BOSTON UNIVERSITY ACADEMY

Title: Automatic Inference of Players' On-Court Locations from Basketball Videos

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Abstract:

The fields of computer vision, object detection, and sports analytics are growing rapidly. This growth will only speed up as automation becomes more prevalent. To analyze sports strategies and player movement, knowing the location of players is crucial. Putting physical trackers on players is difficult and expensive and manually annotating vidoes is incredibly labor intensive. The goal of this thesis is to create a system that can automatically locate and track the locations of the players on the court from video footage filmed from any angle. This thesis introduces a new system that converts a standard video of a basketball game into colored per-player trajectories on a bird's-eye view of the basketball court. Analyzing a video where the
camera is moving and zooming is very difficult because the motion of the camera and the motion of the players must be separated. To do so, this system builds on state-of-the-art techniques. The system uses the YOLOv4 object detection algorithm to find the original locations of the players on the court. It then uses a Simple Online and Realtime Tracking (SORT) multiple object tracking algorithm to track specific players across the video. Next, it uses homographies to warp the perspective of each frame to a bird's eye view. Then, it uses Scale-Invariant Feature Transforms (SIFT) and the Lucas-Kanade optical flow method to correct for camera motion. Lastly, it uses OpenCV to draw the colored dots on the blank court to create the trajectories of the players. Each color represents one player. These dot diagrams can then be used for sports analytics because by normalizing the points onto a bird's-eye basketball court, they can be used as input for machine learning algorithms. In the future, we hope to make the system even more versatile so that it can work on football and soccer games. The goal is that this becomes a comprehensive system that works from start to finish for multiple sports from all camera angles.