

# MacV Object Tracker - Implementation Summary

## What We Built

A video analysis tool that:

- Detects and tracks objects in videos automatically
- Calculates how long each object appears
- Counts unique objects
- Generates visual reports with bounding boxes and movement paths

## Key Components Used

### 1. Object Detection

Model: YOLOv8 (Pre-trained on 80 common objects like people, cars, animals)

Why: Fast and accurate for real-time processing

How it works: Analyzes each video frame to find objects

### 2. Object Tracking

Algorithm: ByteTrack

Why: Maintains consistent IDs even when objects disappear briefly

How it works: Links detections across frames using motion prediction

### 3. Analytics Engine

Metrics Calculated:

- Time each object stays in video
- Total unique objects detected

Visual Features Added:

- Colored boxes around objects

- Center dots (centroids)
- Trailing lines showing movement history

## Implementation Steps

### Video Input Handling

- Accepts common formats (MP4, MOV, AVI)
- Processes frame-by-frame

### Detection -> Tracking Pipeline

- YOLOv8 spots objects in each frame
- ByteTrack connects them across frames

### Data Collection

- Records when objects enter/exit
- Calculates duration for each

### Visualization

- Draws tracking markers on video
- Adds real-time counters

### Output Generation

- Saves processed video (WebM format)
- Creates text report with statistics

## Technical Choices Explained

Component	Why We Chose It	Benefits
YOLOv8	Best speed/accuracy balance	Works on modest hardware

ByteTrack	Handles occlusions well	Fewer ID switches
WebM Output	Browser-friendly	Small file sizes
Python	Rich CV libraries	Fast development

## **What Makes This Special**

- Tail Visualization: Shows object movement patterns clearly
- Browser-Ready Results: Viewable without special software
- Precise Timing: Measures down to 1/30th second accuracy

## **Limitations**

- Works best with clear videos (not extreme low-light)
- May merge very close objects
- Processing speed depends on hardware

## **Future Potential**

- Add object speed measurement
- Count objects crossing specific lines
- Cloud processing for longer videos