LSR-YOLO: A lightweight and fast model for retail products detection

PLOS ONE • Article • *Open Access* • 2025 • DOI: 10.1371/journal.pone.0334216

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Abstract

Advanced computer vision techniques, particularly deep learning–based object detection, are enhancing the accuracy and efficiency of product identification in retail settings, driving the integration of intelligent systems within urban environments and smart cities. To address the high computational cost and slow detection speed of existing methods, this study proposes LSR-YOLO, a lightweight object detection framework based on YOLOv8n, designed for deployment in robots and intelligent devices. The model introduces architectural optimizations, including the CSPHet-CBAM attention module, to strengthen feature representation, followed by a channel pruning algorithm tailored to the new architecture to reduce redundancy while maintaining accuracy. Experiments on the Locount dataset demonstrate that LSR-YOLO achieves an inference speed of 357.1 FPS with mAP50 of 72.2% and mAP50-95 of 47.8%. Compared with the baseline YOLOv8n, LSR-YOLO increases inference speed by 246.7 FPS, making it substantially faster and more suitable for real-time retail

applications. With only 2,114,768 parameters and 6.6 GFLOPs, it is also significantly lighter than advanced models such as YOLOv11. Furthermore, validation on the COCO dataset confirms the model's superior generalization ability, underscoring its advantages in both accuracy and computational efficiency.

Indexed keywords

MeSH

Algorithms; Commerce; Deep Learning; Robotics

EMTREE medical terms

Article; Batch Normalization; computer vision; convolution algorithm; convolutional neural network; cross validation; data augmentation; decision making; deep learning; environmental factor; environmental parameters; imaging; information processing; lightweight object detection; Lightweight Smart Retail YOLO model; mathematical model; measurement precision; object detection model; product identification; reliability; reproducibility; robotics; training; urban area; validation process; algorithm; commercial phenomena; deep learning

Funding details

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

Funding sponsor	Funding number	Acronym
UCSI University See opportunities	REIG-FETBE-2025/015	

Funding text

The authors would like to express their sincere gratitude to the Centre of Excellence for Research, Value Innovation and Entrepreneurship (CERVIE), UCSI University, Malaysia, for supporting this project under the code REIG-FETBE-2025/015.

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Funding details

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