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Optimizing Region Detection in Enhanced Infrared Images Using Deep Learning

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Abstract:

Infrared imaging, with its unique applications in fields such as wildlife monitoring, has garnered considerable interest. Nevertheless, accurate detection and segmentation of animal regions in enhanced infrared images present significant challenges. This study proposes an optimization framework that leverages deep learning techniques to improve the performance of animal region segmentation in these images. The primary focus of this work is the investigation and implementation of the Region-based Convolutional Neural Network (R-CNN) object detection algorithm. By adapting and fine-tuning the R-CNN model, an increased accuracy and robustness in animal region segmentation is achieved. Transfer learning was utilized in this study, allowing for the application of knowledge learned from a large, albeit different but related, dataset to the task at hand. By fine-tuning the R-CNN model on a smaller dataset of annotated infrared images, the model's ability to accurately segment animal regions is enhanced, even when training samples are limited. This approach helps overcome the constraints associated with training deep learning models from scratch, particularly when available labeled data is scarce. The performance of the optimized R-CNN model was assessed using a comprehensive set of segmentation metrics, including pixel-based metrics such as Intersection over Union (IoU). The optimized R-CNN model outperformed existing methods in terms of segmentation accuracy, achieving higher IoU scores, Dice coefficients, and pixel accuracies. Additionally, the fine-tuned R-CNN model demonstrated improved precision, recall, and F1 score, indicating an overall superior performance in accurately detecting and segmenting animal regions.

Keywords:

infrared imaging, animal region segmentation, enhanced infrared images, deep learning, R-CNN (region-based convolutional neural network), object detection, transfer learning

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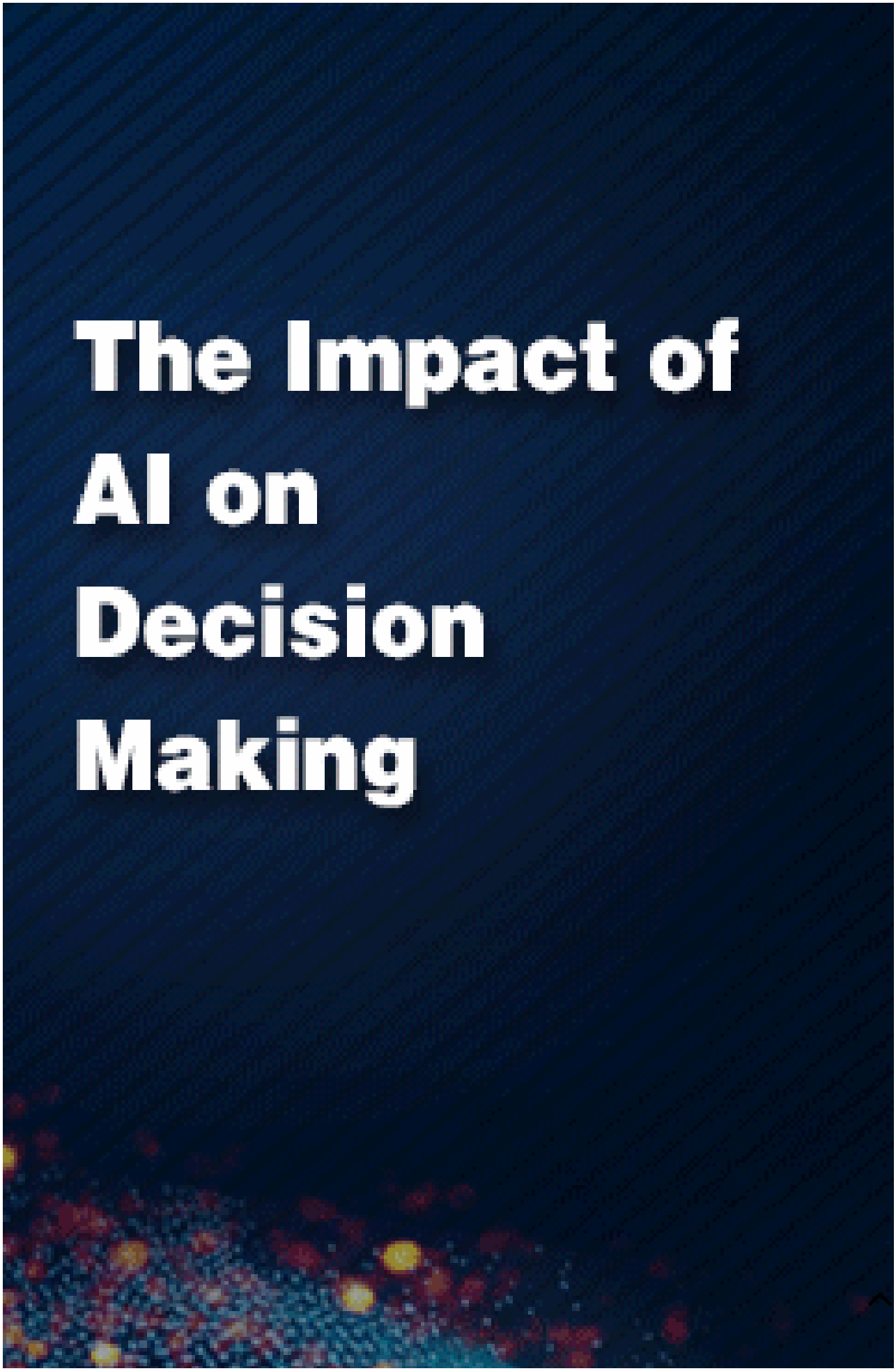
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