

Soccer Player Re-Identification - Brief Report

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Approach and Methodology

The objective of this project was to perform player re-identification and tracking across two soccer videos - one from a Tacticam and the other from a Broadcast camera.

We combined three main components:

1. YOLOv8 (Ultralytics): Used for real-time detection of players in each frame.
2. ResNet50 (Torchvision): A pretrained model used to extract embeddings (feature vectors) from player crops for re-identification.
3. Deep SORT: A tracking algorithm that uses bounding box position and appearance embeddings to track objects across frames.

Each frame from the video is passed through YOLOv8 to detect players. The cropped image of each player is passed through ResNet50 to extract a feature embedding. These embeddings, along with bounding box coordinates and detection confidence, are fed into Deep SORT to maintain consistent player IDs over time.

This combination allows robust multi-object tracking with a re-identification layer, suitable for analyzing soccer matches across different perspectives.

Techniques Tried and Their Outcomes

- Default Deep SORT (without custom embeddings):
- Performed poorly in tracking when players overlapped or moved fast.
- IDs were frequently lost or reassigned incorrectly.

- Deep SORT with ResNet50 Embeddings:
- Significant improvement in maintaining player ID consistency.
- Even during partial occlusions or side view changes, IDs were preserved more accurately.
- Custom-trained YOLOv8 model (best.pt):
- Trained specifically for detecting soccer players, improving accuracy in game footage compared to generic COCO-trained models.

Challenges Encountered

- Player occlusion: When players overlapped or were partially hidden, the tracker sometimes lost ID continuity.
- Jittery bounding boxes: Due to camera movement and fast-paced motion.
- Performance on CPU: ResNet50 embedding extraction was computationally expensive on CPU, leading to slower frame processing.
- No jersey number recognition: While IDs are consistent, we cannot map them to actual player identities yet.

Incomplete Aspects and Future Work

If more time and resources were available, the following improvements could be implemented:

- Cross-view Re-ID matching: Identify the same player between the Tacticam and Broadcast views using embedding similarity.
- Lightweight embedding model: Replace ResNet50 with a faster ReID model like MobileNet or OSNet for real-time applications.
- Jersey number detection: Add OCR (Optical Character Recognition) to extract jersey numbers for name tagging.
- Tracking visualization enhancements: Add color trails for movement history, player statistic overlay, or team-specific color coding.

Conclusion

The integrated use of YOLOv8, ResNet50, and Deep SORT provides a solid foundation for reliable player tracking and re-identification. With some future enhancements, this system could scale to full match analytics and broadcast-level player monitoring.