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Applied Depth Cameras In Sports Biomechanics

Konrad Maciejewski[1], Francisco Martins[2,3,4], Diogo Martinho[2,3], Maciej Sliż[1], Hugo Sarmento[2], Élvio Rúbio Gouveia[3,4,5], and Krzysztof Przednowek[1]

[1]Faculty of Physical Culture Sciences, University of Rzeszow, Poland
[2]Research Unit for Sport and Physical Activity (CIDAF), Faculty of Sport Sciences and Physical Education, University of Coimbra, Portugal
[3]LARSYS, Interactive Technologies Institute, Funchal, Portugal
[4]Department of Physical Education and Sport, University of Madeira, Funchal, Portugal
[5]Swiss Center of Expertise in Life Course Research LIVES, Carouge, Switzerland

Introduction: In recent decades, computer science has become a significant multidisciplinary support for sports. Technologies such as virtual reality (VR) are applied in sports, supporting top-level athletes. Motion capture systems enable the evaluation of sports techniques by collecting vast amounts of data that support statistical and predictive analyses and help coaches make decisions. Depth cameras allow for markerless kinematic analysis, which is less time-consuming and non-invasive.
Aim: The aim of this systematic review is to provide an overview of research published in the last decade regarding depth camera technology in sports biomechanics, reflect on past interventions, and envision future directions and implications of these innovative devices in the world of physical activity and sports.
Methodology: The systematic review was conducted following the PRISMA guidelines. Eligibility criteria were based on the PICOT model. Three databases were searched, identifying 14 relevant studies. Data were extracted and harmonized by two authors, and the quality of the studies was assessed using the COSMIN checklist.
Results: The analysis showed versatile applications of depth cameras in sports assessment and training support. These cameras observe kinematic parameters, analyze techniques, and assess the effectiveness of movements in various sports disciplines. The most used technology was Microsoft Kinect, used in nine studies. Depth cameras have been applied in individual sports such as running, swimming, karate, golf, fencing, sport climbing, gymnastics, and table tennis. This technology improves performance analysis, providing real-time feedback and monitoring movement accuracy.
Conclusions: Depth cameras are effective in analyzing techniques in individual sports; however, their use in team sports is limited by occlusion problems. They have the potential for injury prevention, progress monitoring, and technical error correction. The low frame rate and data noise make it difficult to fully exploit their capabilities. The advantages of this technology include markerless motion capture, ease of use, and low cost; however, the lack of methodological standards makes it difficult to compare different devices. The development of noise-reduction algorithms, error correction, and the integration of artificial intelligence can eliminate occlusion problems.
Keywords: motion capture, sport science, biomechanics, applied technology