Fencing Tracking and Visualization System

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ABSTRACT

We developed the “Fencing tracking and visualization system.” It detects the tips of sabers (fencing swords) to visualize the trajectory of the sabers in real time, which doesn't require any markers but works only with the input of the images from cameras. This is the only fencing visualization technology that has been used in actual international fencing matches, such as the H.I.H. Prince Takamado Trophy JAL Presents Fencing World Cup 2019.

Fencing sabre, especially its tip, moves quite fast, and its flexibility results in a large distortion in its shape. Additionally the tip is the size of only a few pixels when captured even by a 4K camera so that it is too small to detect with image recognition techniques. We developed a multi-stage deep learning network for general object detection based on YOLO v3[1][2], starting from the hardware selection of a camera for analysis. Since a single camera can only cover about 8 meters, we eventually installed 24 4K cameras on the both sides of the piste to cover the entire match area and improved the robustness of the sabre tip detection. We also developed a system to estimate the 3D position of the tips from the detection results of multiple cameras.

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