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CROSS-DOMAIN ANALYSIS OF YOLOV8 AND FASTER R-CNN MODELS FOR ENHANCED PRECISION IN MARITIME OBJECT DETECTION

Journal of Engineering Science and Technology • Article • 2025

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Abstract

Recent advancements in machine vision, particularly through Convolutional Neural Networks (CNNs), have significantly enhanced object detection in maritime environments. This study focuses on the performance of different object detection algorithms and its respective variants: YOLOv8 and Faster-RCNN across two specialised maritime datasets: the SeaShip and Sea Maritime Dataset (SMD). Through comprehensive intra-domain and cross-domain evaluations, we analysed the models' precision, recall, and mean Average Precision (mAP) metrics over 50 training epochs. Notably, the YOLOv8x variant demonstrated exceptional adaptability to the SMD dataset, achieving high precision and recall rates with scores of 98.3% and 96.1%respectively. Whilst the YOLOv8m variant was more effective on the SeaShip dataset. The Faster R-CNN X101-FPN model variant shared similar metrics to the intra-domain evaluations for the YOLO comparisons, however showed significant improvement for cross-domain evaluation, noticeable for the SMD model, outperforming its YOLO

counterpart with an improvement of 47.9% for the mAP(50) score. Likewise, the SeaShip model had an improvement of 4.48% for the same metric This paper highlights the challenges of applying machine vision in maritime settings due to environmental variability and dataset specificity. The cross-domain analysis revealed significant performance degradation when models were applied outside their training dataset, emphasising the need for robust domain adaptation strategies. Our findings underscore the importance of selecting appropriate object detection algorithms tailored to specific dataset characteristics to optimise object detection performance in diverse maritime environments. © School of Engineering, Taylor's University.

Author keywords

Convolutional neural network; Domain adaptation; Faster-RCNN; Machine vision; Maritime object detection; YOLOv8

Funding details

Details about financial support for research, including funding sources and grant numbers as provided in academic publications.

Funding sponsor	Funding number	Acronym
IUM Engineering Merit Scholarship		
International Islamic University Malaysia See opportunities by IIUM ↗		IIUM
CXSense System		
Ministry of Higher Education, Malaysia See opportunities by MOHE ↗		MOHE
KOEIEMS		

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Abstract

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