MANGO FRUIT DETECTION FROM AERIAL IMAGES

Marawan A. Eldeib[1], Mohd Haris Lye Bin Abdullah[2]
[1,2]Faculty of Engineering, Multimedia University, 63100 Cyberjaya, Malaysia.
marawandeep13@gmail.com, haris.lye@mmu.edu.my.

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Abstract

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This research explores the application of deep learning models for mango detection using aerial imagery. The primary models investigated are Faster R-CNN and YOLO variants, evaluated on datasets from the University of Sydney, CQUniversity, and a locally prepared dataset. The study aims to identify the most effective model for accurate and efficient mango detection to aid agricultural monitoring.

Faster R-CNN models were tested with VGG-16 and ResNet-50 backbones, revealing that ResNet-50, enhanced with the Detectron2 framework and AdamW optimizer, achieved an AP50 of 93.02 on the Sydney dataset and 80.52 on the local dataset. YOLO models, particularly YOLOv8, demonstrated superior performance across different configurations and datasets. The best configuration for YOLOv8 on the CQUniversity dataset, early stopping with SGD, achieved a mAP@0.5 of 0.992, while on the Sydney dataset, it achieved a mAP@0.5 of 0.959. YOLOv10 also performed well, with the best results on the CQUniversity dataset reaching a mAP@0.5 of 0.970 using early stopping with augmentation.

Overall, YOLOv8 outperformed both YOLOv10 and traditional Faster R-CNN implementations, with the highest performance seen in the YOLOv8 model on the CQUniversity dataset. Additionally, our best YOLOv8 model achieved an F1 score of 0.985 and a mAP of 0.959 on the Sydney dataset, significantly outperforming the highest F1 score of 0.908 and mAP of 0.869 reported in the "Deep Fruit Detection in Orchards" study.

The development of MangoVision, a user-friendly GUI application, integrated these advanced object detection models with features such as image and video processing, GPS coordinates extraction, and annotation, providing a practical solution for mango detection in agricultural applications. This research demonstrates that YOLOv8, particularly with early stopping and SGD, offers the highest performance for mango detection, making it suitable for real-world agricultural monitoring.