ABSTRACT

Automated video analysis of soccer matches poses a substantial challenge in the domain of computer vision, particularly with regard to the accurate detection of objects and the classification of significant events. Conventional object detection methods frequently encounter difficulties in processing the rapid movements of p*layer*s, variations in lighting, and occlusions that are prevalent in soccer matches.Moreover, event classification necessitates an understanding of the temporal context, which cannot be acquired solely from the analysis of individual frames. The necessity for this research stems from its potential to automate the previously manual match analysis process, thereby saving time and enhancing the objectivity of the analysis.The proposed approach aims to provide the coaching team and analysts with valuable tactical insights, enabling them to improve team performance based on objective data.The developed solution integrates the YOLOv8 model with transfer learning for object detection and an LSTM architecture for temporal event classification.The dataset consists of 938 video frames that were manually annotated and segmented into 2,250 frames. The detection process generates bounding box information, which is then structured into sequence data for LSTM input.The LSTM model was designed with three *layer*s (128, 64, 32 units) to classify five categories of events: attacks and goals from both teams.The experimental results show promising performance, with the YOLOv8 model achieving mAP50 0.959 and mAP50-95 0.76 in object detection. The LSTM model attained a classification accuracy of 0.953 on the testing data, attaining a perfect F1-score for Liverpool events but a lower (0.50) score for Chelsea goals.The inference pipeline effectively processed the video at 15 frames per second (fps).This research makes a significant contribution to the development of automated soccer match analysis systems and opens up opportunities for further research in the field of computer vision for sports analysis.

Keywords: YOLOv8*, LSTM, transfer learning, object detection, event classification, sports video analysis, soccer, football.*