EAST WEST UNIVERSITY

Assignment-4

Underwater Plastic Pollution Detection using YOLOv8 Introduction

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Objective

The objective of this project is to develop an efficient model for detecting plastic pollution in underwater environments using the YOLOv8 object detection algorithm. This tool aims to aid environmental conservation by automatically identifying and quantifying underwater plastic waste.

Introduction

Plastic pollution in marine ecosystems poses a significant threat to aquatic life. Traditional monitoring methods are labor-intensive and time-consuming. This project leverages the YOLOv8 model, a state-of-the-art deep learning algorithm known for its accuracy and real-time performance, to automate the detection of plastic waste in underwater images.

The "Underwater Plastic Pollution Detection" dataset contains labeled images of plastic waste, structured into training, validation, and test sets. This report outlines the process of setting up, training, and evaluating the YOLOv8 model on this dataset, along with performance metrics and visualizations.

Dataset Overview

The dataset is organized into the following structure:

- train: Contains images and corresponding labels for training.
- valid: Contains images and labels for validation.
- test: Contains images for testing the model's performance.
- data.yaml: Configuration file specifying the dataset paths and class names.

Methodology

Step 1: Environment Setup

The YOLOv8 environment is prepared by installing necessary dependencies and setting up the required tools.

Step 2: Model Training

The YOLOv8 model is trained using the provided dataset, optimizing the performance by adjusting parameters like image size, batch size, and epochs.

Step 3: Model Evaluation

The trained model is evaluated on the validation set to measure its performance, focusing on precision, recall, and mean Average Precision (mAP).

Step 4: Inference on Test Images

The model is tested on unseen data to verify its ability to detect underwater plastic pollution accurately.

Step 5: Visualization

The outcomes are visualized to assess the model's predictions, providing a clear understanding of its detection capabilities.

Results

The model's performance is assessed based on the following metrics:

- **Precision**: The percentage of true positive detections out of all positive detections.
- **Recall**: The percentage of true positive detections out of all actual positive instances.

Graphs and visualizations of the training and validation process, including loss curves and training metrics and confusion matrix are provided to give insight into the model's learning behavior.

Conclusion

The YOLOv8 model effectively detects underwater plastic pollution, achieving satisfactory performance metrics on the test set. Further improvements can be made by fine-tuning hyperparameters, augmenting the dataset, and experimenting with different YOLO versions or architectures.