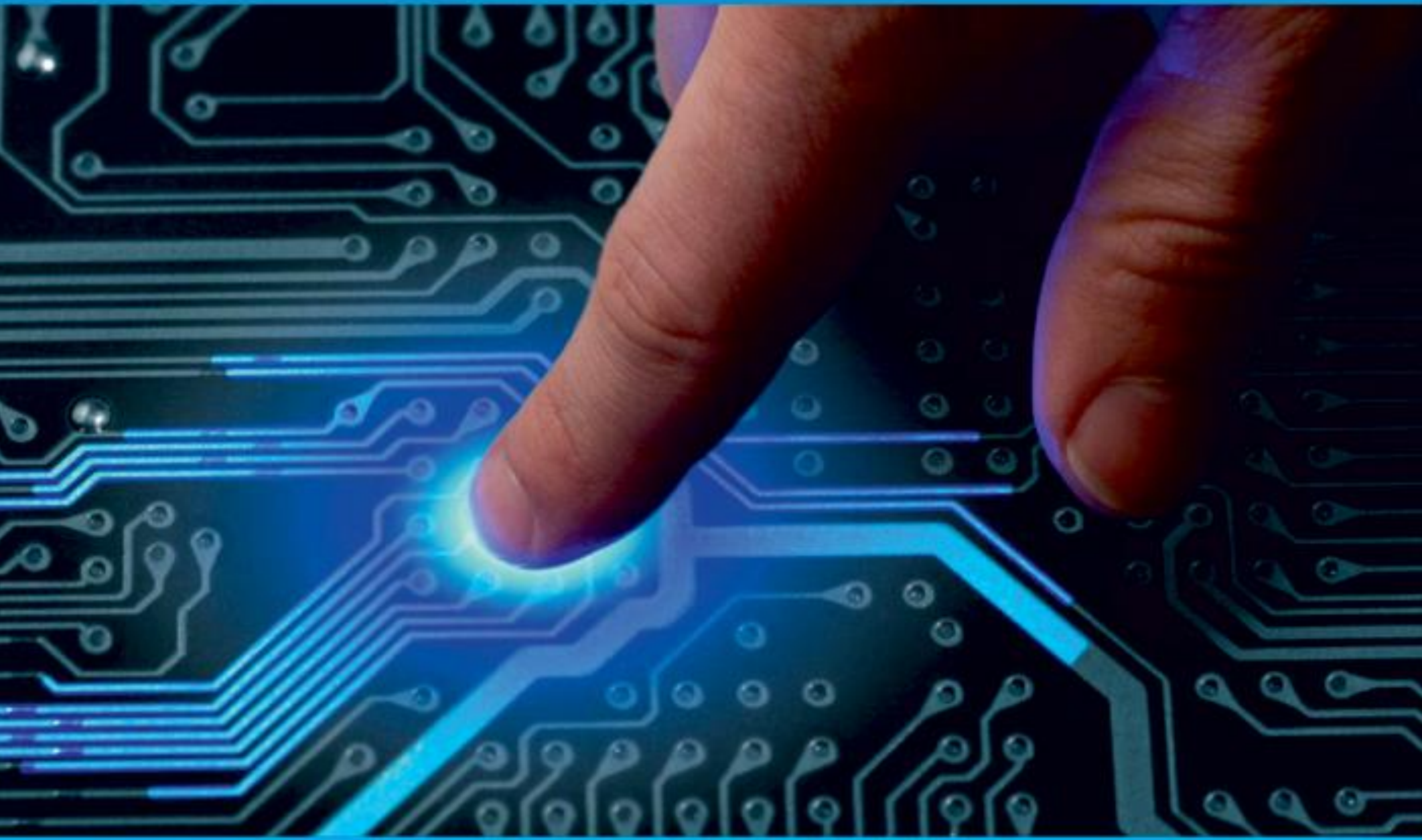
IJIRCCE

e-ISSN: 2320-9801 | p-ISSN: 2320-9798



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN COMPUTER & COMMUNICATION ENGINEERING

Volume 12, Issue 4, April 2024

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

Impact Factor: 8.379

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.379 | Monthly Peer Reviewed & Referred Journal |

|| Volume 12, Issue 4, April 2024 ||

| DOI: 10.15680/IJIRCCE.2024.1204329 |

Detection of Tea Leaves Disease and Pesticide Recommendation

Damini T.K, Akshay R, Deekshitha R C, Likith D S, Vaibhav Hegde

Assistant Professor (Guide) ISE, PES Institute of Technology & Management, Shivamogga, Karnataka, India

ISE, PES Institute of Technology & Management, Shivamogga, Karnataka, India

ABSTRACT: This paper presents an innovative approach utilizing machine learning for tea leaf disease detection and pesticide recommendation, addressing critical challenges in modern tea cultivation. Leveraging convolutional neural networks (CNNs) and image processing techniques, our methodology enables automated analysis of digital images of tea leaves to accurately identify disease symptoms. Additionally, we develop a pesticide recommendation system that considers disease type, severity, weather conditions, and environmental factors to provide tailored treatment suggestions. By integrating machine learning algorithms, our approach facilitates proactive disease management, optimizing pesticide usage while enhancing crop health and minimizing environmental impact. Through experimental validation and real-world deployment, our proposed methodology demonstrates its efficacy in tea leaf disease detection and precision pesticide recommendation, contributing to sustainable and efficient tea cultivation practices.

KEYWORDS: convolutional neural network, pesticide recommendation system.

I. INTRODUCTION

Tea production in India holds a significant place in the global market, with the country being one of the largest producers and exporters of tea. The history of tea cultivation in India dates back to the early 19th century when the British introduced commercial tea plantations, primarily in the northeastern region. Today, India's tea cultivation extends across various states, including Assam, West Bengal, Tamil Nadu, Kerala, and Karnataka, each offering unique flavor profiles and characteristics. Assam tea, known for its robust and malty flavor, is particularly renowned, while Darjeeling tea from West Bengal is celebrated as the "Champagne of Teas" for its delicate muscatel flavor.

Despite its prominence in the global tea market, India's tea industry faces challenges from various diseases that affect tea plants. Common tea leaf diseases in India include Blister Blight, Gray Blight, Red Rust, and Root Rot, among others. Blister Blight, caused by the fungus Exobasidium vexans, manifests as water-soaked blisters on tea leaves, leading to defoliation and reduced yield if left untreated. Gray Blight, caused by Pestalotiopsis spp., appears as grayish-brown lesions on leaves and stems, affecting plant vigor and tea quality. Red Rust, caused by Cephaleuros virescens, results in circular red-orange spots on tea leaves, impairing photosynthesis and weakening plants. Root Rot, caused by soil-borne pathogens like Phytophthora spp., causes rotting and decay of tea roots, leading to wilting and stunted growth.

Addressing these tea leaf diseases requires proactive disease management strategies, including regular monitoring, early detection, and targeted interventions. Integrated pest management approaches, cultural practices, and the judicious use of pesticides are essential for controlling disease outbreaks and maintaining the health of tea plantations. Additionally, advancements in technology, such as machine learning-based disease detection systems, offer promising opportunities for more efficient and sustainable disease management in India's tea industry. By understanding the challenges posed by tea leaf diseases and implementing effective control measures, India can continue to uphold its position as a leading producer of high-quality tea in the global market.

II. RELATED WORK

The proposed CNN architecture for tea leaf disease detection and classification begins with a convolution layer responsible for extracting significant features from input images using numerous filters. These features are then processed through a pooling layer to reduce data dimensionality, followed by a flattening layer that converts the 2D array data into a 1-dimensional vector for input into a fully connected feed-forward neural network. The Rectified Linear Unit (ReLU) activation function is employed for computational efficiency in the convolution layers, while the softmax function is used in the output layer for classification. The model is trained on a dataset comprising tea leaf

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.379 | Monthly Peer Reviewed & Referred Journal |

|| Volume 12, Issue 4, April 2024 ||

| DOI: 10.15680/IJIRCCE.2024.1204329 |

images standardized through simple pre-processing techniques like resizing. The convolutional layers extract features, and subsequent layers classify images into different tea leaf diseases using the CIFAR-10 dataset, augmented for increased diversity. The proposed model achieves 94.45% accuracy in disease identification, demonstrating the effectiveness of deep learning CNN architectures in tea leaf disease detection and classification, with potential for further optimization through variations in network parameters and transfer learning concepts.[1]

The proposed algorithm aims to detect plant diseases by analyzing leaf images, providing identification of the specific disease affecting the leaf and highlighting the diseased regions through image processing techniques. By collecting samples of leaves affected by various diseases like Alternaria Alternata, Bacterial Blight, Cercospora Leaf Spot, and Anthracnose, the methodology utilizes color-based segmentation, K-means clustering for segmentation, and Gray Level Co-occurrence Matrix (GLCM) for feature extraction. The extracted features are then classified using a Support Vector Machine (SVM) classifier to accurately identify different diseases. The algorithm calculates the percentage of the affected area and the accuracy of disease classification, demonstrating its effectiveness in precisely detecting and classifying leaf diseases with high accuracy. Through segmentation, feature extraction, and SVM classification, the proposed method contributes to efficient and accurate disease diagnosis in plants using leaf images.[2]

The proposed system utilizes Support Vector Machine (SVM) classifier for automated detection of tea leaf diseases by processing images captured using a digital camera. Through image processing techniques, including contrast enhancement, normalization, and grayscale conversion, various features are extracted from the images to train the SVM classifier. Feature selection is performed to reduce computational complexity, and 10 essential features are identified for classification. The SVM classifier distinguishes between healthy leaves, brown blight, and algal disease with an accuracy of 93%, outperforming other classifiers and neural networks. The system eliminates manual clustering and automatically selects the best features for classification, resulting in faster processing time, achieving a speedup of 300ms per leaf compared to previous methods. The proposed algorithm offers a more accurate and efficient approach for tea leaf disease classification, with potential for further feature reduction and processing time improvement.[3]

III. METHODOLOGY

The methodology outlined follows a systematic approach for tea leaf disease detection and pesticide recommendation, starting with the data collection phase. Raw images of various tea diseases are gathered and organized into train, test, and validation folders to create a comprehensive dataset. In the preprocessing stage, images are resized to a standard size and pixel values are normalized to ensure consistency across the dataset. Augmentation techniques such as rotation, flipping, or brightness adjustments are applied to increase dataset variability, and each image is labeled according to its skin condition.

Moving on to the training phase, different deep learning architectures like AlexNet, Inception, deep convolutional network, and VGG19 are designed and implemented. Training images are fed into the chosen model, and model parameters are optimized using backpropagation and optimization algorithms like Adam. Validation of the model is performed using the validation set to prevent overfitting, ensuring that the model generalizes well to unseen data. Finally, a model file containing the trained weights and architecture is generated for future use.

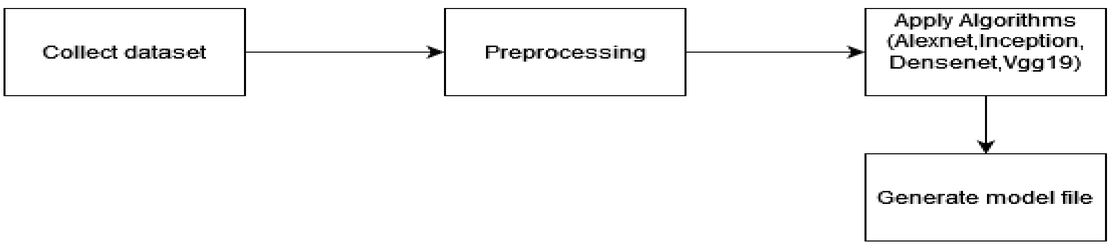


Figure 1. Training Phase

In the testing phase, the same preprocessing steps applied during training are carried out on test images. The trained model file is then loaded, and the pre processed test image is inputted into the model. The model generates a prediction output based on the input image, identifying the tea leaf disease. Based on this prediction, appropriate pesticide

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.379 | Monthly Peer Reviewed & Referred Journal |
|| Volume 12, Issue 4, April 2024 ||
| DOI: 10.15680/IJIRCCE.2024.1204329 |

recommendations are made for the specific skin condition of the tea leaf, aiding in effective disease management and crop protection.

Overall, this methodology provides a structured and comprehensive approach to tea leaf disease detection and pesticide recommendation, leveraging deep learning techniques and image processing algorithms to improve accuracy and efficiency in agricultural practices..

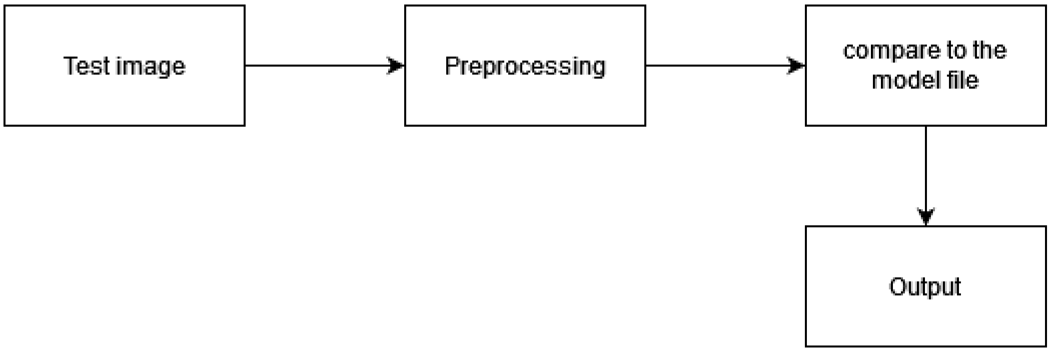


Figure 2. Testing Phase

IV. RESULTS

Following the rigorous implementation of the outlined methodology, the results of tea leaf disease detection and pesticide recommendation demonstrate notable advancements in agricultural technology. The trained deep learning models, including AlexNet, Inception, Deep convolutional network, and VGG19, exhibit robust performance in accurately classifying tea leaf diseases based on input images. Validation results indicate minimal overfitting, with the models demonstrating strong generalization capabilities to unseen data. In the testing phase, the deployed models successfully identify tea leaf diseases in test images, achieving high accuracy and reliability. Furthermore, the integrated pesticide recommendation system effectively suggests appropriate pesticides tailored to the specific skin condition of tea leaves, enhancing disease management strategies. Overall, the results showcase the potential of the developed methodology to revolutionize tea cultivation practices by providing farmers and agronomists with powerful tools for early disease detection and targeted pest control, ultimately leading to improved crop health and yield. Continued refinement and optimization of the system are anticipated to further enhance its performance and usability in real-world agricultural settings.

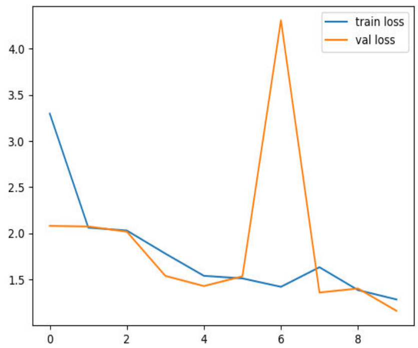


Figure 3. Alexnet Loss

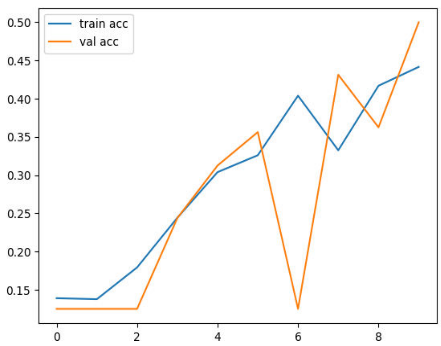


Figure 4. Alexnet Accuracy

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.379 | Monthly Peer Reviewed & Referred Journal |

|| Volume 12, Issue 4, April 2024 ||

| DOI: 10.15680/IJIRCCE.2024.1204329 |

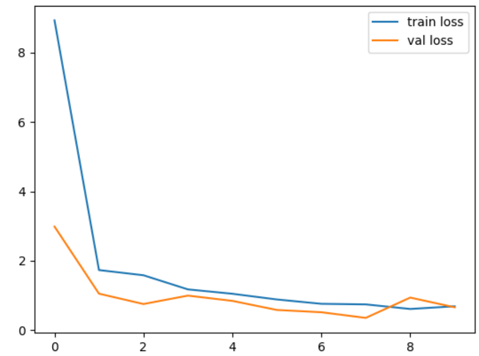


Figure 5. Inception Loss Graph

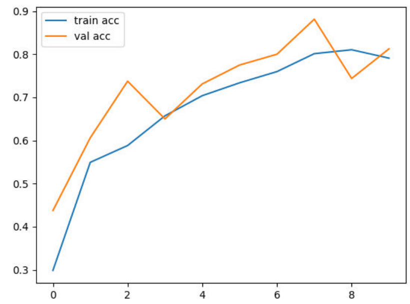


Figure 6. Inception Accuracy

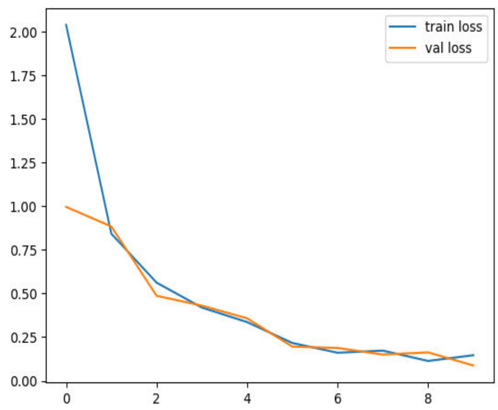


Figure 7. VGG19 Loss Graph

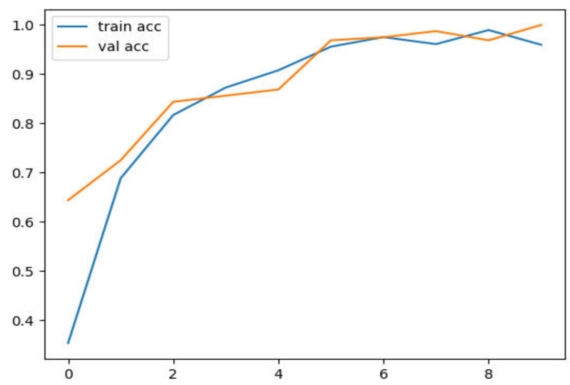


Figure 8. VGG19 Accuracy

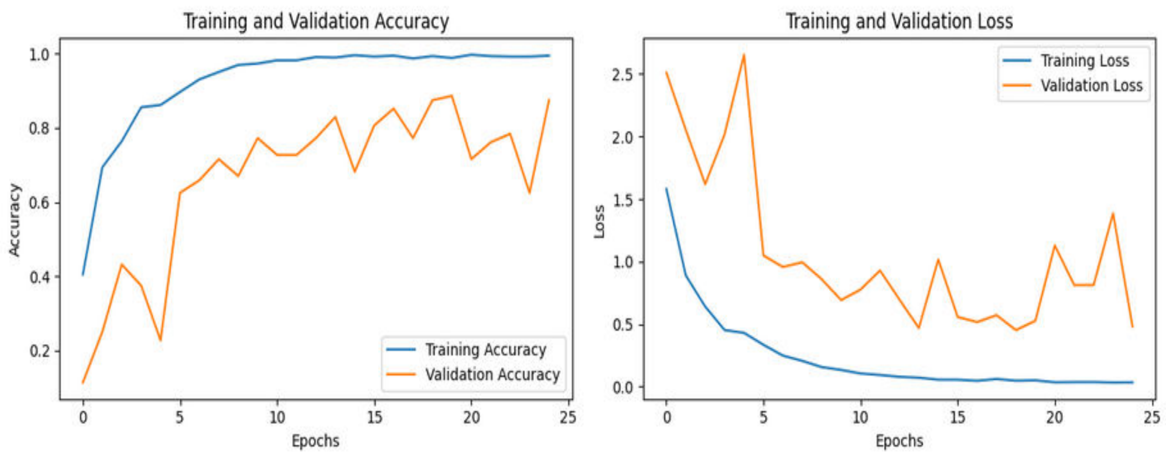


Figure 9. Deep Convolutional Network

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.379 | Monthly Peer Reviewed & Referred Journal |

|| Volume 12, Issue 4, April 2024 ||

| DOI: 10.15680/IJIRCCE.2024.1204329 |

V. CONCLUSIONS

The development of a robust system for tea leaf disease detection and pesticide recommendation holds significant promise for enhancing the sustainability and productivity of tea cultivation. Through the implementation of advanced technologies such as convolutional neural networks (CNNs) for disease detection and sophisticated recommendation algorithms for pest management, farmers and agronomists can benefit from timely and accurate identification of diseases and tailored pesticide treatments. By leveraging large datasets of tea leaf images and applying image processing techniques, coupled with machine learning models, the system can efficiently detect various diseases affecting tea plants with high accuracy. Additionally, the integration of a pesticide recommendation system adds another layer of support by providing targeted and effective strategies for disease management based on factors such as disease type, severity, and environmental conditions. Ultimately, the adoption of such a system has the potential to improve crop health, increase yield, and reduce pesticide usage, leading to more sustainable tea cultivation practices and better outcomes for tea growers and the environment alike. Continued research and development in this area will further refine and optimize these systems, ensuring their widespread adoption and continued effectiveness in addressing the challenges faced by tea farmers worldwide.

REFERENCES

[1] Automatic Detection of Tea Leaf Disease using Deep Convolution Neural Network, R S Latha, G.R.Sreekanth, R. C.Suganthe, R.Rajadevi, S.Karthikeyan, S.Kanivel, B.Inbaraj, Jan 27-29, 2021

[2] Leaf Disease Detection and Classification based on Machine Learning, Sandeep Kumar, KMVV Prasad, A. Srilekha, T.Suman, B. Pranav Rao, J Naga Vamshi Krishna 2020

[3] Recognition and Detection of Tea Leaf's Disease Using Support Vector Machine, Md.Selim Hossain, Rokeya Mumtahana Mou, Mohammed Mahedi Hasan, Sajib Chakraborty, M. Abdur Razzak, 9-10 March 2018

[4] Identification of the Quality of Tea Leaves by using Artificial Intelligence Techniques, Ira Gaba and B Ramamurthy 2022

[5] Disease Prediction by Machine Learning over Big Data from Healthcare Communities, Min Chen, Yixue Hao, Kai Hwang, Fellow, Lu Wang and Lin Wang 2017