

Player Re-Identification and Tracking System for Football Video

1. Objective

The goal of this project is to build an automated system that can detect, track, and consistently re-identify football players in a video. The challenge addressed here is ensuring that players who temporarily leave the frame or are occluded can be accurately recognized and assigned consistent IDs when they reappear.

2. Methodology

The system combines multiple computer vision models and metrics:

- YOLOv11 is used for real-time player detection from video frames.
- DeepSORT handles short-term tracking and ID propagation using motion and appearance cues.
- A custom re-identification module enhances DeepSORT by resolving ID switches using appearance feature similarity, perceptual similarity (LPIPS), and spatial consistency (IoU).

Player crops are extracted from the video stream, and appearance features are computed using ResNet50. These features are stored and compared with newly detected players to determine whether a match exists or if a new ID should be assigned.

3. System Components

- Detection: YOLOv11 detects players in each video frame.
- Tracking: DeepSORT manages temporary IDs and tracks players across frames.
- Re-Identification: Multi-cue re-ID with ResNet50 features, LPIPS, and IoU.
- Feature Buffering: Sliding window of features and crops for identity consistency.
- Analytics: Heatmap and trajectory visualizations summarize player movement.

4. Evaluation Metrics

To evaluate the visual and temporal consistency of the re-identification:

- LPIPS measures perceptual similarity between consecutive crops.
- FID (Fréchet Inception Distance) evaluates distributional similarity between the first and second halves of a player's appearance.

These metrics provide insight into how well the system maintains consistent IDs.

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5. Outputs

The system generates the following outputs:

- Annotated video (output.mp4) with bounding boxes and player IDs.
- heatmap.png showing where players appear most frequently.
- trajectories.png visualizing player movement paths.
- LPIPS and FID scores printed for each tracked player.