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Position: ML Engineer Intern Applicant  
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**Task Title: Real-Time Detection of Object Missing and New Object Placement in Video**

**Objective**

The goal of this project is to develop a real-time video analytics system capable of detecting two key scenarios:

* **Missing Object Detection:** Identify when an object previously present in the scene disappears.
* **New Object Placement Detection:** Detect the appearance of new objects in the scene.

**Approach**

1. Model Used

* YOLOv8n (Ultralytics): Selected for its lightweight architecture, fast inference on CPU, and decent accuracy for real-time tasks.
* Framework: Ultralytics YOLO (v8) via Python API.

2. Tracking Strategy

* Custom Centroid Tracker:
  + Maintains a dictionary of tracked objects using centroids and object labels.
  + Uses Euclidean distance to associate detections between frames.
  + Identifies new objects and flags missing ones based on a configurable frame threshold (max\_missing\_frames=30).

3. Optimization Techniques

* Reduced Resolution: Video frames are resized to 640x360 to balance performance and detection accuracy.
* Efficient I/O Handling: Output video writing is done with cv2.VideoWriter using mp4v codec.
* Minimal Drawing Overhead: Only bounding boxes and ID labels are drawn to reduce processing time.

**Performance**

* **Hardware Used**:
  + **CPU**: AMD Ryzen 5
  + **RAM**: 8 GB
  + **No dedicated GPU: (My system does not have GPU)**
* **Achieved FPS**: ~10–12 FPS on CPU (depending on lighting and object movement)

**Requirements**

* ultralytics
* opencv-python
* numpy

**Note:** I’m unable to run the docker on my system as it is not working properly and taking a lot of time for docker image creation.