DAUPHIN ISLAND SEA LAB

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Enhancing the Efficiency of Video Processing with an AI-Based Fish Recognition Model

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Background

- The Fisheries Ecology Lab conducts offshore fisheries independent surveys of Alabama's Artificial Reef Zones that monitor the species composition, abundance, and size frequency of reef fishes over time.
- Fisheries-independent surveys use Remotely Operated Vehicles (ROVs) to non-invasively record artificial reefs and their fish communities. Trained readers then analyze these videos to identify species, count individuals, document reef type, and measure fish lengths. Figure 1 shows a typical view encountered during manual ROV analysis.
- As Artificial Intelligence becomes ubiquitous, it's important to explore how these tools can support our research. AI models can be very useful tools that can increase efficiency through machine learning and improve consistency when applied correctly.
- The purpose of this project is to train an AI based recognition model to process ROV videos for automated fisheries data acquisition

Figure 1: Still image taken from ROV video

Methods

- The primary task in this study involved training the AI model by first annotating frames for a select set of species as seen in Figure 2.
- These annotated images were then used to train the model how to recognize each fish within the frames.
- A total of 4,729 images were annotated with 15,398 bounding boxes to train the model on four reef fish classifications: Red Snapper, Gray Triggerfish, Seriola spp., and Acanthuriformes (spadefish and angelfish).
- Images used in model training were selected from multiple ROV videos representing a range of water visibility.

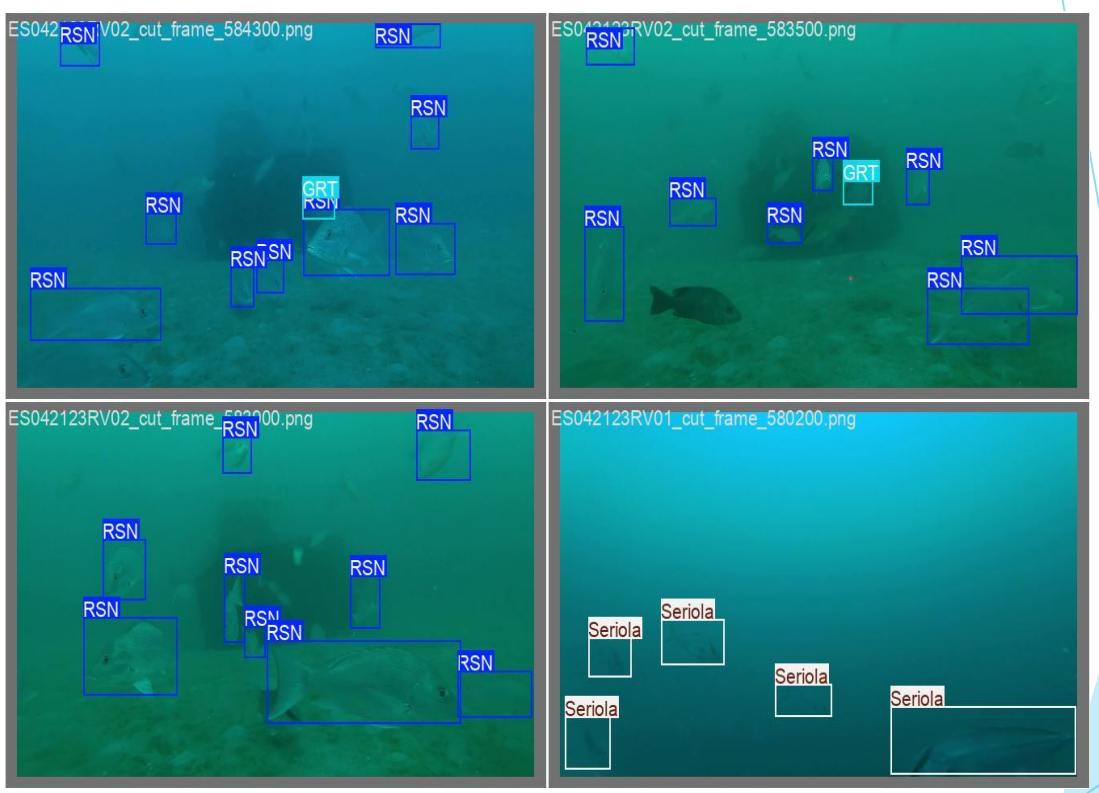
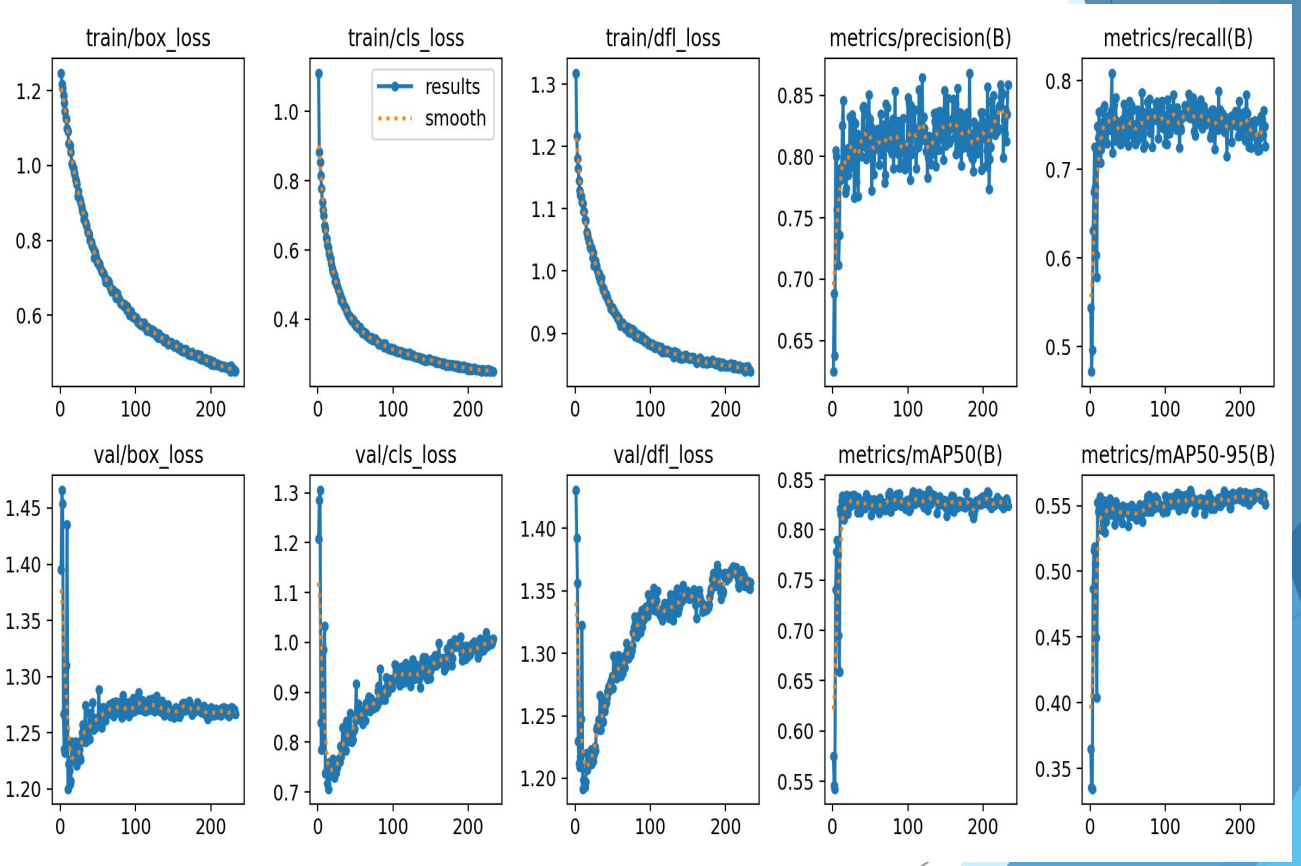


Figure 2: Bounding Box Annotation of still images

Results



- Figure 3 displays the model's performance over ~230 training epochs. The top row represents training metrics, while the bottom row shows validation metrics, with loss decreasing (lower is better) and accuracy increasing (higher is better).

- The model showed steady learning, with precision and recall stabilizing at ~0.82–0.86 and ~0.75–0.80, indicating reliable species identification across diverse image conditions. Slightly higher validation loss suggests minor but acceptable overfitting. Detection performance was strong overall, with mAP50 ~0.82–0.85 and mAP50-95 ~0.53–0.56, demonstrating that the model can accurately locate and classify fish even under variable visibility typical of ROV reef surveys.

- Overall, the model is effective at identifying key reef fish species and shows strong potential for use in fisheries monitoring and automated video processing.

Conclusion

- The model continues to improve with training and is showing promising potential for automated species identification in reef survey videos.

- We are examining the utility of model performance on accurately identifying species, specifically targeting the consistency. Ongoing refinement and more diverse training data are expected to reduce errors.

- Upcoming datasets will further strengthen model performance and move it closer to reliably assisting with routine ROV video processing.

Acknowledgments

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