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Advancing coral reef monitoring: a deep learning perspective on automated segmentation and classification

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Abstract

In this study, we investigate the potential of computer vision and artificial intelligence techniques, particularly deep learning, to revolutionize coral reef monitoring. Traditional methods, relying heavily on manual assessments, are labor-intensive and inadequate for the vast and remote areas of coral reefs. Our research focuses on addressing these limitations by developing and evaluating deep learning models for automated coral reef image segmentation and classification. Specifically, we explore the application of state-of-the-art convolutional neural networks for accurately segmenting and classifying coral reef images into distinct categories, such as alive, dead, sandy, and unknown. A comprehensive literature review, utilizing databases such as IEEE Xplore, Google Scholar, and Science Direct, informed our understanding of existing approaches and challenges. Our models were trained and evaluated on a carefully curated dataset of coral reef imagery from [mention general region, e.g., a specific reef system in Southeast Asia]. Our findings demonstrate the effectiveness of deep learning in enhancing the accuracy and efficiency of coral reef monitoring, with implications for conservation efforts. The proposed methods show promise in advancing the precision and scalability of coral reef monitoring systems, underscoring the critical role of interdisciplinary collaboration in this endeavor. © The Author(s) 2025.

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