

AN EFFICIENT HYBRID MODEL FOR EARLY DETECTION OF MANGO LEAF PESTS

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Abstract

Mango is a vital cash crop widely cultivated across tropical and subtropical regions, including Sri Lanka, where it contributes significantly to agricultural income and rural livelihoods. However, mango cultivation is often hindered by pest infestations, which cause substantial yield losses and reduce fruit quality, adversely affecting farmers' economic stability. Traditional pest detection relies on manual inspection, a labor-intensive, time-consuming process prone to human error, especially on large-scale plantations. To overcome these limitations, this research proposes an efficient automated pest identification system specifically designed for mango cultivation. The framework employs a hybrid approach that integrates advanced deep learning models, VGG19, ResNet50, DenseNet121, MobileNetV2, InceptionV3, and Unet, for effective feature extraction, combined with machine learning classifiers such as Support Vector Machines (SVM), Random Forest, and Logistic Regression for accurate pest classification. The system is evaluated using 200 images per class across 10 classes in the MangoPestClassification dataset, which contains real-world images of healthy and pest-affected mango leaves captured under diverse environmental conditions, reflecting practical field scenarios. Experimental results show that Logistic Regression, trained on a combined feature set derived from ResNet50 features extracted after the fully connected layer, achieved the highest test accuracy of 97%. This performance surpasses all other feature-classifier combinations, demonstrating the robustness and strong generalization capability of Logistic Regression in distinguishing pest categories. Overall, the proposed framework offers a scalable and effective solution for early pest detection, enabling timely interventions, reducing dependence on manual inspection, and supporting technology-driven precision agriculture in mango cultivation.

Keywords: mango pest detection, machine learning, deep learning, feature extraction, precision agriculture