

# Cross-Camera Player Mapping - Brief Report

## 1. Approach and Methodology

The objective was to develop a system for consistent player identification across two different camera feeds (broadcast.mp4 and tacticam.mp4) of the same gameplay. The following approach was adopted:

### Detection:

- YOLOv8 (Ultralytics) was used as the primary object detection model to detect players in both video streams.
- Only detections corresponding to the 'person' class were considered.

### Tracking:

- Deep SORT was integrated with YOLO to assign unique player\_id values within each video stream, enabling consistent tracking of players frame-by-frame.

### Feature Extraction:

- Visual appearance features (cropped player images) were extracted for each detected player.
- Spatial positions (bounding box centroids) were also tracked to aid in player correspondence.

### Player Mapping Across Views:

To match players across the two camera feeds, a combination of:

- Visual similarity (appearance-based matching)
- Spatial reasoning (relative positions on the field, where applicable)
- Temporal consistency (movement patterns over time) was utilized.

## 2. Techniques Tried and Their Outcomes

### A] YOLO + Deep SORT Integration

- Provided reliable within-video tracking with consistent temporary IDs.
- Successfully tracked most players in both broadcast and tacticam videos.

## B] Appearance-Based Matching

- Cropped player images were compared using color histograms and pixel-wise comparison.
- Worked moderately well for players with distinct jersey colors.
- Struggled with visually similar appearances.

## C] Spatial Matching

- Attempted homography estimation between the two views for projecting player positions.
- Due to limited field markings and different camera angles, reliable homography was challenging.
- Spatial cues were partially helpful in combination with visual features.

## 3. Challenges Encountered

- **Occlusions:** Frequent player overlaps made detection and tracking difficult at times.
- **Visual Ambiguity:** Similar jerseys and player appearances reduced the effectiveness of purely appearance-based matching.
- **Camera Perspective Difference:** The large variation in angles between broadcast and tacticam made spatial mapping non-trivial.
- **Model Download Issues:** The provided object detection model link was inaccessible, so YOLOv8 was used as a reliable alternative.

## 4. Incomplete Aspects and Future Work

While consistent IDs were assigned within each video and partial player matching was achieved, full automation of cross-camera mapping remains incomplete due to:

- Insufficiently robust appearance feature extraction (considering integrating deep ReID models like fast-reid).
- Homography estimation requires better field landmark detection.

- The system currently requires manual validation of the player mapping output.

**Future Improvements:**

- Integrate more sophisticated deep appearance embeddings for player ReID.
- Explore improved field localization techniques for accurate spatial projection.
- Optimize runtime for smoother, real-time processing.
- Expand testing across more varied datasets.