GameSense: Automated Sports Insights

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1   Introduction

Project "GameSense" aims to provide automated sports insights using computer vision and AI/ML algorithms. Centered around two-player sports like badminton, tennis, or table tennis, the project aims to achieve several key objectives: tracking player movements, detecting pivotal game events, automating score-keeping, and providing detailed metrics such as rally lengths and player activity. An ambitious stretch goal is to develop live commentary, showcasing AI's potential in sports broadcasting. Additionally, "Game-Sense" plans to expand its scope to include doubles games within these sports, enhancing the overall spectator experience.

This project presents an exciting opportunity to explore the convergence of computer vision and AI/ML in sports analytics and broadcasting. By focusing on two-player games, you are required to develop robust techniques for tracking players, ball or shuttlecock, and key game events, ultimately generating comprehensive statistics. Developing and integrating these components will not only enhance your technical skills but also deepen your insight into the latest advancements in AI/ML. Embrace the challenges, stay innovative, and enjoy the journey of turning video streams into game insights.

2   Problem Statement

The project aims to develop an end-to-end process that takes a video stream of a game as input, and automatically analyze it to generate statistics throughout game-play without any manual intervention.

1. **Game Selection:** Focus on any one of the following two-player games

    (a) Badminton
    (b) Tennis
    (c) Table tennis

2. **Play Area Marking:** Accurately identify and mark play area boundaries, including the net, court boundaries, and other relevant critical game areas.

3. **Ball/Shuttle Tracking:** Accurately track the location/speed/trajectory of the shuttlecock or ball throughout the game.

4. **Player Tracking and Movement Analysis:** Develop methods to track players throughout the game, capturing their movements and positioning on the court.

5. **Event Detection:** Identify key events, such as the shuttle/ball hitting the ground or net, fouls, providing insights into game-play dynamics.

6. **Automated Scoring and Metrics:** Develop algorithms to automatically track and update scores throughout the game, including points scored and fouls committed.

7. **Rally Length Calculation:** Calculate and display the length of each rally.

8. **Player Movement Metrics:** Measure player movement metrics such as distance covered by each player, active time, to provide detailed personalized statistics.

9. **[Bonus] Real-Time Commentary Generation:** Generate real-time commentary based on the video feed and measured stats, enhancing viewer engagement and understanding of the game dynamics.

10. **[Bonus] Doubles Game:** Include doubles games, further enhancing the applicability and utility in various competitive sports settings.

2.1 Input

Game video streams can be sourced from any online platform or recorded from your own gameplay sessions. Initially, these video streams can be assumed to originate from a fixed-angle camera setup, with potential to later incorporate multiple camera angles.

For specific aspects of the project, you can leverage existing ML models or solutions, such as YOLO for object detection and identification.

2.2 Output

The expected output includes a display of the measured statistics, such as marked area boundaries, shuttle/ball location and speed, score metrics, and player movement metrics, all continuously updated throughout the game. Additionally, as a stretch goal, the system can provide text and audio commentary based on the video feed and measured statistics.

2.3   Components

1. **Video Input Handling:** Capture and process video streams from game sessions.

2. **Computer Vision Algorithms:** Utilize state-of-the-art techniques including, but not limited to, object detection, optical flow, and tracking algorithms to accomplish tasks such as ball tracking, player tracking, and event detection.

3. **Score-keeping Logic:** Implement rules-based or machine learning models to interpret game-play actions and update scores accordingly.

4. **Real-Time Statistics Generation:** Continuously update and display statistics based on the analyzed video stream.

   For various aspects of the project, you can explore and leverage various prior arts, such as YOLO for object detection and identification.

2.4   Challenges to Consider

1. **Performance:** Ensure algorithms can process frames quickly enough for updates.

2. **Accuracy and Robustness:** Algorithms should be able to handle various lighting conditions, player movements, and game scenarios.

3. **Integration and Deployment:** Creating a seamless pipeline from video input to statistical output in a user-friendly manner. As a stretch goal, running on a mobile device.

4. **Documentation and Presentation:** Thoroughly document your process, findings, and results for your project report or presentation. Clearly outline any assumptions made and limitations of the solution.