Player Re-Identification in a Single Feed - Report

1) Approach and Methodologies

The objective of this project was to detect and re-identify players within a single video feed, ensuring consistent player IDs even if individuals leave and later re-enter the frame.

Steps Followed:
- Utilized a provided YOLOv11 object detection model, fine-tuned for players and ball detection.
- Loaded the video (15sec_input_720p.mp4) frame-by-frame using OpenCV.
- Converted each frame from BGR to RGB, as YOLO models expect RGB format.
- Ran object detection on each frame using the Ultralytics YOLOv11 API.
- Assigned unique player IDs based on bounding box tracking.
- Maintained consistent IDs for players across frames, even when they left and re-entered the scene.
- Output video was generated with bounding boxes and player IDs overlaid.

2) Techniques Tried and Outcomes

Techniques Applied:
- YOLOv11 object detection for real-time player detection.
- Centroid-based tracking to approximate player movement between frames.
- ID reassignment logic to ensure consistency after reappearance.
- Real-time frame display with OpenCV for visual verification.

Outcomes:
- Players were successfully detected in all visible frames.
- Unique IDs assigned during the first few seconds of the video.
- Players retained the same ID when leaving and re-entering the frame, simulating real-world re-identification.
- The final output video demonstrated reliable tracking and re-identification across the clip.

3) Challenges Encountered

Key Challenges Faced:
- Large Model File Restrictions: The YOLOv11 model (best.pt) exceeded GitHub's 100MB file size limit, requiring Git LFS setup.
- Color Format Issues: Initial detection errors occurred due to OpenCV reading frames in BGR, while YOLO expects RGB format.
- Real-Time Processing Performance: Frame processing slowed down on lower-end hardware; optimizations included skipping alternate frames during testing.
- ID Consistency: Accurate player ID maintenance required careful tuning of tracking logic to prevent misidentification after temporary occlusions.

Conclusion

The project successfully demonstrated real-time player detection and re-identification in a single video feed. The solution handled common challenges, including model size constraints, frame processing requirements, and ID tracking logic.