

ABSTRAK

Penyakit pada daun labu kuning, seperti *bacterial leaf spot*, *downy mildew*, *mosaic disease*, dan *powdery mildew*, dapat menurunkan kualitas dan kuantitas hasil panen apabila tidak dideteksi sejak dini. Penelitian ini bertujuan mengembangkan sistem klasifikasi penyakit daun labu kuning berbasis *Convolutional Neural Network* (CNN) dengan arsitektur MobileNetV2 melalui *Transfer Learning*, serta mengoptimalkan *hyperparameter* menggunakan *Randomized Search* yang dikombinasikan dengan *3-Fold Cross Validation*. Dataset berjumlah 2.000 citra daun labu kuning terbagi dalam lima kelas, diperkaya melalui augmentasi data. Optimasi dilakukan dengan mengevaluasi 15 kombinasi *hyperparameter* secara acak (*optimizer*, *epoch*, *batch size*, *learning rate*), menghasilkan 45 proses pelatihan. Model *baseline* dengan *hyperparameter* default memperoleh akurasi 86,31% pada data uji. Setelah optimasi, kombinasi terbaik (*Adam*, *epoch* 30, *batch size* 16, *learning rate* 0,0001) menghasilkan *mean accuracy* validasi silang 86,17%, dan setelah dilatih penuh mencapai *test accuracy* 88,62% dengan *macro average F1-score* 88,60% pada 1.125 sampel uji. Peningkatan 2,31 poin persentase dibandingkan *baseline* membuktikan kontribusi nyata optimasi *hyperparameter* terhadap kinerja model. Kelas *Mosaic Disease* memperoleh F1-score tertinggi (95,98%), sedangkan *Bacterial Leaf Spot* terendah (81,53%) akibat kemiripan gejala visual. Sistem ini berpotensi digunakan sebagai alat bantu deteksi dini penyakit daun labu kuning berbasis citra digital.

Kata kunci: klasifikasi penyakit tanaman, labu kuning, *Convolutional Neural Network*, MobileNetV2, *Randomized Search*, *hyperparameter tuning*

ABSTRACT

Diseases affecting pumpkin leaves, such as bacterial leaf spot, downy mildew, mosaic disease, and powdery mildew, can reduce harvest quality and quantity if not detected early. This study aims to develop a pumpkin leaf disease classification system based on a Convolutional Neural Network (CNN) using the MobileNetV2 architecture via Transfer Learning, combined with hyperparameter optimization using Randomized Search integrated with 3-Fold Cross Validation. The dataset consists of 2,000 pumpkin leaf images across five classes, expanded through data augmentation. Optimization evaluated 15 randomly sampled hyperparameter combinations (optimizer, epoch, batch size, learning rate), resulting in 45 training processes. The baseline model with default hyperparameters achieved a test accuracy of 86.31%. After optimization, the best combination (Adam, 30 epochs, batch size 16, learning rate 0.0001) achieved a cross-validation mean accuracy of 86.17%, and after full training reached a test accuracy of 88.62% with a macro average F1-score of 88.60% on 1,125 test samples. The 2.31 percentage-point improvement over the baseline confirms the significant contribution of hyperparameter optimization to model performance. The Mosaic Disease class achieved the highest F1-score (95.98%), while Bacterial Leaf Spot had the lowest (81.53%) due to visual similarities with other classes. The system has potential as an early detection tool for pumpkin leaf diseases using digital imagery.

Keywords: plant disease classification, pumpkin, Convolutional Neural Network, MobileNetV2, Randomized Search, hyperparameter tuning

