Object Detection & Tracking Project Report

Project Details

OBJECT DETECTION & TRACKING USING YOLOv8 + DEEP SORT

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Specialization: B.Tech CSE (AI & ML)
Platform: Streamlit (Web GUI)
Technologies: Python, OpenCV, YOLOv8, Deep SORT, Streamlit
Date: July 2025
Repository: https://github.com/aryansengar007/Object-Detection-and-Tracking

Introduction

This project focuses on building a real-time intelligent system that detects and tracks objects in live webcam feeds, video files, and images. The solution uses Ultralytics' YOLOv8 for object detection and Deep SORT for object tracking, integrated seamlessly into a modern Streamlit web interface. It demonstrates applied computer vision for surveillance, monitoring, and smart video analytics.

Problem Statement

Traditional video surveillance lacks automation and intelligence. Detecting and tracking multiple moving objects in real-time remains a challenge. This project addresses the need for a system that can:
- Accurately detect known objects in frames
- Maintain identity tracking across frames
- Support input flexibility (webcam, video, image)
- Offer user control over detection parameters (model, confidence, filtering)

Key Observations

- YOLOv8 performs exceptionally well in speed-accuracy tradeoffs.
- Lightweight variants like `yolov8n` are ideal for CPU systems, while `yolov8x` achieves best accuracy on GPUs.
- Deep SORT improves object tracking consistency.
- Real-time inference benefits from confidence filtering and class selection.

Challenges / Doubts

- Deep SORT integration complexity.
- Memory issues with high-resolution videos.
- Streamlit real-time video rendering limitations.
- Undetected non-COCO classes like tablet or mug.

Libraries Used

- ultralytics
- opencv-python
- numpy
- pandas
- streamlit
- tempfile

Functions Explained

main.py:
- UI rendering, input handling, calls processing functions.

detect_and_track.py:
- process_video(): frame-by-frame video analysis.
- process_image(): single image detection.

utils.py:
- get_model_description(), get_available_classes(), export_csv().

Main Components

- YOLOv8: Object detection on COCO classes.
- Deep SORT: Real-time object ID tracking.
- Streamlit UI: Modern frontend for controlling the system.
- Video Engine: Reads, processes and writes video frames.
- CSV Exporter: Generates class-wise object count summaries.

Future Improvements

- Full Deep SORT/StrongSORT integration.
- Custom training on domain-specific objects.
- Auto model download.
- Dual view: original vs processed frame.
- Public deployment and audio integration.

Conclusion

This project delivers a fully functional and interactive system for object detection and tracking. It provides a strong base for smart surveillance, analytics, and vision-based AI applications.