

## ABSTRAK

Lemon california memiliki nilai ekonomi yang tinggi karena mampu berbuah sepanjang tahun dan banyak dimanfaatkan dalam industri pangan, minuman, serta kesehatan. Akan tetapi, produktivitas tanaman lemon sering kali terganggu oleh serangan penyakit daun yang menghambat pertumbuhan tanaman, menurunkan kualitas buah, bahkan menyebabkan penurunan hasil panen secara signifikan. Berdasarkan hasil wawancara dan observasi pada kebun lemon california di Desa Munggu, Kabupaten Kebumen, ditemukan bahwa penyakit seperti karat daun, daun keriting, kutu kebul, dan daun kuning menjadi faktor utama penurunan produktivitas. Sementara itu, petani dalam identifikasi penyakit daun umumnya masih dilakukan secara manual sehingga berpotensi menimbulkan kesalahan diagnosis. Oleh sebab itu, diperlukan suatu metode berbasis teknologi yang mampu mengidentifikasi penyakit daun lemon secara otomatis, akurat, dan efisien guna membantu petani dalam melakukan deteksi dini.

Penelitian ini menggunakan pendekatan klasifikasi citra berbasis *Convolutional Neural Network* (CNN) dengan arsitektur MobileNetV2 yang mengimplementasikan metode *transfer learning*. Data diperoleh melalui proses wawancara, observasi secara langsung, dan pelabelan data bersama narasumber ahli, yaitu pemilik perkebunan lemon. *Dataset* yang digunakan berjumlah 240 citra daun lemon california yang terbagi ke dalam lima kelas, yaitu penyakit kutu kebul, daun keriting, karat daun, daun kuning, dan daun sehat. Tahapan penelitian meliputi pengumpulan data, *pre-processing* data, implementasi model, pengujian kombinasi hyperparameter, serta evaluasi terhadap model. Selain itu, penelitian ini juga mencakup pengembangan sistem klasifikasi penyakit daun lemon berbasis aplikasi *android* yang dikembangkan menggunakan bahasa pemrograman *Dart*.

Hasil penelitian menunjukkan bahwa kombinasi *hyperparameter* terbaik diperoleh pada *batch size* 32, *learning rate* 0,001, dan 30 *epoch* pelatihan. Model mampu mencapai akurasi validasi yang tinggi sejak *epoch* awal. Hal ini menunjukkan bahwa model mampu menangkap pola utama data secara cepat. Pengujian terhadap 25 data uji menunjukkan bahwa model berhasil mengklasifikasikan 24 citra dengan benar, dengan satu kesalahan prediksi terjadi antara kelas kutu kebul dan karat daun. Secara keseluruhan, model menghasilkan nilai akurasi sebesar 96%, *precision* sebesar 96,6%, *recall* sebesar 96%, dan *F1-Score* sebesar 95,8%. Hasil tersebut menunjukkan bahwa metode *transfer learning* CNN berbasis MobileNetV2 efektif untuk membantu petani dalam mengklasifikasikan penyakit daun lemon california.

**Kata Kunci:** Lemon california, penyakit daun, *transfer learning*, *Convolutional Neural Network*.

## ABSTRACT

*California lemons have high economic value because they can bear fruit year-round and are widely used in the food, beverage, and health industries. However, lemon plant productivity is often hampered by leaf diseases that inhibit plant growth, reduce fruit quality, and even cause a significant decrease in yield. Based on interviews and observations at a California lemon orchard in Munggu Village, Kebumen Regency, it was found that diseases such as leaf rust, leaf curl, whitefly, and yellow leaf spot are the main factors in reducing productivity. Meanwhile, farmers generally still identify leaf diseases manually, which has the potential to lead to misdiagnosis. Therefore, a technology-based method is needed that can identify lemon leaf diseases automatically, accurately, and efficiently to assist farmers in early detection.*

*This study uses a Convolutional Neural Network (CNN)-based image classification approach with the MobileNetV2 architecture that implements the transfer learning method. Data were obtained through interviews, direct observation, and data labeling with expert sources, namely lemon plantation owners. The dataset used consisted of 240 images of California lemon leaves divided into five classes: whitefly disease, curly leaves, leaf rust, yellow leaves, and healthy leaves. The research stages include data collection, data pre-processing, model implementation, hyperparameter combination testing, and model evaluation. In addition, this study also includes the development of an Android application-based lemon leaf disease classification system developed using the Dart programming language.*

*The results showed that the best hyperparameter combination was obtained with a batch size of 32, a learning rate of 0.001, and 30 training epochs. The model achieved high validation accuracy from the initial epoch, indicating that the model was able to quickly capture key data patterns. Testing on 25 test data sets showed that the model successfully classified 24 images correctly, with one misprediction occurring between the whitefly and leaf rust classes. Overall, the model achieved an accuracy of 96%, a precision of 96.6%, a recall of 96%, and an F1-Score of 95.8%. These results indicate that the MobileNetV2-based CNN method is effective in classifying California lemon leaf disease.*

**Keywords:** *California lemon, leaf disease, transfer learning, Convolutional Neural Network.*