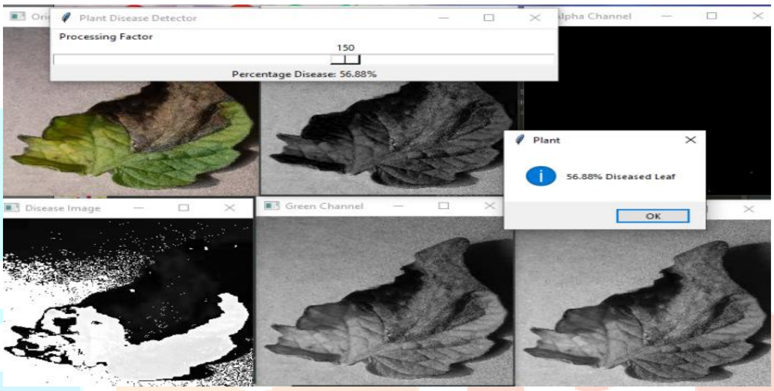

Fig 4: Displays the leaf disease % and leaf is diseased or not

IX. CONCLUSION

The project has yielded an automated system for the precise detection of plant diseases utilizing Convolutional Neural Networks (CNNs). Through meticulous data collection, model training, and validation, a reliable tool capable of accurately identifying various diseases affecting plant leaves has been developed. Leveraging advanced CNN-based techniques, the system demonstrates effectiveness in providing timely diagnoses, empowering farmers to implement prompt intervention measures to mitigate crop losses. The integration of user-friendly interfaces and comprehensive disease information enhances the system's usability and practicality in real-world agricultural settings. Future enhancements based on user feedback and technological advancements promise to further improve the system's effectiveness and relevance in supporting sustainable agriculture and ensuring global food security.

REFERENCES

[1]T.Vijaykanth Reddy, et.al. “Deep Leaf Disease Prediction (DLDPF) with Transfer Learning for Automatic Leaf Disease Detection”, 2021 Fifth International Conference on Computing Methodologies and Communication (ICCMC 2021),

[2]Roy, Arunabha M.,et.al. "A Deep Learning Enabled Multi Disease Detection Model Based on Computer Vision" 413-428.

[3]Sardoğan, Melike, et.al. “Plant Leaf Disease Detection and Classification Based on CNN with LVQ Algorithm.” International Conference on Computer Science and Engineering (UBMK) (2018), pp. 382-385.

[4]N. Goel, et. al. "Prediction Model for Automated Leaf Disease Detection & Analysis," 2018 IEEE 8th International Advance Computing Conference (IACC), 2018, pp. 360 10.1109/IADCC.2018.8692116

[5]Sandeep Kumar, et al. “Leaf Disease Detection and Classification based on Machine learning”, International Conference on Smart Te in Computing, Electrical and Electronics (ICSTCEE 2020)

[6]P. Jiang, Y. Chen, B. Liu, D. He and C. Liang, "Real Apple Leaf Diseases Using Deep Learning Approach Based on Improved Convolutional Neural Networks," in 59069-59080, 2019.

[7]K. P. Panigrahi ,et al. “Maize Leaf Disease Detection and Classification Using Machine Learning Algorithm”, 2020, Springer, pp.659

[8]S. Gayathri, et al. “Image Analysis and Detection of Tea Leaf Disease using deep Learning, 2020,” International Conference on Electronics and Sustainable Communication Systems (ICESC 2020), pp.398

[9]Sammy V. Militante et al. “Plant Leaf Detection and Disease Recognition using Deep Learning, 2019,” IEEE Eurasia Conference on IOT, Communication and Engineering, 2019, pp.579

[10]Prajwala TM, el al. “Tomato Leaf Disease Detection using Convolutional Neural Networks,” Eleventh International Conference on Contemporary Computing (IC3), 2018.