Discussion of YOLOv8 and ReID Tracking Project

**1. Project Overview**

This project involved developing a system capable of detecting and tracking adults and children in videos using a combination of YOLOv8 for object detection and OSNet for re-identification (ReID). The primary goal was to accurately track individuals across frames, even when they left and re-entered the scene or were occluded. The system maintains unique IDs for each detected person, allowing consistent tracking throughout the video.

The system was applied to a set of 10 test videos, where the goal was to correctly detect, classify, and track both adults and children, demonstrating accurate re-identification across frames.

**2. Data Preparation and Model Training**

2.1 Data Collection and Annotation

To train the YOLOv8 model, I manually collected a dataset of over 1000 images. These images were selected to represent different environments and scenarios, ensuring a robust and generalized model. Using Roboflow, I performed the annotation of objects, focusing on defining bounding boxes for adults and children.

2.2 Data Augmentation and Preparation

To enhance model generalization, I applied data augmentation techniques in Roboflow, such as random rotations, flips, and lighting adjustments. The dataset was split into training, validation, and test sets to ensure proper evaluation of the model's performance.

2.3 Model Training

The YOLOv8 model was fine-tuned on the annotated dataset. The model was trained to detect two primary classes: adults and children. The training process involved optimizing detection accuracy while minimizing the trade-off with real-time performance.

**3. Tracking and Re-Identification with OSNet**

To maintain accurate tracking across frames, I used the DeepSORT tracker in conjunction with the OSNet model for person re-identification. The system assigns unique IDs to individuals and re-tracks them even if they leave and re-enter the frame.

ReID embeddings generated by OSNet are crucial for associating detections across different frames. These embeddings are high-dimensional vectors representing the unique appearance of each individual, helping the system identify the same person even after occlusion or disappearance from the frame.

**4. Results and Output Videos**

After implementing the detection and tracking system, I tested the model on 10 different videos. The key results are summarized below:

ID Re-tracking: All individuals (adults and children) were correctly re-tracked after leaving and re-entering the frame. The system was able to maintain unique IDs, ensuring consistency in tracking.

Adult and Child Detection: The YOLOv8 model successfully detected and differentiated between adults and children with high accuracy in all videos.

Occlusion Handling: The system effectively handled partial occlusions, correctly assigning IDs to individuals once they became visible again.

Video Playback and Saving: Each processed video was saved with clear visualizations of bounding boxes, IDs, and class labels (adult or child).

These results demonstrate the effectiveness of the system in real-world scenarios where individuals may move in and out of the frame, be occluded, or appear under different lighting conditions.