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

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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.

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