

Brief Report: Soccer Player Re-Identification Using YOLOv5

Objective

The goal of this project is to detect and re-identify soccer players across video frames using a deep learning-based object detector (YOLOv5) and a custom tracking algorithm based on Intersection over Union (IoU). This can be used in sports analytics to track player movements, positions, and performance.

Methodology

1. Model Selection:

- Used YOLOv5 (You Only Look Once v5), a real-time object detection model.
- Focused on detecting the 'person' class to identify players on the field.

2. Tracking Logic:

- Implemented a basic IoU-based tracking mechanism.
- Assigned a unique ID to each detected player and maintained identity across frames.

3. Data Input:

- A 15-second soccer match video in 720p resolution was used as input.
- Each frame was pre-processed and passed through YOLOv5 for inference.

4. Output:

- Players were successfully detected and tracked with unique IDs.
- A processed video ('reid_output.mp4') was generated showing bounding boxes and IDs on players.

Techniques Tried

- Letterbox Image Resizing for input compatibility.
- Non-Max Suppression to filter overlapping detections.
- IoU Matching to maintain track IDs for players.
- OpenCV Video Writer for saving output frame-by-frame.
- Visualized output using matplotlib.

Challenges Faced

- Initially, the model 'best.pt' was missing, causing a load error.
- File format issues occurred when attempting to open .mp4 in Jupyter.
- Real-time tracking was sensitive to fast player movements or occlusion.

Limitations & Future Scope

Limitations:

- Tracking fails if a player is occluded for many frames.
- The basic tracker doesn't handle re-identification after long disappearance.

Future Improvements:

- Use Deep SORT or ByteTrack for robust tracking.
- Train a custom YOLOv5 model for better accuracy on soccer datasets.
- Integrate pose estimation for more detailed analytics.

Conclusion

This project successfully demonstrates how to combine object detection (YOLOv5) with simple tracking logic to perform player re-identification in a soccer match. The approach is modular, lightweight, and serves as a solid foundation for more advanced sports analytics systems.