**Vehicle Detection and Accuracy Verification Using YOLOv8**

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***ABSTRACT***

**Recent advances in machine learning technology have enabled object detection to be used in a variety of applications, most notably in YOLO (You Only Look Once). The purpose of this study is to evaluate the vehicle detection performance of YOLOv8 at different distances using images captured by a drone, and to analyse its efficiency and accuracy.** This study used 246 images taken by a DJI Phantom4 Pro drone at an altitude of approximately 10m at 2-second intervals from 10:42am to 10:50am on 1 November 2023 at the Pukyong National University roundabout. The images were processed with the YOLOv8 model to perform object detection and the results were analysed. In this study, we evaluated the vehicle detection performance using the YOLOv8 model. First, we analysed a total of 246 images and detected 193 vehicles, of which 171 were cars and 22 were trucks. Second, we evaluated the detection accuracy from two perspectives. "Was the vehicle correctly identified at a certain distance?" and "How confident is the YOLO model that the object is a vehicle and what is the machine's confidence in the result?" Third, we compared vehicle detection rates across models. Finally, we evaluated the performance of YOLOv8 by analysing the Intersection over Union (IoU) values by distance. The study analysed 246 images using multiple YOLO models in Ultralytics and drew the following conclusions. The study compared the N-SEG and X-SEG models and found that the X-SEG model had higher vehicle detection accuracy. In particular, the L-SEG model had higher than expected confidence and higher average precision (AP) for the car class. The aerial images taken by the drone showed a high detection rate of nearly 90% at a distance of 90m, suggesting that it can be used as a reliable vehicle detection technique in various applications such as autonomous vehicles, drones, and smart traffic systems.

**Keywords:** You Only Look Once (YOLO), Intersection over Union (IoU), Average Precision (AP)