Informatics Institute of Technology

In Collaboration With

University of Westminster, UK

University of Westminster, Coat of Arms

AI-Ref

A Human Action Recognition System for Detecting Fouls In Boxing

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May 2023

Submitted in partial fulfilment of the requirements for the

BSc (Hons) Computer Science degree at the University of Westminster.

ABSTRACT

In the competitive realm of boxing, the accurate detection and enforcement of fouls are critical to ensure a fair and safe environment for the athletes. However, referees often struggle to identify and call fouls in real-time, owing to the sport's fast-paced nature, their limited experience, or potential bias towards certain competitors. This issue not only affects the integrity of the sport but also jeopardizes the health and well-being of the boxers. Consequently, there is an urgent need for an effective and reliable solution that can aid referees in their decision-making process and enhance boxers' training experience.

To address this problem, the AI-Ref system was developed as an innovative approach for automated multi-human action recognition and foul detection in boxing. The system employs an InceptionV3-LSTM model, which combines the power of a convolutional neural network (CNN) with the sequential processing capabilities of a Long Short-Term Memory (LSTM) network. The InceptionV3 CNN module effectively extracts and processes spatial features of the input video, while the LSTM component captures temporal dependencies between consecutive frames. This approach ensures that the system is capable of detecting the fouls and providing valuable insights to both referees and athletes.

The AI-Ref system was evaluated using various data science metrics, focusing on its performance in identifying fouls and providing accurate decisions. Results demonstrated a high level of precision and recall, achieving an accuracy of 0.7778. Additionally, the system exhibited an area under the curve (AUC-ROC) of 0.8557 and a Matthews Correlation Coefficient of 0.5553. These metrics indicate that the system effectively identifies and distinguishes between fair and foul actions, providing a reliable and efficient solution to the challenges faced in the boxing domain. Ultimately, the AI-Ref system has the potential to revolutionize the sport by enhancing referee decision-making and facilitating a safer and more equitable environment for all participants.

Keywords: Human action recognition system, Foul recognition, Machine learning, Boxing

Subject Descriptors:

Theory of computation → Theory and algorithms for application domains → Machine learning theory → Models of learning

Computing methodologies → Artificial intelligence → Computer vision → Computer vision tasks → Activity recognition and understanding.

Computing methodologies → Artificial intelligence → Computer vision → Computer vision problems → Tracking