

ABSTAK

Kopi merupakan komoditas penting di Indonesia, namun proses sortasi biji kopi masih banyak dilakukan secara manual (*double picker*) yang bersifat subjektif, lambat, dan tidak konsisten. Penelitian ini bertujuan untuk mengimplementasikan algoritma YOLOv8 dalam mendeteksi cacat fisik dan kontaminan pada biji kopi secara otomatis. Model didasarkan pada *fine-tuning* YOLOv8s menggunakan dataset sebanyak 451 citra biji kopi yang menghasilkan 6.487 anotasi dengan 25 kelas cacat dan kontaminan sesuai standar SNI 01-2907-2008 dan ICO. Proses pelatihan dilakukan dengan teknik transfer learning dan augmentasi data. Sistem yang dikembangkan berbasis web menggunakan *framework* FastAPI dan OpenCV, mendukung dua mode yaitu deteksi *real-time* (*video stream*) dan deteksi berbasis citra statis untuk perhitungan nilai cacat. Perhitungan skor cacat dilakukan secara otomatis berdasarkan bobot nilai cacat SNI. Hasil pengujian menunjukkan model mencapai mAP@0.5 sebesar 77.3%. Model sangat baik dalam mendeteksi kelas Biji Normal (mAP 96%) dan kontaminan, meskipun masih terdapat tantangan pada kelas yang memiliki kemiripan visual seperti Biji Pecah dan Biji Hitam. Sistem berhasil diintegrasikan dengan antarmuka yang user-friendly dan mampu memberikan hasil deteksi serta perhitungan nilai cacat secara cepat.

Kata Kunci: YOLOv8, deteksi cacat biji kopi, *computer vision*, *deep learning*, sortasi kopi, mAP.

ABSTRACT

Coffee is an important commodity in Indonesia, but the coffee bean sorting process is still largely carried out manually (double picker), which is subjective, slow, and inconsistent. This study aims to implement the YOLOv8 algorithm for automatic detection of physical defects and contaminants in coffee beans. The model is based on fine-tuning YOLOv8s using a dataset of 451 coffee bean images, yielding 6,487 annotations across 25 classes of defects and contaminants according to SNI 01-2907-2008 and ICO standards. Training was conducted using transfer learning and data augmentation techniques. The developed system is web-based using the FastAPI and OpenCV frameworks, supporting two modes: real-time detection (video stream) and static image-based detection for defect score calculation. The defect score is calculated automatically based on the SNI defect weight values. Experimental results show that the model achieved an mAP@0.5 of 77.3%. The model performed very well in detecting the Normal Bean class (mAP 96%) and contaminants, although challenges remain in classes with high visual similarity such as Broken Bean and Black Bean. The system has been successfully integrated with a user-friendly interface and is able to provide detection results and defect score calculations quickly.

Keywords: YOLOv8, coffee bean defect detection, computer vision, deep learning, coffee sorting, mAP.