Object Detection using YOLO

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Introduction

This project demonstrates the application of YOLOv8, a state-of-the-art object detection algorithm, to identify and localize objects in a single input image. The goal is to achieve accurate detection results using the YOLOv8x pretrained model with optimized inference parameters.

Object detection is a fundamental problem in computer vision, aiming to detect instances of semantic objects of certain classes in digital images. YOLO (You Only Look Once) is a popular real-time object detector known for its speed and accuracy. YOLOv8 is the latest advancement in this family, with improvements in model architecture and training strategies.

This project applies YOLOv8 for object detection on a single uploaded image, focusing on accurate inference and visualization.

Objective

- Perform object detection on single images using the latest YOLOv8 model.
- Utilize a robust pretrained YOLOv8x model for better accuracy.
- Demonstrate efficient inference with confidence threshold tuning and augmentation.
- Visualize bounding boxes and class labels accurately on the image.

Tools and Libraries

- Python 3.12
- Ultralytics YOLOv8 package
- OpenCV for image processing

- Matplotlib for visualization
- Google Colab as the computational environment

Implementation Steps

1. Installed necessary libraries using pip on the Colab platform.
2. Uploaded the input image through Colab's file upload dialog.
3. Loaded the YOLOv8x pre-trained model from Ultralytics for high accuracy object detection.
4. Configured model parameters for inference: confidence threshold = 0.6, IoU threshold = 0.5, input image size = 1024, enabled test-time augmentation (TTA) for robustness.
5. Ran prediction on the uploaded image.
6. Extracted detection results including class names, confidence scores, and bounding box coordinates.
7. Visualized, saved, and displayed the annotated image with detected bounding boxes and labels.

Results and Observations

The YOLOv8x model detected multiple objects in the input image with high confidence levels. Bounding boxes were accurately drawn around the detected objects, and class labels with confidence scores were displayed. The use of TTA and increased image size improved robustness and detection quality.

Conclusion

This project effectively implements YOLOv8 for single-image object detection, striking a balance between accuracy and inference efficiency. The pretrained YOLOv8x model combined with optimized parameters produces reliable detections which can be visualized and saved. Future enhancements include batch image processing and custom training for specialized applications.