Course Project Part 1: CVPR Workshop Selection

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Abstract

General Information regarding the 9th International Workshop on Computer Vision in Sports(CVsports) at CVPR 2023, and reasoning for selecting it. Also including information on other related papers.

1. Introduction

Sports have for a long time now, played a major role in both society as a whole, as well as how many individuals enjoy their lives. Whether it is playing or spectating, sports have the ability to really grasp the hearts of numerous people. With people's accessibility and desire to watch sports online increasing rapidly in recent years, so does the effort in using technology to enhance the viewing of sports. I picked the 9th iteration of the International Workshop on Computer Vision in Sports(CVsports) at CVPR 2023 because this workshop puts a focus on using computer vision to understand and learn more from the sports that many people watch. Computer Vision can be used for several purposes in sports, including tracking objects such as players or balls, recognizing events/incidents, relaying the sport to those with vision difficulties, or even creating AR/VR in sports, among other things. There is so many different possibilities for computer vision to enhance the experience for sports fans, as well as to improve data collection for professional sports teams, which would potentially help improve the performances of individuals in sports. This workshop is difficult because not only is there a large variety of sports, but each sport has a multitude of things to consider, so the implementation of computer vision would have to be specialized for different sports. Besides required understanding of the specific sport, with much data to be used in computer vision for sports being videos, it adds another level of complexity for the workshop. The combination of these two things (computer vision and sports knowledge) also has the potential to conflict. If you wanted to use computer vision to analyze performance of competitors in sports, or analyzing incidents like fouls, just like how there is room for disagreement between two people, a person could also disagree with a computer's interpretation through computer vision. The dataset, while mentioned that could include both videos and images, combines multiple different domains/application areas, depending on the sport. For example with soccer, there would be a combination of scenes analyzing the entire pitch and detecting all the objects, or images/videos specifically looking players or referees to analyze their actions.

1.1. Workshop Information

Following is the link for the 2023-2021 CVPR workshops:

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https://vap.aau.dk/cvsports/
https://vap.aau.dk/cvsports/8th-international-workshop-on-computer-vision-in-sports/
https://vap.aau.dk/cvsports/7th-international-workshop-on-computer-vision-in-sports-cvsports/
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The workshop page for the current year holds links for every year of this workshop from 2023-2013. The deadline for paper submission if March 6, 2023 (11:59pm PST).

2. Dataset

The dataset associated to the workshop and it's competition is called SoccerNet, a large dataset containing gameplay of soccer taken from multiple different major European leagues. The dataset includes 550 broadcasted and 12 single camera games, over 5 million feature frames, and both temporal and spatial annotations. While the dataset can be used for several different purposes, the competition for the workshop this year specifically measures the ability to understand the players (as objects), the field, and the broadcast video. Currently more information for the competition has not been shared, in previous years competition details have been posted on the workshop page, with more in depth details shared on SoccerNet's website:

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https://www.soccer-net.org/challenges
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More information regarding the competition this

year(deadlines, rewards, challenges, etc), are expected to be posted on the workshop page and SoccerNet's website in the near future. The SoccerNet challenges were also presented in the 8th version of this workshop in 2022, hosting competitions for Camera Calibration and Field Localization. The competition had evaluation servers hosted on "eval.ai", the test set is blind, but after a certain date, participants are able to use the evaluation server on the challenge set, before having the challenge set determine the winners later on after the evaluation servers are closed. In 2022, the Camera Calibration competition had 7 competitors, with the average final score being 52.178 and the winning final score was 83.96(for reference, the second highest score was 66.58, and the lowest final score was 21). The Field Localization competition had 13 total competitors, with the average final score being 63.38 and the winning final score was 87.61. Both competitions had a clear winner, and these competitions are no longer currently active.

3. Past Research Papers

The following sections contains summaries on three different relevant research papers submitted to this workshop in past years.

3.1. SoccerTrack

Fully titled as "SoccerTrack: A Dataset and Tracking Algorithm for Soccer with Fish-eye and Drone Videos", is an article that focuses on using footage obtained from fish-eye and drone(above the pitch looking down) cameras to accurately track the soccer players on the pitch as well as the ball. The reason for using fish-eye cameras and drone cameras is because they are able to view the entire soccer field at all times, allowing for consistent tracking of objects throughout the game. SoccerTrack specifically refers to "a dataset set consisting of video captured with an 8K-resolution fisheye camera and a 4K-resolution drone camera" [1]. The article explains the work of having to design a MOT (Multi-object tracking) dataset, as well as MOT algorithms. They collected the data themselves, and demonstrated that both approaches(fish-eye and drone videos) are usable. This article relates to the workshop as it ultizes CV through an innovative approach and is able to optimally track multiple objects for soccer. While this article is specifically tested and trained with soccer, it proves that using Fish-eye and Drone videos for other sports for the same purpose is feasible.

3.2. Tackle Detection System for Rugby

Fully titled "End-to-End High-Risk Tackle Detection System for Rugby", aims to analyze tackles in rugby, and create "a system to detect high-risk tackles, potential triggers of concussion, based on deep learning models" [2]. In this article, they approached analyzing data by viewing rugby match videos, and collecting frames of tackles. They then analyze other features of the frame to identify patterns that result in injuries. Some of these features include where the tackle occurred, and the posture of both individuals involved in the tackle. The article states that "our system was able to detect 50% of high-risk tackles without any human intervention", meaning that of those 50% identified, by using this system they can confirm immediately if a tackle was high risk and potentially notify medical staff if the system was in use, which is amazing [2]. This is related to this workshop as it is a perfect example of how computer vision in sports could potentially save lives and lower the impact of high-risk injuries.

3.3. Computer Vision in Sports

This article, "Computer Vision in Sports" is authored by many of the individuals who are organizers for this workshop [3]. It has a focus on talking about different ways that computer vision can be applied positively to sports in general, as well as current and potential issues that arise when trying to do so. Specifically, they talk about current commercial use of computer vision in sports, what is currently being researched, as well as open issues involved with computer vision in sports. The article was shared on the workshop page and is a very related article to the workshop as it covers the whole breadth of computer visions current and (currently recognized) potential involvement in sports.

References

[1] Atom Scott, Masaki Onishi, Yoshinari Kameda, Keisuke Fujii. (2022). SoccerTrack: A Dataset and Tracking Algorithm for Soccer with Fish-eye and Drone Videos. *2022 IEEE/CVF Conference on Computer Vision and Pattern Recognition Workshops (CVPRW)*. https://openaccess.thecvf.com/content/CVPR2022W/CVSports/papers/Scott_SoccerTrack_A_Dataset_and_Tracking_Algorithm_for_Soccer_With_Fish-Eye_CVPRW_2022_paper.pdf

[2] Naoki Nonaka, Ryo Fujihira, Monami Nishio, Hidetaka Murakami, Takuya Tajima, Mutsuo Yamada, Akira Maeda, Jun Seita. (2022). End-to-End High-Risk Tackle Detection System for Rugb. *2022 IEEE/CVF Conference on Computer Vision and Pattern Recognition Workshops (CVPRW)*. https://openaccess.thecvf.com/content/CVPR2022W/CVSports/papers/Nonaka_End-to-End_High-Risk_Tackle_Detection_System_for_Rugby_CVPRW_2022_paper.pdf

[3] Thomas B. Moeslund, Graham Thomas, Adrian Hilton, Peter Carr, Irfan Essa. (2017). Computer Vision in Sports. https://www.sciencedirect.com/journal/computer-vision-and-image-understanding/vol/159/suppl/C