

PENGEMBANGAN APLIKASI ANDROID PENGUKUR DERAJAT SANGRAI BIJI KAKAO BERBASIS ANALISIS CITRA MOBILENETV2 DENGAN PEMBELAJARAN TRANSFER LEARNING

INTISARI

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Penyangaian merupakan faktor penting dalam tahapan proses pengolahan biji kakao dengan derajat sangrai sebagai parameter mutunya, yang ditandai dengan aroma harum coklat, kulit biji terlihat retak, dan warna kulit biji kakao menjadi sedikit pucat. Namun, dalam menentukan derajat sangrai biji kakao memerlukan kemahiran khusus karena resiko kesalahan dan kekeliruan terhadap menentukan derajat sangrai biji kakao sering terjadi yang dapat menurunkan nilai ekonomis produk. Oleh karena itu, diperlukan suatu bantuan alat yang dapat dengan mudah menentukan derajat sangrai biji kakao secara akurat. Penelitian ini bertujuan untuk mengembangkan suatu aplikasi *Android* untuk mengklasifikasikan derajat sangrai biji kakao dengan analisis citra menggunakan *transfer learning by smartphone*. Model *deep learning* yang digunakan yaitu model *Convolutional Neural Network* (CNN) dengan arsitektur *MobileNetV2* berbasis *Android*. Beberapa parameter meliputi, ukuran citra 256 x 256 *Pixels*, *learning rate* 0,0001, dan *epoch* 20-25. Pengambilan citra dilakukan menggunakan *smartphone* dengan perbesaran 4 kali. Adapun dataset yang digunakan untuk data latih, data validasi, dan data uji terbagi menjadi dua kategori yaitu, biji kakao dikupas berjumlah 2223 citra dan biji kakao tidak dikupas berjumlah 2156 citra. Dari penelitian yang telah dilakukan, diperoleh derajat sangrai biji kakao terbaik pada suhu 120°C selama 5-6 menit. *Classification report* pada model biji kakao dikupas pada 5 menit, *precision* 0,95, *recall* 1,00, dan *F1-score* 0,97. Pada 6 menit, *precision* 0,68, *recall* 0,73, dan *F1-score* 0,71, sedangkan pada model biji kakao tidak dikupas pada 5 menit, *precision* 0,83, *recall* 0,77, dan *F1-score* 0,80. Pada 6 menit, *precision* 0,79, *recall* 0,72, dan *F1-score* 0,76. Tingkat *accuracy* pada model perbandingan, model biji kakao dikupas, model biji kakao tidak dikupas, dan model perbedaan warna, berturut-turut sebesar 99%, 81%, 83%, dan 87%. Klasifikasi derajat sangrai dapat diimplementasikan pada sebuah aplikasi bernama *Cocoa Roast Scan*.

Kata Kunci: Biji Kakao, derajat sangrai, *Android*, *Convolutional Neural Network* (CNN), *MobileNetV2*

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THE DEVELOPMENT *ANDROID* APPLICATION FOR MEASURING THE ROASTING DEGREE OF COCOA BEANS BASED ON IMAGE ANALYSIS USING *MOBILENETV2* BY TRANSFER LEARNING

ABSTRACT

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Roasting is a critical factor in the processing stages of cocoa bean's, with quality parameters determined by the degree of roast, which is characterized by a pleasant chocolate aroma, cracked bean shells, and a slightly pale coloration of the cocoa bean's skin. However, determining the optimal roasting degree requires specific expertise because the roast degree frequently occur error and potentially reducing the economic value of the final product. Therefore, a reliable tool is needed to accurately determine the roasting degree of cocoa bean's with ease. **"The objective of this study is to develop an *Android*-based application capable of classifying the roasting degree of cocoa bean's through image analysis utilizing transfer learning by smartphones.** The deep learning model employed is a Convolutional Neural Network (CNN) using the *MobileNetV2* architecture on an *Android*-based platform. Key parameters include an image resolution of 256 x 256 Pixels, a learning rate of 0.0001, and 20–25 training epochs. Image acquisition was conducted with 4x magnification using a smartphone. The dataset consists of two categories: 2223 images of peeled cocoa bean's and 2156 images of unpeeled cocoa bean's, which were divided into training, validation, and testing sets. The study found that the optimal roast degree is achieved within 5–6 minutes at a temperature of 120°C. The classification report for peeled cocoa bean's at 5 minutes yielded a precision of 0.95, recall of 1.00, and F1-score of 0.97; whereas at 6 minutes, the precision was 0.68, recall was 0.73, and F1-score was 0.71. For unpeeled cocoa bean's at 5 minutes, the precision was 0.83, recall was 0.77, and F1-score was 0.80; at 6 minutes, the precision was 0.79, recall was 0.72, and F1-score was 0.76. The comparison between peeled cocoa bean's and the unpeeled model achieved an overall accuracy of 99%, with 81% accuracy for the peeled cocoa bean's model, 83% for the unpeeled bean's model, and 87% for the colour difference model. The roast degree classification system can be implemented in an application named Cocoa Roast Scan.

Keywords: Cocoa Bean's, Roasting Degree, *Android*, Convolutional Neural Network (CNN), *MobileNetV2*

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