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Optimizing Perennial Plants Image Classification by Fine-Tuning Deep Neural Networks

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Abstract : Perennial plant classification plays a significant role in various agricultural and environmental applications, assisting in plant identification, disease detection, and biodiversity monitoring. Nevertheless, attaining high accuracy in perennial plant image classification remains challenging due to the complex variations in plant appearance, the diverse range of environmental conditions under which images are captured, and the inherent variability in image quality stemming from various factors such as lighting conditions, camera settings, and focus. This paper proposes an adaptation approach to optimize perennial plant image classification by fine-tuning the pre-trained DNNs model. This paper explores the efficacy of fine-tuning prevalent architectures, namely VGG16, ResNet50, and InceptionV3, leveraging transfer learning to tailor the models to the specific characteristics of perennial plant datasets. A subset of the MYLPHerbs dataset consisted of 6 perennial plant species of 13481 images under various environmental conditions that were used in the experiments. Different strategies for fine-tuning, including adjusting learning rates, training set sizes, data augmentation, and architectural modifications, were investigated. The experimental outcomes underscore the effectiveness of fine-tuning deep neural networks for perennial plant image classification, with ResNet50 showcasing the highest accuracy of 99.78%. Despite ResNet50's superior performance, both VGG16 and InceptionV3 achieved commendable accuracy of 99.67% and 99.37%, respectively. The overall outcomes reaffirm the robustness of the fine-tuning approach across different deep neural network architectures, offering insights into strategies for optimizing model performance in the domain of perennial plant image classification.

Keywords : perennial plants, image classification, deep neural networks, fine-tuning, transfer learning, VGG16, ResNet50, InceptionV3
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