

Computer Vision and Advanced Computational Algorithms for Risk Assessment and Performance Enhancement in Track and Field Teaching

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ABSTRACT

This paper discusses the application of computer vision and advanced calculation algorithm in evaluating the teaching risk and teaching effect of track and field. Because of the inherent uncertainty and risk of PE and sports activities (especially track and field), it is necessary to establish an effective risk management mechanism. Using computer vision technology, this paper puts forward a method of analyzing and processing video data to detect and track moving objects, so as to identify potential risks in real time. This method not only improves the safety of students in track and field classes, but also provides valuable insights for improving teaching methods and reducing sports injuries. This paper discusses the background subtraction motion detection algorithm, which is very important for dynamic image modeling and shadow suppression, and can realize accurate motion state detection. The ultimate goal is to ensure the healthy development of school sports and optimize the teaching results of track and field sports.

KEYWORDS

Instructional Effect Assessment, Target Detection, Track and Field Sports, Video Analysis

INTRODUCTION

There are various risk factors associated with school sports, with risk events occurring due to imperfect risk management mechanisms and a lack of awareness regarding sports risk avoidance (Onofri et al., 2014). Physical education (PE)—a discipline focused on fitness, teaching, and well-being—involves many unexpected factors. In particular, the open teaching stage of track and field classes carries specific risks (Zhu, 2021).

Sports injuries in schools often occur accidentally during teaching and training, with sports risks being both uncertain and accidental (Mazerolle & Eason, 2018). Establishing an effective risk management mechanism is an effective means to avoid risks related to school PE activities. For instance, computer vision technology uses computers and related video image extraction equipment to simulate biological vision. Through this technology, 3D information can be obtained by analyzing and processing collected pictures or videos from a corresponding scene (Sun & Ma, 2021).

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Student safety in the classroom is directly related to the successful development of teaching activities. Minimizing potential risks in track and field teaching and training with the help of modern computer technology, while also strengthening students' physical fitness in a safe teaching environment, is a crucial issue that deserves consideration.

Understanding school sports risk events and establishing a risk management mechanism to minimize potential sports-related risks and ensure the healthy development of school sports in China are urgent challenges for sports practitioners (Aelterman et al., 2014). Moving object detection and tracking technology in video has wide application value, and its realization method is closely related to the research of video object segmentation algorithm based on motion. Dynamic image modeling is a key component of the background subtraction motion detection algorithm, with its quality playing a decisive role in the effectiveness and reliability of the global detection algorithm (Back et al., 2014). Shadow suppression and removal algorithms in video detection can be effectively applied to virtual-real interaction control for video scenes, allowing the detection of the motion state of the interactive person through shadow detection.

This article combines advanced computational science algorithms based on video analysis and applies a deep learning (DL)-based moving target detection algorithm to assess the effectiveness of track and field instructional. Through video image analysis, it aims to realize risk identification, prevention, and control in track and field teaching.

The sport of track and field has broad mass base (Milani & Moley, 2018). PE teaching and sports development can benefit from a deeper understanding of how to avoid teaching risks and minimize injuries. Employing specific countermeasures for different risks not only greatly benefits the quality of PE teaching but also promotes the development of sports.

Video object detection is the foundation of extracting moving objects from video streams, tracking and monitoring moving objects, and realizing the behavior analysis and recognition of target objects. Thus, digital image and video processing is a vital area of research. This article studies risk identification in track and field teaching using video analysis to assess the effectiveness of teaching methods.

First, an advanced computational science algorithm based on video analysis is used to discuss the assessment of track and field instructional effect, offering an innovative perspective. Second, the study applies DL-based moving target detection algorithm for risk identification in track and field sports, aiming to reduce the risk of sports injuries and ensure the safe development of PE.

RELATED WORK

As an important branch of computer vision, video-based tracking and recognition of human moving targets studies ways to recognize human movements within specified video sequences. Extensive research has been conducted in the field of human motion recognition, studying ways to understand and interpret human movements through various technologies and methodologies.

McCrary (2011) found that, among the universities surveyed, only one-third offered track and field classes. The decline of track and field events in universities has attracted the attention of many sports professionals, highlighting the need for further study and the development of corresponding countermeasures. Li and Gu (2021) noted that strengthening the research on risk assessment and prevention of university PE teaching is both a theoretical hotspot and an urgent practical task. A combination of the literature review method, questionnaire survey method, and Pareto analysis method was used to conduct a comprehensive qualitative and quantitative analysis of risk events in university PE teaching.

According to Toomas et al. (n.d.), schools should fully recognize the existence of sports risks and use knowledge-based analysis methods, model-based analysis, and other methods to assess and evaluate various potential risks. Additionally, they should use effective and legal preventive measures

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