

Comparison of circular and rectangular bounding boxes for apple detection in orchards

Abstract

Intelligent vision systems are essential for intelligent agriculture. This paper investigates the detection of apples in orchards for harvesting robots. Fruits typically appear circular in images, providing the rationale for research in circular object detection. Deep learning models, especially YOLO algorithms, perform particularly well in object detection using rectangular bounding boxes. They are also widely used in smart agriculture. We modified the YOLOv1 and YOLOv3 architectures to use bounding circles by changing the final layers and cost functions. The models were trained on three merged public datasets for apple detection (ACFR Orchard Fruit, Artificial Light, and Minne Apple). The results for detection with bounding circles and rectangles were compared, controlling for the effect of the method used for intersection over union (IoU) computation. The results showed that replacing the bounding rectangles with circles did not improve detection performance, as measured by mean average precision (mAP). Therefore, further research on circular object detection with deep neural networks is needed.