



ANALISIS KINERJA *DEEP LEARNING* PADA CITRA BIJI KOPI UNTUK PREDIKSI DERAJAT SANGRAI

INTISARI

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Penyangraian merupakan tahap penting dalam pengolahan kopi karena memengaruhi cita rasa, aroma, dan karakteristik sensoris. Penentuan derajat sangrai biasanya dilakukan melalui pengamatan visual berdasarkan perubahan warna biji, namun metode ini kurang akurat akibat subjektivitas penilai dan potensi kesalahan manusia. Untuk mengatasi keterbatasan tersebut, penelitian ini mengusulkan pendekatan berbasis *Deep Learning* dalam klasifikasi citra biji kopi. Empat kelas digunakan sebagai target klasifikasi, yaitu *Green Bean* (belum disangrai), *Light Roast*, *Medium Roast*, dan *Dark Roast*. Dua model dibandingkan, yakni *Convolutional Neural Network* (CNN) arsitektur *MobileNetV2* dan *Artificial Neural Network* (ANN). Dataset terdiri atas 1.600 citra biji kopi robusta yang diambil dari petani di kaki Gunung Merapi, Kabupaten Magelang, menggunakan kamera telepon genggam dalam *photo box* mini dengan latar putih polos dan pencahayaan terkontrol. Dataset dibagi menjadi data latih, validasi, dan uji dengan proporsi 80%:10%:10%. Hasil menunjukkan bahwa CNN berbasis *MobileNetV2* mencapai akurasi 96% dengan pembelajaran yang stabil, *loss* rendah, serta performa evaluasi yang konsisten pada *precision*, *recall*, dan *F1-score*. Sebaliknya, ANN hanya memperoleh akurasi 53% dan menunjukkan keterbatasan dalam generalisasi data. Model CNN kemudian dikonversi ke TensorFlow Lite dan berhasil diintegrasikan ke dalam aplikasi *Android* untuk klasifikasi derajat sangrai secara *offline* dengan cepat dan akurat. Temuan ini menegaskan keunggulan CNN dengan arsitektur *MobileNetV2* dibandingkan ANN, sekaligus menawarkan solusi praktis bagi pelaku usaha mikro, kecil, dan menengah (UMKM) dalam menentukan kualitas sangrai.

Kata kunci: Penyangraian Kopi, *Convolutional Neural Network*, *Artificial Neural Network*, *MobileNetv2*, Klasifikasi Citra

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PERFORMANCE ANALYSIS OF *DEEP LEARNING* MODELS ON COFFEE BEAN *IMAGES* FOR ROAST LEVEL PREDICTION

ABSTRACT

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Roasting is a vital stage in coffee processing, as it significantly influences the flavor, aroma, and *overall* sensory quality of coffee beans. Traditionally, roast level determination relies on visual assessment of color changes, a method that is often subjective and prone to human error, thereby reducing accuracy. To address these limitations, this study applies a Deep Learning-based approach for coffee bean image classification. The classification task involved four categories: Green Bean (unroasted), Light Roast, Medium Roast, and Dark Roast. Two models were developed and evaluated: a Convolutional Neural Network (CNN) employing the MobileNetV2 architecture and a conventional Artificial Neural Network (ANN). A dataset of 1,600 robusta coffee bean images was collected from farmers on the slopes of Mount Merapi, Magelang Regency. Images were captured using a smartphone camera inside a controlled mini photo box with a plain white background and standardized lighting. The dataset was divided into training, validation, and testing subsets in an 80%:10%:10% ratio. Experimental results revealed that the CNN with MobileNetV2 achieved 96% accuracy, characterized by stable learning performance, low loss values, and consistent metrics across precision, recall, and F1-score. In contrast, the ANN attained only 53% accuracy, indicating weaker generalization. The CNN model was subsequently converted into TensorFlow Lite and deployed in an Android application, enabling offline classification that is both efficient and accurate. *Overall*, the study demonstrates the superiority of CNN with MobileNetV2 *over* ANN for coffee bean image classification and underscores its potential as a practical tool for small-scale enterprises to assess roast quality objectively and effectively.

Keywords: Coffee *Roasting*, Convolutional Neural Network, Artificial Neural Network, *MobileNetv2*, Image Classification

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