

PROTOTYPE PENDETEKSI BIJI KAKAO KERING BERBASIS *COMPUTER VISION* UNTUK MEMBANTU PROSES *SAMPLING* PENERIMAAN BAHAN BAKU

INTISARI

Oleh:

FIFI NUR ZAKIYATUR ROSYIDAH
21/476739/TP/13126

Kakao (*Theobroma cacao* L.) merupakan salah satu komoditas perkebunan yang memiliki peranan penting dalam perekonomian nasional dengan produksi mencapai 632.117 ton pada tahun 2023 dan menjadi komoditas penyumbang devisa terbesar ke-4 dalam sub sektor perkebunan di Indonesia. Kenyataannya produksi kakao dari tahun 2019-2023 mengalami penurunan. Walaupun begitu, industri pengolah biji kakao senantiasa menjaga kualitas bahan bakunya. Kualitas bahan baku menjadi pertimbangan dalam pembelian karena nantinya akan berpengaruh terhadap biaya yang dikeluarkan. Uji *sampling* yang dilakukan oleh QC (*Quality Control*) digunakan untuk mengetahui kualitas bahan baku. Oleh karena itu, untuk membantu QC dalam menyupervisi kegiatan *sampling* dapat menggunakan pendekatan teknologi berupa penerapan *computer vision*.

Penelitian ini dilakukan dengan mengembangkan *computer vision* melalui eksperimen perancangan dan pengujian prototipe pendeteksi biji kakao kering. Pembuatan prototipe yang dilakukan disesuaikan dengan kebutuhan penggunaan alat serta dengan pendekatan *computer vision* diharapkan dapat memberikan hasil yang konsisten dan akurat dalam klasifikasi biji kakao.

Hasil penelitian didapatkan prototipe pendeteksi biji kakao kering yang digunakan untuk uji *sampling* fisik dan uji belah (*cut test*). Prototipe yang dibuat telah mampu dalam mendeteksi biji kakao sebanyak 100 gram. Dari uji yang dilakukan, didapatkan perbedaan performa antara nilai *testing* melalui *Google Colab* dengan nilai *testing* secara *real* menggunakan prototipe *computer vision*. Pada pengujian uji *sampling* fisik yang dilakukan melalui *Google Colab*, didapatkan performa model 84.5% *precision*, 83.5% *recall*, 90.4% mAP50 dan performa *testing* secara *real* menggunakan prototipe *computer vision* didapatkan nilai *recall* 100%, *precision* 81.7%, 89.9% F1-score. Sementara pada uji belah didapatkan performa model secara *testing* melalui *Google Colab* dengan nilai *precision* 97.2%, *recall* 97.2%, mAP50 99.93% dan performa *testing* secara *real* menggunakan prototipe *computer vision* didapatkan nilai *precision* 87.5%, *recall* 88.9%, F1-score 86.2%. Berdasarkan hasil yang didapatkan terdapat perbedaan antara performa *testing* melalui *Google Colab* dengan *testing* secara *real* menggunakan prototipe *computer vision*. Hal ini bisa terjadi karena model mengalami *overfitting* dan penggunaan dataset yang *imbalance*.

Kata kunci: biji kakao kering, *computer vision*, prototipe, *sampling*

PROTOTYPE OF COMPUTER VISION BASED DRY COCOA BEAN DETECTOR TO ASSIST RAW MATERIAL RECEIPT SAMPLING PROCESS

ABSTRACT

By:

FIFI NUR ZAKIYATUR ROSYIDAH
21/476739/TP/13126

Cocoa (*Theobroma cacao* L.) is one of the plantation commodities that plays an important role in the national economy, with a production volume reaching 632,117 tons in 2023, making it the fourth-largest foreign exchange-earning commodity in Indonesia's plantation sub-sector. However, cocoa production from 2019 to 2023 has experienced a decline. Despite this, cocoa bean processing industries continue to maintain the quality of their raw materials. The quality of raw materials is a key consideration in purchasing decisions, as it directly affects production costs. *sampling* tests conducted by Quality Control (QC) are used to determine the quality of raw materials. Therefore, to assist QC in supervising *sampling* activities, a technological approach such as the implementation of computer vision can be utilized..

This research was conducted by developing a computer vision system through the design and testing of a prototype for detecting dried cocoa beans. The prototype was built based on the functional requirements of the tool, and the use of computer vision is expected to produce consistent and accurate classification results of cocoa beans.

The research resulted in a prototype for detecting dried cocoa beans, which was used for physical *sampling* tests and cut tests. The developed prototype was capable of detecting cocoa beans weighing up to 100 grams. From the tests conducted, differences in performance were observed between the testing results obtained through Google Colab and the real testing results using the computer vision prototype. In the physical *sampling* test conducted via Google Colab, the model achieved a performance of 84.5% precision, 83.5% recall, and 90.4% mAP50, while real testing with the computer vision prototype yielded 100% recall, 81.7% precision, and an F1-score of 89.9%. Meanwhile, in the cut test, the model tested through Google Colab achieved 97.2% precision, 97.2% recall, and 99.93% mAP50, whereas the real testing with the computer vision prototype produced 87.5% precision, 88.9% recall, and an F1-score of 86.2%. Based on these results, there is a noticeable difference between testing performance via Google Colab and real testing using the computer vision prototype. This discrepancy may be attributed to model overfitting and the use of an imbalanced dataset.

Keywords: computer vision, dried cocoa bean, prototype, sampling