Cricket Ball Trajectory Prediction – Assessment Report

1. Introduction

This assessment focuses on detecting, tracking, and analyzing the trajectory of a cricket ball from match videos. The system generates accurate frame-wise ball coordinates in CSV format and produces trajectory overlay videos for visualization.

2. Dataset

The dataset consists of multiple cricket match videos in .mp4 and .mov formats. The ball is fast-moving, small in size, sometimes occluded, and under varying lighting conditions.

3. Modelling Decisions

A hybrid approach combining Classical Computer Vision and Deep Learning was adopted:
Classical CV: HSV color filtering, background subtraction (MOG2), contour analysis, and circularity checksYOLOv8 Deep Learning: Used for verification of candidate centroidsSingle-object temporal tracking with distance-based gatingTrajectory tail visualization for smooth motion representation

4. Fallback Logic

The detection system implements a hierarchical fallback mechanism:
Primary: Classical CV detection Secondary: YOLOv8 verification if CV fails or candidate is suspicious

5. Assumptions Made

Only one ball per frameMaximum ball movement between frames ≤ 120 pixelsBall roughly circular with area 15–250 px²Videos frame rates approximately 25–60 FPS

6. Issues Identified & Fixes

Issue	Original Behavior	Fix Implemented
Detection fails for blurred balls	Classical CV misses ball	Added YOLO verification
Centroid jumps to wrong object	Noise, occlusion	Temporal consistency + MAX_JUMP filter
Tensor rounding error in CSV	`TypeError: type Tensor`Convert	YOLO confidence tensor to float before rounding
Inconsistent trajectory	Missing frames	Kalman filter fallback prediction

7. Example Outputs

Trajectory Overlay Video: Smooth red tail showing ball motion. Green circle marks the current centroid.
CSV Annotation:
frame,x,y,confidence,visible 0,620,340,0.82,1 1,628,338,0.79,1 2,,,0,0

8. Model Performance Improvements

Hybrid detection reduced false positives significantlyTrajectory tail smoothing reduced centroid jitterTemporal filtering eliminated unrealistic jumpsYOLO fallback ensures detection under motion blur and occlusion

9. Conclusion

The hybrid pipeline successfully detects and tracks the cricket ball across multiple videos, generating accurate CSV annotations and trajectory videos. The system is robust, visually smooth, and ready for extension with velocity, bounce detection, or custom YOLO training.

10. Future Work

Bounce detection and impact point predictionVelocity and angle estimationCustom YOLO model fine-tuning on cricket ball dataset