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Real-time gymnast detection and performance analysis with a portable 3D camera

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Sports analysis is a useful application of technology, providing value to athletes, coaches, and sports fans by producing quantitative evaluation of performance. To address this field in the context of men's gymnastics, a team at the Colorado School of Mines has developed a system that utilizes a Microsoft Kinect 2 camera to automatically evaluate the performance of a gymnast on the pommel horse apparatus, specifically in regards to the consistency of the gymnast's timing and body angle. The Kinect's ability to determine the depth at each pixel provides information not available to typical sports analysis approaches based solely on RGB data. Our approach consists of a three stage pipeline that automatically identifies a depth of interest, localizes the gymnast, detects when the gymnast is performing a certain routine, and finally provides an analysis of that routine. We demonstrate that each stage of the pipeline produces effective results: Our depth of interest approach identifies the gymnast 97.8% of the time and removes over 60% of extraneous data; Our activity recognition approach is highly efficient and identifies 'spinning' by the gymnast with 93.8% accuracy; and our performance analysis method evaluates the gymnast's timing with accuracy only limited by the frame rate of the Kinect. Additionally, we validate our system and the proposed methods with a real-world online application, used by actual gymnastics coaches and viewed as a highly effective training tool.

Biography

William Hoff is currently with the DAQRI Austria Research Center in Vienna. Prior to that, he was an Associate Professor in Computer Science at the Colorado School of Mines. His research interests include computer vision and pattern recognition, with applications in augmented reality, robotics, and interactive systems.

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