

ABSTRAK

Kualitas daun teh segar merupakan faktor penentu kualitas produk teh akhir, namun penilaian kualitas secara manual memiliki keterbatasan pada konsistensi, efisiensi waktu, dan aksesibilitas, terutama ketika pemasok dan pembeli berada pada lokasi yang berbeda. Penelitian ini bertujuan membangun sistem klasifikasi kualitas daun teh secara otomatis menggunakan algoritma YOLOv11 (You Only Look Once) yang diimplementasikan dalam antarmuka berbasis website, sehingga pengguna dapat menilai kualitas daun teh hanya dengan mengunggah gambar tanpa memerlukan keahlian teknis maupun tenaga ahli.

Dataset yang digunakan terdiri dari 2.208 gambar daun teh, terbagi dalam empat kategori berdasarkan umur daun teh sebelum dipetik: Kategori A (1–2 hari), B (3–4 hari), C (5–7 hari), dan D (lebih dari 7 hari). Tahap preprocessing mencakup data split dan tiga pipeline augmentasi (dua offline menggunakan Albumentations dan satu online bawaan YOLO). Sebelas percobaan pelatihan dilakukan dengan arsitektur YOLOv11s menggunakan transfer learning, dan model terbaik menghasilkan mAP@50 sebesar 0,919, Precision 0,922, Recall 0,879, F1-Score 0,900, dan kecepatan inferensi $\pm 4,9$ ms per gambar. Website dibangun menggunakan Python, Html, Css dan Streamlit dengan fitur unggah gambar, crop interaktif, dan visualisasi hasil deteksi. Pengujian fungsional terhadap 4 fungsi utama seluruhnya berhasil, dan pengujian usability terhadap 15 responden menghasilkan skor rata-rata di atas 83% pada seluruh aspek. Penelitian ini membuktikan bahwa YOLOv11 efektif untuk klasifikasi kualitas daun teh secara otomatis dan berpotensi menjadi alat bantu praktis bagi konsumen maupun pelaku usaha teh.

Kata Kunci: YOLOv11, klasifikasi kualitas daun teh, deteksi objek, deep learning, Streamlit

ABSTRAK

The quality of fresh tea leaves is a key determinant of the final tea product however, manual quality assessment is limited in consistency, time efficiency, and accessibility particularly when suppliers and buyers are in different locations. This study aims to develop automated tea leaf quality classification system using the YOLOv11 (You Only Look Once), algorithm implemented in a web-based interface, enabling users to assess tea leaf quality simply by uploading an image without requiring technical expertise or professional evaluators.

The dataset used consists 2,208 tea leaf images divided into four categories based on the age of the tea leaves before harvest: Category A (1–2 days), B (3–4 days), C (5–7 days), and D (+7 days). Preprocessing steps included data split and three augmentation pipelines (two offline using Albumentations and one online via built-in YOLO augmentation). Eleven training experiments were conducted using YOLOv11s with transfer learning, the best model achieved mAP@50 of 0.919, Precision 0.922, Recall 0.879, F1-Score 0.900, and an inference speed of ± 4.9 ms per image. The website was built using Python and Streamlit, featuring image upload, interactive cropping, and detection result visualization. Functional testing of 4 core functions passed entirely, and usability testing with 15 respondents yielded average scores above 83% across all aspects. This study demonstrates that YOLOv11 is effective for automated tea leaf quality classification and has strong potential as a practical tool for tea consumers and industry practitioners.

Keywords: YOLOv11, tea leaf quality classification, object detection, deep learning, Streamlit