

Player Re-Identification in Sports Footage Report

My Approach and Methodology

This project addresses the "Option 2: Re-identification in a Single Feed" task, aiming to identify players in a 15-second video clip and maintain consistent IDs when they re-enter the frame. The solution leverages a fine-tuned Ultralytics YOLOv11 model for player detection, integrated with OpenCV for video processing. The methodology involves:

- Initial ID assignment based on detections in the first 2 seconds (60 frames at 30 FPS).
- Re-identification using spatial proximity (distance < 100 pixels) for players re-entering the frame.
- Real-time simulation with frame-by-frame processing, saving outputs to an "outputs" folder for review.

Techniques Tried and Their Outcomes

- **Distance-Based Re-Identification:** Implemented a 100-pixel threshold to match re-entering players to their original IDs. This approach successfully maintained consistency across the video, with minimal ID swaps observed during testing.
- **Frame Saving:** Added functionality to save each processed frame as a JPEG in the "outputs" folder, enabling post-analysis. This resulted in 450 frames for a 15-second clip, confirming the pipeline's operation.
- **Model Integration:** Used the ultralytics library to load the provided YOLOv11 model, adapting its output to fit the ID assignment logic.

Challenges Encountered

- **TypeError Resolution:** Encountered a `TypeError: unhashable type: 'dict'` when using dictionaries as keys in the `player_ids` dictionary. Resolved by switching to tuples of (x, y, w, h) as hashable keys.
- **Model Loading Issues:** Initial errors due to incorrect file paths were fixed by ensuring the `model.pt` file was correctly placed in the project directory.
- **Performance Limitations:** The current implementation processes frames sequentially, leading to noticeable latency. Real-time performance was not fully achieved due to frame saving overhead.

If Incomplete, Describe What Remains and How You Would Proceed with More Time/Resources

The solution is functional but incomplete in terms of real-time optimization and full accuracy. With more time and resources:

- **Optimization:** Implement multi-threading or GPU acceleration to improve frame rate and reduce latency.
- **Accuracy Enhancement:** Tune the re-identification threshold and incorporate temporal features (e.g., motion vectors) to improve ID consistency.
- **Additional Features:** Add ball tracking and cross-frame validation to enhance the system's robustness, pending access to the full model capabilities.

Conclusion

This submission provides a working prototype for player re-identification, meeting the assignment's core objectives. The code is documented in README.md, and outputs are saved for evaluation. Further development could address performance and accuracy, aligning with real-world constraints.