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Plant Identification Using Convolution Neural Network and Vision Transformer-Based Models

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Abstract : Plant identification is a challenging task that aims to identify the family, genus, and species according to plant morphological features. Automated deep learning-based computer vision algorithms are widely used for identifying plants and can help users narrow down the possibilities. However, numerous morphological similarities between and within species render correct classification difficult. In this paper, we tested custom convolution neural network (CNN) and vision transformer (ViT) based models using the PyTorch framework to classify plants. We used a large dataset of 88,000 provided by the Royal Horticultural Society (RHS) and a smaller dataset of 16,000 images from the PlantClef 2015 dataset for classifying plants at genus and species levels, respectively. Our results show that for classifying plants at the genus level, ViT models perform better compared to CNN-based models ResNet50 and ResNet-RS-420 and other state-of-the-art CNN-based models suggested in previous studies on a similar dataset. ViT model achieved top accuracy of 83.3% for classifying plants at the genus level. For classifying plants at the species level, ViT models perform better compared to CNN-based models ResNet50 and ResNet-RS-420, with a top accuracy of 92.5%. We show that the correct set of augmentation techniques plays an important role in classification success. In conclusion, these results could help end users, professionals and the general public alike in identifying plants quicker and with improved accuracy.

Keywords : plant identification, CNN, image processing, vision transformer, classification
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