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TRANSFER LEARNING FOR PLANT LEAF DISEASE CLASSIFICATION WITH CONVOLUTIONAL NEURAL NETWORKS

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Many farmers use the traditional approaches for plant leaf disease detection. However, it requires significant time and continuous monitoring of the field resulting in unforeseen losses. Computerised cultivating practices can be a solution for effectively and rapidly recognising plant leaf diseases. This research analyses the transfer learning approaches and how the transfer learning techniques can increase the performance of neural network architecture with predefined models. Two well established convolutional neural network (CNN) models, VGG 19 and GoogLeNet (InceptionV3), were used to find the best model for plant leaf detection in terms of loss and accuracy metrics. All the models have been configured with consistent hyperparameter values. The technique is applied on plantVillage Kaggle datasets of potato, bell pepper, and tomato leaves to investigate the disease of unhealthy leaves. 70% of the dataset was used for training with the 5-fold cross-validation, and 30% was used for testing. Next, the feature extraction and classification process were performed in dataset images to detect leaf diseases using VGG 19 and GoogLeNet (InceptionV3) models by applying image processing. The experimental results confirm the effectiveness of the study, with an overall accuracy of 94.8% of VGG 19 and an overall accuracy of 95.6% of InceptionV3. The results illustrate that the leaf image classification can be achieved with high accuracy using the transfer learning technique without deep knowledge in image processing. Among the two architecture models, InceptionV3 performs well with the validation accuracy of 96%, validation loss of 19.2%, and training loss of 11.9%, where augmentation, dropout, and early stopping techniques are applied. This study confirms that the proposed model can be effectively utilised to identify potential diseases in plant leaves.

Keywords: CNN, Image augmentation, Leaf disease, Transfer learning