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Advancing Marine Ecosystem Conservation: Object Detection with AUVs and Real-time Algorithms

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Advancements in computer vision, particularly in image segmentation and object detection, play a pivotal role in marine ecosystem monitoring—an essential component of conservation efforts. However, traditional underwater object detection systems often suffer from limitations such as poor visibility, low-quality imagery, high computational costs, and inadequate performance in real-time scenarios, especially when faced with diverse marine species and complex underwater environments. Additionally, the inherent risks and impracticality of manual human observation in these environments underscore the need for efficient automation. To address these challenges, the development and deployment of Autonomous Underwater Vehicles (AUVs) for fish monitoring in aquaculture and fisheries management have become imperative. This research focuses on improving real-time underwater object detection using advanced algorithms, specifically masked convolutional neural networks implemented via Detectron2, a state-of-the-art library developed by Meta AI Research. Utilizing the Google Open Fish dataset—which contains a wide variety of fish species differing in size, shape, and appearance—the study assesses performance using metrics such as precision, recall, Intersection over Union (IoU), and mean Average Precision (mAP). Through multiple training iterations and fine-tuning, the approach demonstrates significant improvements in detection accuracy, thereby validating its effectiveness for practical deployment in marine conservation and aquaculture applications.
Keywords: Marine Ecosystem Conservation, Autonomous Underwater Vehicles (AUVs), Realtime Object Detection, Detectron2, Fish Monitoring and Identification

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