

## Room-wise Unique Object Detection

### Project Objective

Build a computer vision system that detects and counts unique objects in rooms, ensuring duplicates in the same room are counted only once.

### Dataset Requirements

- **Input:** Images or videos of indoor rooms (living room, bedroom, office)
- **Minimum:** 500 labeled room images (synthetic or public datasets allowed such as OpenImages or COCO Indoor scenes, or custom-annotated)
- **Annotations required:**
  - Room boundaries/identification (at least per-image "room ID")
  - Object bounding boxes with class labels (TV, sofa, chair, table, bed)

### Core Features

#### 1. Object Detection

- Use YOLO (v8/v11 or similar) to detect objects within rooms

#### 2. Room Identification

- Tag each image/frame with a room ID (metadata or scene classification/segmentation)

#### 3. Unique Object Counting

- **Within a single room:** If the same object appears multiple times, count it as one
- **Across different rooms:** Count the object separately per room

#### Example:

- Two TVs in Room A → Count = 1 TV
- One TV in Room B + one TV in Room A → Count = 2 TVs

#### 4. Room-wise Report Generation

- Output a structured report showing each room and its unique objects list

### Sample Test Scenarios

#### Scenario 1:

- **Input:** Photo of living room with 2 sofas, 3 chairs, 2 TVs
- **Output:** Room A → Sofa: 1, Chair: 1, TV: 1

### Scenario 2:

- **Input:** Apartment with 2 rooms → Room A (2 TVs), Room B (1 TV)
- **Output:** Room A → TV: 1, Room B → TV: 1 (Total unique TVs = 2)

### Scenario 3:

- **Input:** Studio room with bed + chair + duplicate bed annotation error
- **Output:** Room C → Bed: 1, Chair: 1

### Technical Stack

- **Backend/Model:** Python, YOLOv8/YOLOv11 (Ultralytics or custom)
- **Room Classification/Segmentation:** Metadata tags or pretrained scene classification model
- **Processing Pipeline:**
  - YOLO for object detection
  - Room-wise grouping logic
  - Deduplication of objects per room
- **Frontend:** Simple web/desktop interface (Streamlit, React, or Flask UI)
- **Output Format:** JSON/CSV + visualization (bounding boxes on images)

### Deliverables

1. Working YOLO-based application that processes images and outputs room-wise unique objects
2. Source code with documentation
3. Sample annotated dataset
4. Demo video showing detection and deduplication logic in action
5. Technical report explaining:
  - Object detection approach
  - How room-wise deduplication was implemented

### Evaluation Criteria

- **Accuracy:** Correct detection and unique counting per room
- **Robustness:** Handles multiple rooms and duplicate objects correctly
- **Code Quality:** Clean, modular, well-documented code
- **Practicality:** Clear pipeline from image → report
- **Innovation:** Bonus if the applicant uses techniques like scene segmentation, room classification, or embeddings for uniqueness detection

Here's a simple project requirement draft for your LiDAR-based floor plan system: