AI-Based Tea Leaf Disease Detection Using Deep Learning and Image Recognition

J.K. Kaushica* and V. Sudharshan
Faculty of Engineering, The Open University of Sri Lanka, Sri Lanka
* jkkau@ou.ac.lk

Tea (*Camellia sinensis*) is one of the most economically important plantation crops in Sri Lanka; however, foliar diseases such as blister blight and brown blight continue to cause significant yield and quality losses if not identified at early stages. Conventional disease detection methods rely heavily on manual visual inspection, which is time-consuming, subjective, and difficult to scale across large plantation areas. To address these limitations, this study proposes a deep learning–based tea leaf disease detection system using image recognition and a custom Convolutional Neural Network (CNN), with an emphasis on real-time field applicability. A dataset of 1,200 tea leaf images was collected from tea estates in the upcountry region of Sri Lanka under natural field conditions. The dataset comprises three classes: healthy leaves, blister blight–infected leaves, and brown blight–infected leaves. Images were preprocessed using resizing, normalization, and data augmentation techniques to enhance robustness against lighting variations and background noise. The CNN model was trained and evaluated using a 70:15:15 train–validation–test split. Experimental evaluation demonstrates that the proposed model achieves an overall classification accuracy of 92.4% and an F1-score of 0.92, indicating effective discrimination among disease classes. The trained model was successfully integrated into an Android-based mobile application, enabling on-device inference with an average prediction time of less than two seconds per image, making it suitable for real-time agricultural use without continuous internet connectivity. Despite promising results, the study is limited by the moderate dataset size and variability in lighting conditions during image acquisition. Future work will focus on dataset expansion, improved robustness under diverse field environments, and large-scale field validation. The proposed system highlights the potential of deep learning–enabled mobile solutions to support precision agriculture and early disease management in Sri Lanka's tea industry.

Keywords: Artificial Intelligence (AI), Convolutional Neural Networks (CNN), Image Recognition, Precision Agriculture, Sustainable Farming