

A Computer Vision Project Snapshot: Bear Detection and Aggression Identification

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Abstract—Bear encounters are a significant concern, and using computer vision techniques to recognize bears, particularly aggressive ones, could help to provide timely alerts and notifications. Currently, no dedicated model exists for this purpose. This project first compares the performance of six models using transfer learning to develop a Bear vs. Non-Bear classifier. Then, a segmentation model isolates the bear from its background. Finally, a binary classifier identifies the bear as 'Aggressive' or 'Normal' based on zoological knowledge. The top-performing aggressive bear recognition model achieved an F1-score of 0.91, a recall of 0.83, and a precision of 1.

Index Terms—Aggressive bear recognition, MobileNets, EfficientNets, YOLOv8, image segmentation, image classification

1 Datasets



Fig. 3. A Sample Image in Brown Bear Class and Its Mask



Fig. 4. An Example of an Aggressive Brown Bear and Its Mask

TABLE I
BEAR VS. NON-BEAR CLASSIFICATION DATASET

Dataset	Bear Images	Non-bear Images	Total Images
Total data	477	477	954
Training data	287	287	574
Testing data	95	95	190
Validation data	95	95	190

2 Methodology

Model 2: Aggressive Bear Recognition

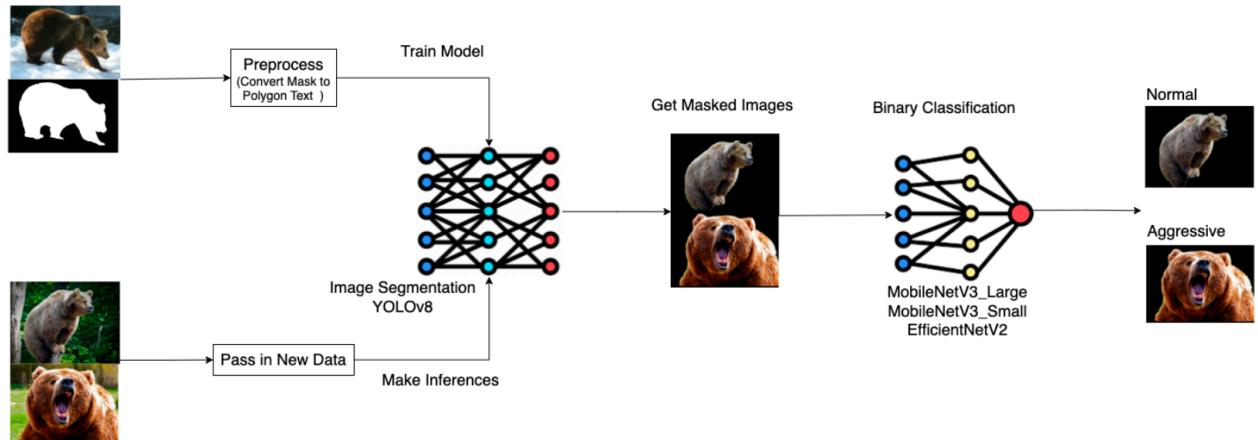


Fig. 5. Aggressive Bear Recognition Workflow

3 Evaluation

Task One: Bear vs. Non-Bear Classification

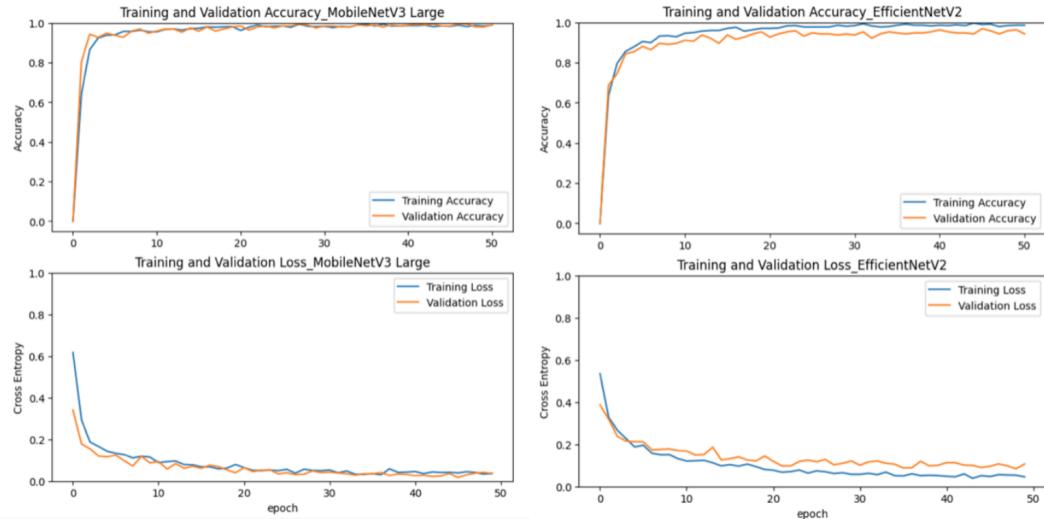


Fig. 6. Training and Validation Accuracy and Loss Comparison for Bear vs. Non-Bear Classification Models

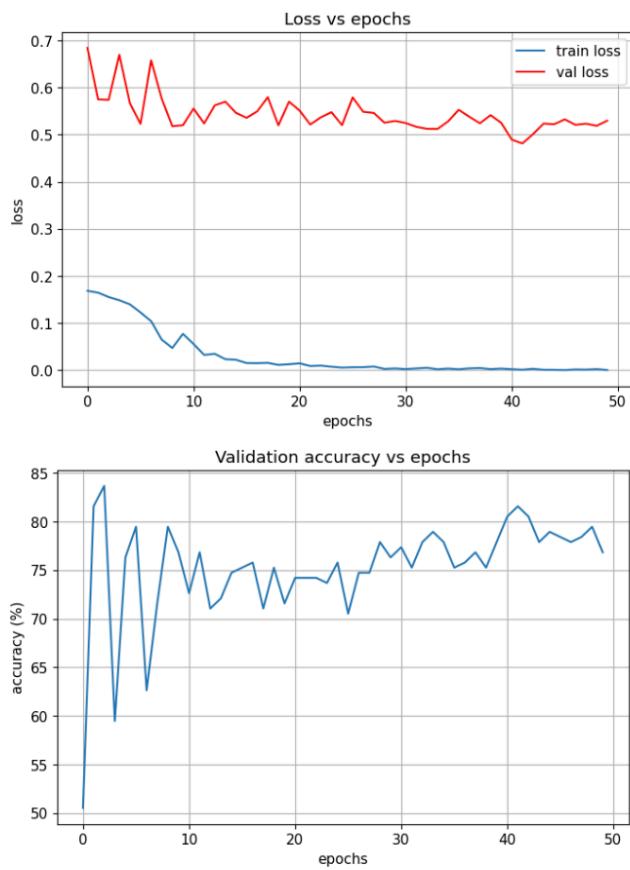


Fig. 7. YOLOv8 for Bear vs. Non-Bear Classification

Task Two: Bear Segmentation

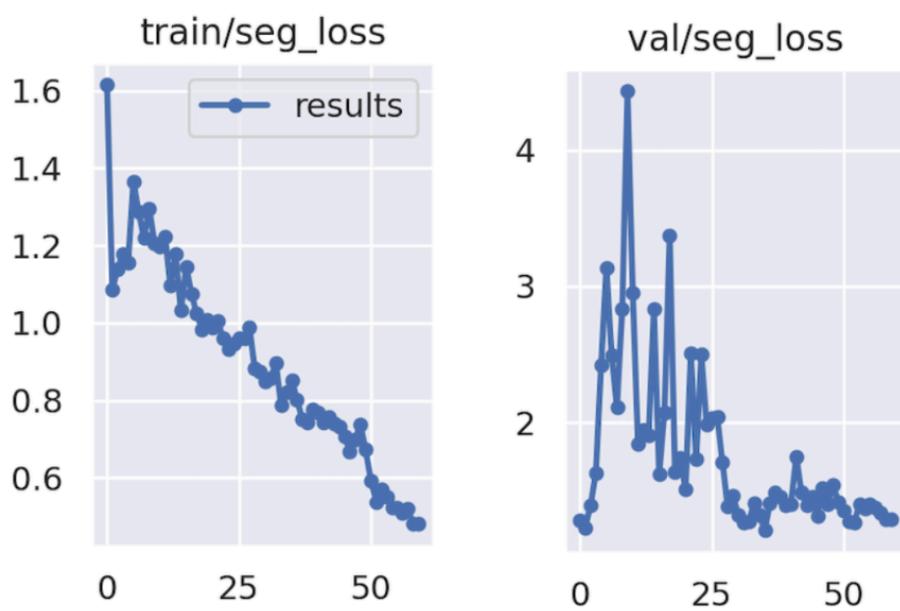


Fig. 8. Training and Validation Segmentation Loss of YOLOv8



Fig. 9. Original Image Segmentation Data



Fig. 10. YOLOv8 Predictions of the Image Segmentation Data

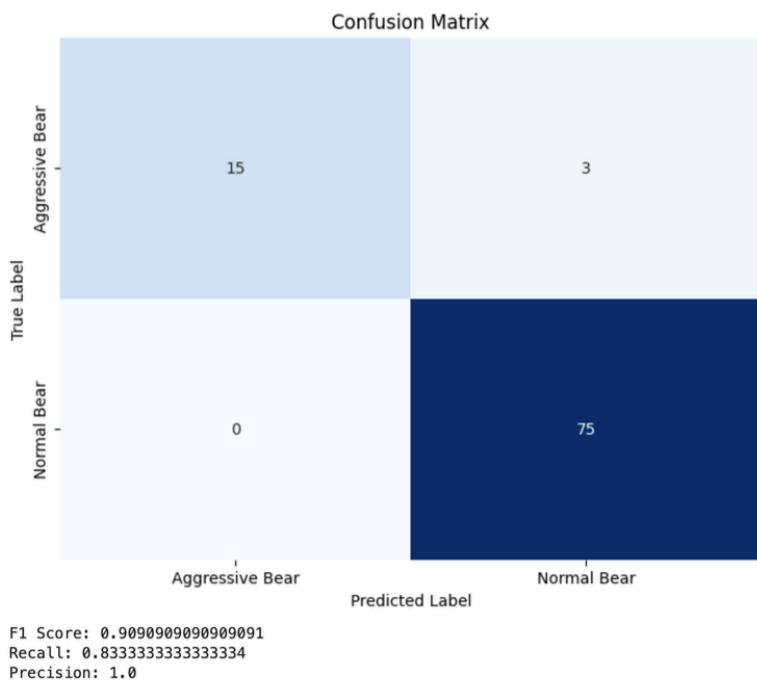
Task Three: Aggressive Bear Recognition

TABLE III
PERFORMANCE METRICS AND INFERENCE TIME FOR AGGRESSIVE BEAR RECOGNITION MODEL

Models	Precision	Recall	F1-score	Average Inference Time (30 runs, seconds)
MobileNetV2	1	0.75	0.89	0.2942
MobileNetV3 Small	1	0.71	0.83	0.2705
MobileNetV3 Large	1	0.83	0.91	0.2911
EfficientNet	1	0.67	0.80	0.3146
EfficientNetV2	1	0.83	0.91	0.3150

	precision	recall	f1-score	support
0	1.00	0.83	0.91	18
1	0.96	1.00	0.98	75
accuracy			0.97	93
macro avg	0.98	0.92	0.94	93
weighted avg	0.97	0.97	0.97	93

Fig. 11. MobileNetV3 Large Classification Report for Aggressive Bear Recognition



* The full paper, dataset construction details, and code are available upon request.