Title:

Player Re-Identification in a Single Video Feed using YOLOv11 and IoU-Based Tracking

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Objective:

To develop a computer vision pipeline that consistently identifies players in a single video, even when they leave and re-enter the frame, using object detection and a custom tracking mechanism.

Approach Overview:

- We used a pretrained **YOLOv11** model to perform player detection frame by frame.
- To assign **consistent player IDs**, we implemented a simple **IoU-based tracking** mechanism.
- The model processes a 15-second input video and produces an output video with **bounding boxes** and **unique player IDs** drawn on each frame.

Steps Followed:

1. **Data Preparation:**
   - Input: `15sec_input_720p.mp4`
   - Uploaded the pretrained YOLOv11 weights.
2. **Detection:**
   - Loaded YOLOv11 using the Ultralytics Python API.
   - Detected players (`class 0`) on each frame.
3. **Tracking (Re-Identification):**
   - Calculated **IoU** (Intersection over Union) between current frame detections and previous frame tracks.
   - If IoU > 0.5, reused the same ID.
   - If no match found, assigned a **new player ID**.
4. **Visualization:**
   - Used OpenCV to draw bounding boxes and labels (e.g., `ID 0`, `ID 1`) on each frame.
   - Saved the output as `tracked_output.mp4`.

Strengths of the Approach:

- ✅ Fast and easy to implement.
- ✅ Requires minimal setup (no training needed).

- ✅ Maintains fairly consistent player identity for short videos.

Limitations:

- ❌ Performance drops if players overlap or move erratically.
- ❌ IoU-only tracking fails in complex re-entry scenarios.
- ❌ Does not use appearance features (like jersey color or face).

Future Improvements:

- Integrate a tracking algorithm like **DeepSORT** or **ByteTrack** for more accurate re-identification.
- Use **embedding features** (appearance vectors) along with spatial data.
- Improve robustness against occlusions and long-term disappearance.
- Apply smoothing to reduce ID-switch jitter.

Conclusion:

This project demonstrates a working player re-identification system using YOLOv11 and a basic tracking approach. While simple, the method is effective for controlled environments and can be a baseline for more advanced solutions using deep re-ID models.

Author:

Sunayana Yadav
sunayanawork6@gmail.com