Player Re-Identification Report

1. Project Overview

This project focuses on solving the problem of player re-identification in sports analytics. The goal is to assign consistent IDs to players throughout a single video feed, even when players go out of frame and return later. A custom-trained YOLO model was used for accurate player detection.

2. Approach and Methodology

The core methodology involved:
- Using a fine-tuned YOLO model (`best.pt`) trained specifically to detect players and the ball.
- Detecting bounding boxes for players frame by frame using the Ultralytics YOLO framework.
- Extracting the centroid of each detected player and comparing with previous centroids.
- Assigning a consistent ID using a basic distance-based tracking logic.
- Removing IDs after they disappear for a defined duration (to handle frame exit).

3. Techniques Tried and Their Outcomes

- **YOLO + Centroid Tracking**: Provided fast results and was effective when players did not overlap much.
- **Simple Distance Matching**: Lightweight and easy to implement. Worked well in single-camera, sparse scenes.
- **Deep SORT (Considered)**: Was explored but not used due to added complexity. Could be integrated for robustness.

4. Challenges Faced

- Handling overlapping players led to occasional ID mismatches.
- Players moving quickly or changing direction rapidly confused the centroid matcher.
- Varying video resolutions and detection confidence thresholds required tuning.
- The basic tracking logic could not differentiate between very similar appearances.

5. Improvements and Future Work

- Integrate Deep SORT or ByteTrack for better multi-object tracking.
- Use appearance embeddings to improve ID assignment accuracy.
- Expand to multi-camera re-identification for full-field coverage.
- Add a web dashboard or Streamlit app for interactive visual analysis.