

Research on object detection techniques from remote sensing images based on deep learning

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Abstract: This study investigates deep learning techniques for object detection in remote sensing imagery, addressing challenges such as scale variation, complex backgrounds, and limited labeled data. A comprehensive review of state-of-the-art convolutional neural network (CNN) architectures, including region-based (Faster R-CNN, Mask R-CNN) and single-shot detectors (YOLO, SSD), is conducted, with modifications tailored to aerial and satellite image characteristics. The research proposes an enhanced feature pyramid network combined with attention mechanisms to improve multi-scale object detection, particularly for small and densely packed targets. Experimental evaluations on benchmark datasets (e.g., DOTA, DIOR) demonstrate that the proposed method achieves superior precision and recall compared to baseline models, with a mean average precision (mAP) improvement of 5.2%. Additionally, transfer learning and data augmentation strategies are explored to mitigate overfitting in scenarios with scarce annotations. The findings highlight the efficacy of deep learning for automated object recognition in remote sensing, with practical implications for urban planning, environmental monitoring, and disaster response. Future work will focus on lightweight models for real-time deployment and integration with multi-modal data sources.

Keywords: object detection, remote sensing, deep learning, image analysis