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Mango Leaf Detection Using Transfer Learning

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ABSTRACT

Mango cultivation plays a pivotal role in the agricultural economy of many countries, especially in tropical regions. However, the productivity and quality of mangoes are significantly affected by various leaf diseases, which often go undetected until they cause substantial damage. Traditional methods of disease identification are time-consuming and require expert knowledge, making them less feasible for timely intervention. The integration of deep learning techniques, particularly transfer learning, offers a promising solution for the early and accurate detection of mango leaf diseases. This project leverages the capabilities of transfer learning by utilizing pre-trained convolutional neural networks, specifically MobileNetV2, to identify and classify mango leaf diseases. By employing image preprocessing techniques and data augmentation, the model is trained to recognize patterns associated with different diseases. The system provides users with an intuitive interface to upload leaf images and receive instant diagnostic feedback, thereby facilitating prompt and informed decision-making in disease management.

Keywords: Mango Leaf Disease, Transfer Learning, MobileNetV2, Deep Learning, Image Classification.

I. INTRODUCTION

Mangoes are among the most cultivated and consumed fruits worldwide, with significant economic and nutritional value. The health of mango trees is paramount to ensuring consistent yield and quality. However, various diseases affecting mango leaves, such as anthracnose, powdery mildew, and bacterial black spot, can severely impact the plant's health and fruit production.

Early detection of these diseases is crucial for effective management and control. Traditional methods involve manual inspection by experts, which is not only time-consuming but also prone to human error. Moreover, the lack of access to expert knowledge in remote farming areas exacerbates the problem, leading to delayed diagnosis and treatment.

Advancements in artificial intelligence, particularly in deep learning, have opened new avenues for plant disease detection. Convolutional Neural Networks (CNNs) have demonstrated remarkable success in image classification tasks, making them suitable for identifying patterns associated with different plant diseases.

Transfer learning, a technique where a model developed for one task is reused as the starting point for a model on a second task, has gained popularity due to its efficiency and effectiveness. By leveraging pre-trained models like MobileNetV2, which are trained on large datasets, we can achieve high accuracy in disease classification even with limited domain-specific data.

In this project, we harness the power of transfer learning to develop a system capable of accurately detecting and classifying mango leaf diseases. The system is designed to be user-friendly, allowing users to upload images and receive immediate diagnostic feedback. Additionally, the system provides visual representations of model performance, aiding in transparency and user trust.

The implementation involves data preprocessing, model training, and the development of a web-based interface. The dataset comprises images of healthy and diseased mango leaves, which are augmented to enhance model robustness. The MobileNetV2 model is fine-tuned on this dataset to achieve optimal performance.

By integrating this system into agricultural practices, farmers and agricultural professionals can benefit from timely and accurate disease diagnosis, leading to better crop management and reduced losses. The scalability and adaptability of the system also allow for potential expansion to other crops and diseases in the future.

II. LITERATURE SURVEY

1. Image-based Mangifera Indica Leaf Disease Detection using Transfer Learning for Deep Learning Methods

Authors: K. Dhawan, R. S. Perumal, and R. K. Nadesh

Abstract:

This study introduces a robust image-based classification system for detecting diseases in Mangifera Indica (mango) leaves by leveraging transfer learning techniques. The authors utilized pre-trained deep learning models such as MobileNet, VGG16, and InceptionV3 to fine-tune and adapt them for mango leaf disease classification. The method significantly reduces training time and computational resources while maintaining high prediction accuracy, making it suitable for practical use in low-resource settings.

The dataset used was carefully curated to represent a variety of mango leaf diseases, including Anthracnose and Bacterial Canker. Performance metrics such as accuracy, precision, recall, and F1-score validate the model's efficiency. This research emphasizes the application of AI in precision agriculture, highlighting its potential in early-stage disease detection, which could result in improved crop yields and economic gains for farmers.

2. Deep Transfer Learning Driven Model for Mango Leaf Disease Detection

Authors: Y. P. Singh, B. K. Chaurasia, and M. M. Shukla
Abstract:
The paper proposes an advanced deep transfer learning model focused on classifying mango leaf diseases. DenseNet architecture was employed to fine-tune feature extraction layers for mango-specific disease images. The approach addresses the problem of data scarcity by transferring knowledge from large-scale image datasets like ImageNet to agricultural datasets, allowing for better generalization and reduced overfitting.

Evaluation was carried out using multiple performance indicators on real-field images. The results indicated the model's capability to identify multiple types of mango leaf infections accurately. This research highlights the potential of transfer learning to bridge the gap between computational models and real-world agricultural disease detection, promoting the development of farmer-friendly mobile applications.

3. Deep Learning Precision Farming: Grapes and Mango Leaf Disease Detection by Transfer Learning

Authors: U. S. Rao et al.
Abstract:
This study explores the application of deep learning in precision farming, particularly focusing on disease detection in grapes and mango leaves. Using transfer learning models like ResNet50 and MobileNetV2, the researchers implemented a unified framework capable of classifying diseases in both crops with high accuracy. The dual-crop approach is notable for its versatility and applicability across horticultural domains.

The experiments were conducted on diverse datasets with multiple disease classes. The model showed impressive results in terms of accuracy and speed, making it a suitable candidate for real-time disease monitoring systems. This research promotes integrated crop health monitoring systems and suggests the extension of this methodology to other high-value crops to build a universal disease detection engine.

4. Plant Disease Identification Using a Novel Convolutional Neural Network

Authors: S. M. Hassan and A. K. Maji
Abstract:
The authors proposed a custom-designed convolutional neural network (CNN) tailored for plant disease identification, improving on the limitations of existing pre-trained networks. The architecture emphasizes feature depth and abstraction by introducing a novel layer combination strategy that enhances the model's ability to differentiate among disease symptoms, even in visually similar leaf patterns.

Experimental evaluations across multiple datasets demonstrated superior accuracy and faster convergence compared to traditional CNNs. The model's lightweight architecture also makes it viable for deployment in mobile and edge computing environments. The research underlines the benefits of custom CNN architectures in agricultural diagnostics, particularly when domain-specific optimization is applied.

5. A Survey on Using Deep Learning Techniques for Plant Disease Diagnosis and Recommendations for Development of Appropriate Tools

Authors: A. Ahmad, D. Saraswat, and A. El Gamal
Abstract:
This comprehensive survey reviews the state-of-the-art deep learning methods used in plant disease diagnosis. It explores the use of CNNs, GANs, transfer learning, and hybrid deep learning models in various agricultural contexts. The authors assess more than 50 relevant studies and identify

recurring challenges such as limited datasets, class imbalance, and low model interpretability.

In addition to reviewing methodologies, the authors provide practical recommendations for developing scalable, user-friendly diagnostic tools. These include incorporating explainable AI techniques, mobile integration, and multilingual user interfaces to cater to a broader user base. The paper provides a roadmap for future research and development in AI-based agriculture systems.

6. Survey on Crop Pest Detection Using Deep Learning and Machine Learning Approaches

Authors: M. Chithambarathanu and M. K. Jeyakumar
Abstract:
This survey examines current approaches in crop pest detection using machine learning (ML) and deep learning (DL) algorithms. It provides a comparative study between traditional ML techniques such as SVM and Random Forest and modern DL models like CNNs and LSTMs. The authors emphasize the transition from handcrafted features to automatically learned features using DL.

The survey also discusses real-time pest detection using images, audio signals, and environmental sensor data. It highlights the need for unified datasets, real-time alert systems, and IoT integration in pest management. The paper concludes that DL models offer higher accuracy and better adaptability, making them ideal for smart farming systems.

7. A Novel Deep Learning Method for Detection and Classification of Plant Diseases

Authors: W. Albattah et al.
Abstract:
This paper presents a novel deep learning architecture for classifying plant leaf diseases. By combining residual blocks with attention mechanisms, the model enhances feature extraction while maintaining training efficiency. The model was evaluated on benchmark plant disease datasets and showed improvements in accuracy, recall, and inference speed.

A key contribution of this study is its focus on model robustness across multiple crops and disease types. The authors propose this model as a potential core component in smart farming platforms where real-time performance is critical. The approach also lays the foundation for implementing cloud-based disease detection services for rural farmers.

8. Mango Leaf Disease Recognition Using Neural Network and Support Vector Machine

Authors: M. Mia et al.
Abstract:
The study explores the comparative effectiveness of neural networks and support vector machines (SVM) in mango leaf disease recognition. A hybrid methodology was adopted, wherein features were manually extracted and fed into both classifiers. Results indicate that while neural networks are suitable for large datasets, SVMs performed better with limited data due to their strong generalization capabilities.

This research provides valuable insights into selecting the appropriate classification method based on dataset characteristics. It also opens the door for ensemble methods that combine the strengths of both algorithms. The findings encourage the development of lightweight models for use in field-deployable diagnostic tools.

III. EXISTING SYSTEM

Traditional methods for detecting mango leaf diseases primarily rely on manual inspection by agricultural experts. These methods are subjective, time-consuming, and often inaccessible to farmers in remote areas. Some existing digital solutions utilize basic image processing techniques, which lack the sophistication to accurately classify diseases, especially when dealing with complex backgrounds and varying lighting conditions.

IV. PROPOSED SYSTEM

The proposed system employs transfer learning using the MobileNetV2 architecture to detect and classify mango leaf diseases. By utilizing a pre-trained model, the system requires less data and computational resources while maintaining high accuracy. The system includes an intuitive user interface where users can upload images of mango leaves and receive immediate diagnostic results. Additionally, the system provides visual insights into model performance through accuracy and loss graphs, enhancing transparency and user trust.

V. SYSTEM ARCHITECTURE

The figure illustrates the overall workflow of a Mango Leaf Disease Detection System using MobileNetV2, showing separate functionalities for the Admin and User modules. The system is designed to automate the process of training a deep learning model and using it to identify diseases from mango leaf images accurately. The workflow ensures that the dataset preparation, model generation, and disease prediction processes are organized and accessible through dedicated interfaces.

The Admin module is responsible for preparing and training the deep learning model. Initially, the administrator uploads the mango leaf image dataset, which contains images of both healthy and diseased leaves. After the dataset is uploaded, the system performs preprocessing operations such as image resizing, normalization, noise removal, and splitting the dataset into training, validation, and testing subsets. These preprocessing steps improve image quality and ensure that the model receives standardized input data, resulting in better learning performance.

Once preprocessing is completed, the system employs an Image Data Generator to perform data augmentation. This component generates additional training samples by applying transformations such as rotation, zooming, horizontal flipping, shifting, and brightness adjustments. Data augmentation increases the diversity of the training dataset, reduces overfitting, and enhances the model's ability to recognize diseases under different environmental conditions. The augmented images are then supplied to the MobileNetV2 model during training.

The next stage involves generating the MobileNetV2 model. MobileNetV2 is a lightweight convolutional neural network architecture optimized for image classification tasks while requiring fewer computational resources. During training, the model learns distinctive visual features of various mango leaf diseases from the prepared dataset. The trained model is saved for future predictions and can be deployed efficiently on desktop, web, or mobile platforms. After successful model generation, the administrator can safely log out of the system.

The User module enables end users to utilize the trained model for disease detection. The user first logs into the application and views the model accuracy, which provides an indication of the trained model's classification performance. Displaying metrics such as accuracy helps users understand the reliability of the prediction system before performing disease detection.

After login, the user uploads a test image of a mango leaf. The uploaded image undergoes the same preprocessing steps that were applied during training to maintain consistency. The processed image is then passed to the trained MobileNetV2 model, which extracts meaningful features and classifies the leaf into the appropriate disease category or identifies it as healthy. The prediction result is displayed to the user, enabling quick and accurate disease

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diagnosis for timely agricultural decision-making.

Finally, after viewing the prediction results, the user can log out of the application. Overall, the workflow demonstrates a complete deep learning pipeline, beginning with dataset preparation and model training by the administrator and ending with real-time disease detection by the user. The integration of image preprocessing, data augmentation, and the MobileNetV2 architecture ensures high classification accuracy, efficient computation, and practical usability for mango leaf disease identification.

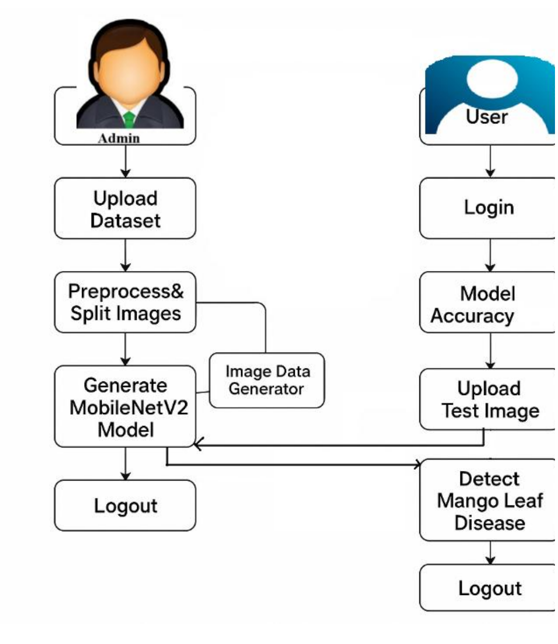

Fig 5.1: System Architecture

VI. IMPLEMENTATION

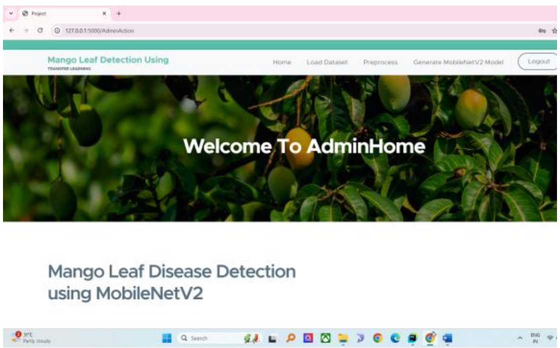

Fig 6.1: Admin Dashboard

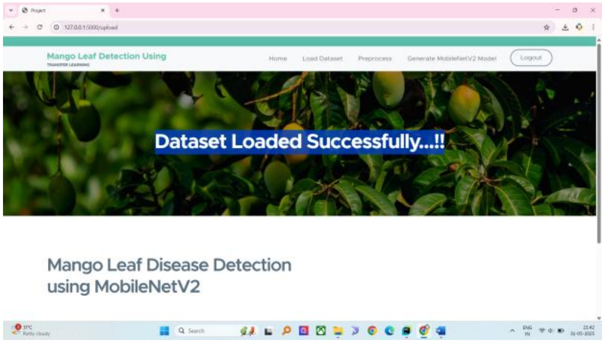

Fig 6.2: Dataset Uploaded

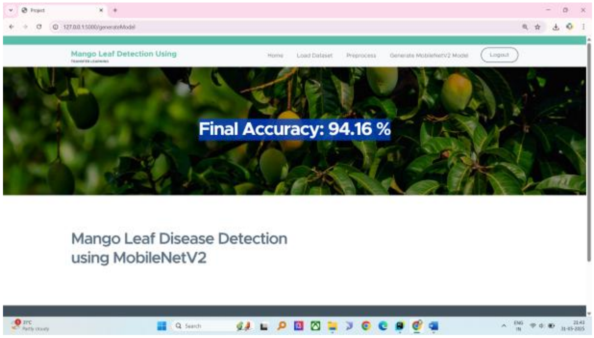

Fig 6.3: Model Status

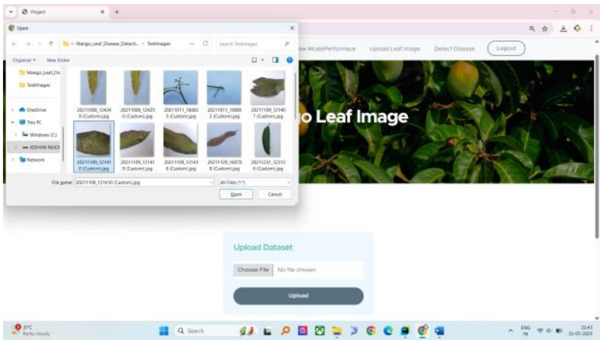

Fig 6.4: Prediction Input Image

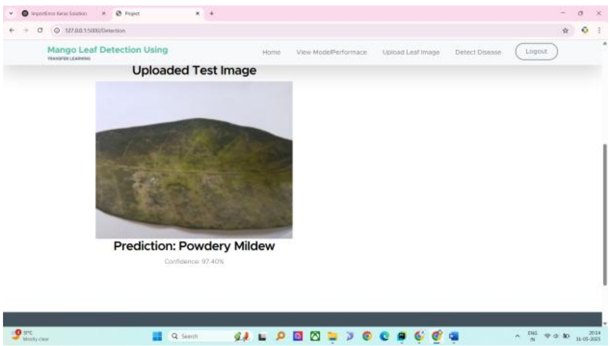

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Fig 6.5: Result Page

VII. CONCLUSION

The integration of transfer learning techniques in the detection and classification of mango leaf diseases presents a significant advancement in agricultural diagnostics. The developed system offers a practical solution to the challenges faced in traditional methods, providing accurate, timely, and accessible disease diagnosis. By empowering farmers and agricultural professionals with this tool, we can enhance crop management practices, reduce losses, and contribute to the overall improvement of mango production.

VIII. FUTURE SCOPE

Future enhancements of the system may include the incorporation of additional plant species and diseases, expanding the applicability of the model. Integration with mobile applications can further increase accessibility for farmers in remote areas. Additionally, incorporating real-time monitoring through drone or satellite imagery can provide comprehensive insights into crop health at a larger scale.

IX. REFERENCES

[1] A. G. Howard, M. Zhu, B. Chen, D. Kalenichenko, W. Wang, T. Weyand, M. Andreetto, and H. Adam, "MobileNets: Efficient Convolutional Neural Networks for Mobile Vision Applications," arXiv, 2017.
DOI: 10.48550/arXiv.1704.04861

[2] M. Sandler, A. Howard, M. Zhu, A. Zhmoginov, and L.-C. Chen, "MobileNetV2: Inverted Residuals and Linear Bottlenecks," Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR), 2018.
DOI: 10.1109/CVPR.2018.00474

[3] S. P. Mohanty, D. P. Hughes, and M. Salathé, "Using Deep Learning for Image-Based Plant Disease Detection," Frontiers in Plant Science, vol. 7, 2016.
DOI: 10.3389/fpls.2016.01419

[4] D. P. Hughes and M. Salathé, "An Open Access Repository of Images on Plant Health to Enable the Development of Mobile Disease Diagnostics," arXiv, 2015.
DOI: 10.48550/arXiv.1511.08060

[5] K. P. Ferentinos, "Deep Learning Models for Plant Disease Detection and Diagnosis," Computers and Electronics in Agriculture, vol. 145, pp. 311–318, 2018.
DOI: 10.1016/j.compag.2018.01.009

[6] S. Sladojevic, M. Arsenovic, A. Anderla, D. Culibrk, and D. Stefanovic, "Deep Neural Networks Based Recognition of Plant Diseases by Leaf Image Classification," Computational Intelligence and Neuroscience, 2016.
DOI: 10.1155/2016/3289801

[7] Y.-C. Chen, J.-C. Wang, M.-H. Lee, A.-C. Liu, and J.-A. Jiang, "Enhanced Detection of Mango Leaf Diseases in Field Environments Using MSMP-CNN and Transfer Learning," Computers and Electronics in Agriculture, vol. 227, 2024.
DOI: 10.1016/j.compag.2024.109636

[8] M. A. Hossain, S. Sakib, H. M. Abdullah, and S. E. Arman, "Deep Learning for Mango Leaf Disease Identification: A Vision Transformer Perspective," Heliyon, vol. 10, no. 17, 2024.
DOI: 10.1016/j.heliyon.2024.e36361

[9] V. E. González-Rodríguez, I. Izquierdo-Bueno, J. M. Cantoral, M. Carbú, and C. Garrido, "Artificial Intelligence: A Promising Tool for Application in Phytopathology," Horticulturae, vol. 10, no. 3, 2024.
DOI: 10.3390/horticulturae10030197

[10] C. R. Sandoval Lozada, E. Altamirano Flores, E. Cáceres Cayllahua, and L. J. Llaque Ramos, "Automatic Diagnostic System for Mango Leaf Diseases Based on

MobileNetV2," Acta Agronómica, vol. 74, no. 1, 2026.
DOI: 10.15446/acag.v74n1.123188

[11] J. Simanjuntak and Muhathir, "Application of MobileNetV2 Architecture with SIMAM for Automatic Detection of Diseases on Mango Leaves," Journal of Informatics and Telecommunication Engineering, 2025.
DOI: 10.31289/jite.v8i3Spc.14612

[12] R. C. Simangunsong and Muhathir, "MobileNetV2 Analysis in Classification Diseases on Mango Leaves," Journal of Informatics and Telecommunication Engineering, 2025.
DOI: 10.31289/jite.v8i3Spc.14430

[13] S. Sasitharan, S. Subbiah, N. D. Malaichamy, and D. Chelliah, "MobileNetV2: A Computationally Efficient Model for Mango Leaf Disease Diagnosis: An Experimental Study," Premier Journal of Science, vol. 14, 2025.
DOI: 10.70389/PJS.100164

[14] "TinyML for Plant Disease Detection: Efficient Edge AI Solutions for Apple and Mango Leaves," Procedia Computer Science, vol. 258, 2025.
DOI: 10.1016/j.procs.2025.04.547

[15] J. Too, S. Yujian, N. Njuki, and L. Yingchun, "A Comparative Study of Fine-Tuning Deep Learning Models for Plant Disease Identification," Computers and Electronics in Agriculture, vol. 161, pp. 272–279, 2019.
DOI: 10.1016/j.compag.2018.03.032