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MACHINE LEARNING-DRIVEN DISEASE DIAGNOSIS AND MANAGEMENT FOR DIVERSE CROPS USING CNN AND TRANSFER LEARNING

M.S. Gunarathna[1*], P.H.K.R. Punchihewa[2] and R.D. Nawarathna[1]

[1]Postgraduate Institute of Science, University of Peradeniya, Sri Lanka
[2]National Institute of Business Management, Colombo, Sri Lanka
[*]sahan.suchi@gmail.com

This research aimed to develop a machine-learning-based framework for disease diagnosis in a variety of crops, including rice, bell pepper, tomato, potato, and coconut. The primary objective of this study is to minimize the gap between farmers and accessible disease identification technologies and increase diagnostic accuracy by using Convolutional Neural Networks (CNN) and advanced transfer learning. CNNs effectiveness in image recognition, especially in capturing spatial hierarchies in images make CNN well suited for identifying complex patterns in crop disease images. This was achieved with a dataset sourced from Kaggle's "Plant Village" and a few other repositories, comprising diverse images of diseased crops. The dataset was pre-processed to account for multiple disease types within each crop. Mirroring the techniques developed for image recognition tasks and using CNNs fed with transfer learning made it possible to train models with impeccable sensitivity, specificity, and accuracy by dividing the dataset into 80% for training to ensure sufficient data exposure,10% for testing to evaluate the model's performance on unseen data and 10% for validation to tune the hyperparameters and check overfitting. Furthermore, the models, based on the Visual Geometry Group (VGG) model, showed good efficiency with high precision, recall, F1 scores, and accuracy on a range of crops. The base CNN model showed slightly weaker performance with precision, recall, and F1-scores of 0.95, 0.95, and 0.95 and accuracy of 94.81%, indicating the VGG model's superior effectiveness across various crops. Validation metrics confirmed the models' high sensitivity and specificity. The resulting web and mobile applications embed a variety of user-friendly interfaces for presaging real-time disease as well as management counselling approaches that are accessible to meet the needs of farmers and agronomists.

Keywords: Convolutional Neural Network, Disease diagnosis, Hyperparameters, Transfer learning, Visual Geometry Group