Tennis Player Detection & Trajactory Prediction

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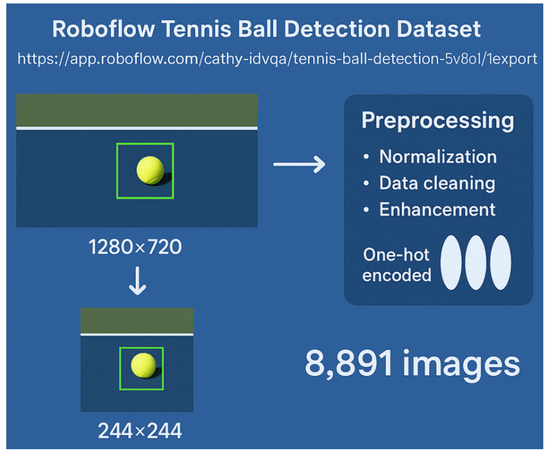
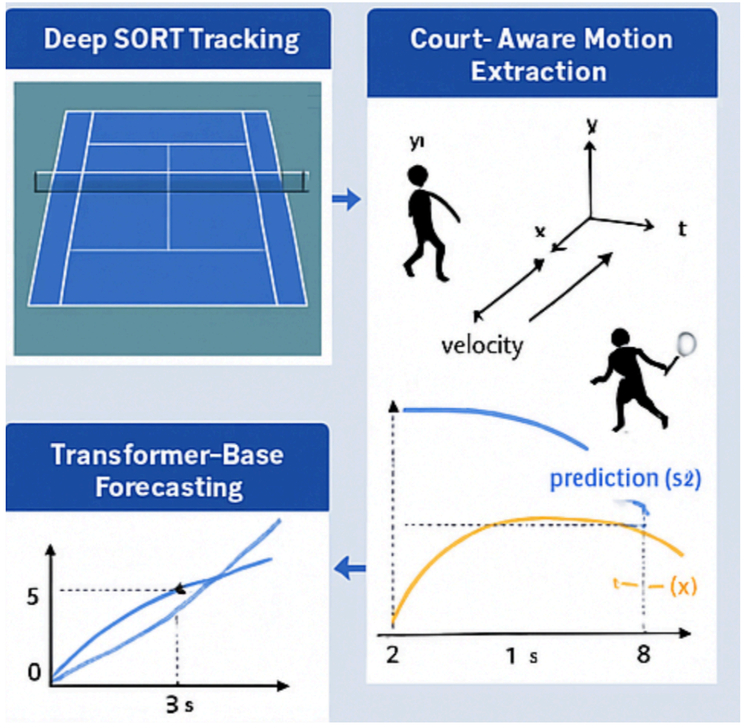
INTRODUCTION

Computer vision systems like **YOLO and ResNet** perform well in detecting players and balls in real time—but they lack predictive power, especially during fast-paced rallies and net approaches.
This project presents an end-to-end pipeline that combines c**ourt-aware motion stats, DeepSORT tracking, and transformer-based forecasting** to predict player trajectories 2–3 seconds ahead. The system supports smarter broadcasting, performance analysis, and AI-driven coaching.

DATA



FROM DETECTION TO TRAJACTORY PREDICTION

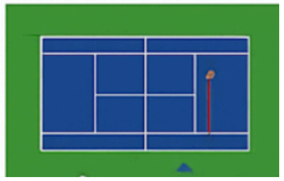


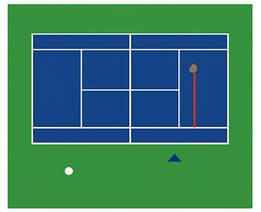
- DeepSORT tracking to maintain player IDs
- Homography transformation to 2D court coordinates
- Extracted velocity and acceleration vectors
- Transformer model trained on past trajectory to forecast future positions

EXPERIMENTS & RESULTS

Short-Term Prediction (20–100 ms)	
Average	FDE
2.84.	2.06

Long-Term Prediction (500 ms— 1 s)	
Average	FDE
6.79	12.23





CONCLUSION

The system achieves strong **short-term accuracy (ADE ≈ 2.84)**, but **long-term prediction shows higher displacement error (FDE ≈ 12.30)**, reflecting the complexity of extended motion forecasting.
To improve long-horizon prediction, future work could include:

- Incorporating richer spatial features (e.g., distance to net or baseline)
- Leveraging player pose estimation (e.g., ViT-Pose)
- Integrating game-state context (e.g., shot type, score)
- Applying hybrid physics-informed models to improve temporal coherence