

Footfall Counter using Computer Vision

1. Objective

The objective of this project is to detect, track, and count the number of people entering or exiting a predefined region of interest (ROI) in a video stream using computer vision and deep learning.

2. Overview

This project implements a Footfall Counter system using:

- YOLOv5 for human detection
- SORT (Simple Online and Realtime Tracking) for object tracking
- A virtual ROI line to count entries and exits

The system automatically detects people in each frame, tracks their movements across frames, and updates the count whenever a person crosses the ROI line.

3. Methodology

A. Human Detection:

Used the YOLOv5s pretrained model to detect humans (`class = 0`) in each video frame.

B. Tracking:

Applied the SORT tracker to assign unique IDs to each detected person, maintaining identity across frames.

C. ROI Line Definition:

A horizontal line is defined across the frame (based on Y-coordinate).
This acts as a virtual threshold to detect direction of movement.

D. Counting Logic:

- a. When a tracked person's centroid crosses the ROI line:
 - i. If moving **upward**, they are counted as an **entry**.
 - ii. If moving **downward**, they are counted as an **exit**.
- b. Counts are updated and displayed live on the video.

E. **Output Generation:**

Processed video is saved with bounding boxes, unique IDs, the ROI line, and real-time entry/exit counts.

4. Tools & Libraries

- Google Colab (GPU runtime)
- Python 3.10
- YOLOv5 (Ultralytics)
- SORT Tracker
- PyTorch
- OpenCV
- NumPy

5. Results

- **Input Video:** 13-second clip with people walking across the scene
- **Output Video:** Displays detection boxes, tracking IDs, ROI line, and live counts
- **Example Result:**
 - Entries: 4
 - Exits: 3
- **Output Path:** 📁 footfall_output.mp4