

# PLAYER DETECTION AND UNIQUE ID TRACKING IN CRICKET FOOTAGE

## 1. Objective:

The objective of this project was to develop a computer vision pipeline to detect cricket players in video footage and assign unique, persistent IDs to track them across frames, handling challenges like occlusion and camera movement.

## 2. Model Architecture:

- **Detection Model:** I selected **YOLOv8 (You Only Look Once, version 8)**, specifically the `yolov8n` (nano) variant.
- **Reasoning:** YOLOv8 is a state-of-the-art single-stage object detector known for its high inference speed and accuracy. The 'nano' version provides a balance between performance and computational efficiency, allowing for near real-time processing on standard hardware.

## 3. Tracking Algorithm:

- **Algorithm:** I implemented **BoT-SORT (Box Tracking + SORT)**, which is integrated into the Ultralytics YOLO framework.
- **Functionality:** This tracker combines the Kalman Filter for motion estimation with Hungarian algorithm matching. It effectively associates detections from the current frame with tracks from previous frames based on spatial proximity and motion prediction.

## 4. ID Consistency & Challenges:

To ensure IDs remained stable (e.g., "Player 5" stays "Player 5"), the following mechanisms were used:

- **Persistence:** The tracking loop utilizes a `persist=True` flag, ensuring the tracker maintains state memory between frames.

- **Occlusion Handling:** When players cross paths (occlusion), the Kalman Filter predicts where the occluded player *should* be. Once they reappear, the algorithm re-associates the new detection with the existing track ID rather than creating a new one.
- **Camera Motion:** The tracker is robust to minor camera movements by relying on relative bounding box coordinates and high-speed detection updates.

## 5. Future Improvements:

- **Re-Identification (ReID):** Integrating a visual appearance model (ReID) would improve tracking when a player leaves the frame completely and returns later.
- **Team Classification:** Implementing a secondary classifier to distinguish between teams (e.g., using jersey color histograms) would add semantic value to the data.