Convolutional Neural Networks based Texture Feature Extraction for Coconut Tree Leaf Disease Classification in Precision Agriculture

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Abstract

This paper investigates the application of deep-learning models (AlexNet, VggNet, ResNet) that have been pre-trained on object categories from ImageNet in texture classification tasks, particularly for detecting coconut tree leaf diseases. Research in precision agriculture is highly significant due to its potential economic benefits for enhancing agricultural productivity and quality. In this context, we propose a method for feature extraction based on deep learning to identify coconut tree leaf species and classify coconut tree leaf diseases. Our focus is on results applicable to real-time processing scenarios that can be seamlessly integrated into both manned and unmanned agricultural machinery, such as tractors, drones, robots, and IoT smart sensor networks, by rethinking the conventional processing pipeline. In our approach, texture features are extracted from various layers of pre-trained Convolutional Neural Network (CNN) models and subsequently utilized in a machine-learning classifier. For experimental evaluation, we employed publicly available datasets that include RGB textured images as well as images of healthy and unhealthy leaves from different coconut tree leaf species. We compared our method against feature vectors derived from traditional handcrafted extraction techniques applied to the same images, as well as end-to-end deep-learning approaches. The results indicate that our method is significantly more efficient regarding processing times and discriminative ability, outperforming both traditional methods and end-to-end CNN approaches while also addressing the challenge of limited datasets in precision agriculture.