Fruit Object Detection using YOLOv8 with Streamlit Application Hosted on AWS

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Abstract

Object detection plays a vital role in modern computer vision applications such as smart agriculture, retail automation, and quality inspection. This project presents a fruit object detection system capable of identifying and localizing Apples, Bananas, and Oranges using the YOLOv8 deep learning model. A custom dataset was annotated in YOLO format and trained using the Ultralytics framework on a GPU-enabled environment. Data augmentation techniques were applied to enhance model generalization. The trained model was deployed as a web-based application using Streamlit and hosted on Amazon Web Services (AWS), enabling real-time fruit detection through user-uploaded images. Experimental results demonstrate high accuracy with strong precision, recall, and mean Average Precision (mAP), validating the effectiveness of the proposed approach for real-world deployment.

Keywords

Object Detection, YOLOv8, Deep Learning, Fruit Detection, Computer Vision, Streamlit, AWS Deployment

1. Introduction

Object detection is a fundamental task in computer vision that involves identifying objects and their locations within an image. Recent advances in deep learning, particularly Convolutional Neural Networks (CNNs), have significantly improved detection accuracy and inference speed. YOLO (You Only Look Once) is a single-stage object detection model that performs detection in real time. YOLOv8, the latest version from Ultralytics, provides improved accuracy, faster inference, and a flexible deployment pipeline.

2. Methodology

The dataset consists of labeled images of fruits such as apples, bananas, and oranges. The dataset was annotated using YOLO format. The YOLOv8 model was trained using the Ultralytics framework with data augmentation techniques such as flipping, scaling, and rotation. After training, the best-performing model weights were saved and used for inference.

3. System Architecture

The system architecture consists of a Streamlit-based frontend, a YOLOv8 inference engine, and AWS EC2 for deployment. Users upload images through the web interface, which are processed by the YOLO model to detect fruits. The output image with bounding boxes and confidence scores is displayed to the user.

4. Deployment on AWS

The application was deployed on an AWS EC2 instance running Ubuntu. Required dependencies such as Python, PyTorch, Ultralytics YOLO, and Streamlit were installed. The Streamlit application was executed using a public IP address, allowing remote access to the fruit detection system.

5. Results and Discussion

The deployed system successfully detects multiple fruits in uploaded images with high confidence. The model achieves strong precision and recall values, demonstrating robustness under varying lighting and background conditions.

6. Conclusion

This project demonstrates an effective fruit object detection system using YOLOv8 and Streamlit, deployed on AWS. The system provides real-time detection with high accuracy and can be extended for additional object classes or real-time video detection.