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Artificial Intelligence in Smart Farms: Plant Phenotyping for Species Recognition and Health Condition Identification using Deep Learning

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Abstract

This paper analyses the contribution of residual network (ResNet) based convolutional neural network (CNN) architecture employed in two tasks related to plant phenotyping. Among the contemporary works for species recognition (SR) and infection detection of plants, the majority of them have performed experiments on balanced datasets and used accuracy as the evaluation parameter. However, this work used an imbalanced dataset having an unequal number of images, applied data augmentation to increase accuracy, organised data as multiple test cases and classes, and, most importantly, employed multiclass classifier evaluation parameters useful for asymmetric class distribution. Additionally, the work addresses typical issues faced such as selecting the size of the dataset, depth of classifiers, training time needed, and analysing the classifier's performance if various test cases are deployed. In this work, ResNet 20 (V2) architecture has performed significantly well in the tasks of Species Recognition (SR) and Identification of Healthy and Infected Leaves (IHIL) with a Precision of 91.84% and 84.00%, Recall of 91.67% and 83.14% and F1 Score of 91.49% and 83.19%, respectively.

Key words:
Species recognition; health identification; plant phenotyping; deep learning.

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