PROJECT 1

EC601: PRODUCT DESIGN

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I Introduction

It is known that during a whole football play, there are a lots of helmet impacts, which may be against the rules, even harmful and dangerous to other players. After obtaining data about impacts, we need more information, just like the involving athletes and corresponding jersey number. It will be helpful and useful to athletes, coaches and judges.

II Application

2.1 In football play

Because impacts will influence the performance and condition of athletes, it is essential for coach to adjust the tactics with the record provided to exploit strengths and avoid weaknesses of the entire team. After the play, the data about what kind of compact and who did can be provided for trainer and coach to analyze the track details of a specific player and create customized personalized plan or training. Also, if there is a competition appeal put up by either team, the record and data could be utilized to analyze controversial judgement.

2.2 In other area

The core of the task is to put up with a solution to realize a connection between an object and a specific tap, a mapping and tracking of moving object in a video. It can be used to analyze the moving track of several objects in a scene, like mapping some particle motion under microscope, tracking vehicles moving in the downtown to analyze the traffic stream and road utilization.

III Focus

The entire task can be divided into several interrelated parts, including impacts detection, which has been accomplished previously, jersey detection and recognition, aiming at obtaining corresponding player information of each jersey, connection between specific player and his/her helmet, mapping and tracking every athlete in the rest of play. I will introduce some research related to this task as following

3.1 Previous Research

Helmet Detection

An author, Tito, has come up with a solution of helmet mapping through comparison NGS tracking data with the lateral coordinates of the boxes and minimize the difference between each boxes and coordinates. Tito also mentioned the rotation of camera during the play should be taken in consideration and maybe depth could improve accuracy of mapping.[1]

Moving Object Mapping and Tracking

Chieh-Chih Wang has established a mathematical framework to integrate simultaneous localization, mapping (SLAM) and moving object tracking, two solutions of SLAM with generalized objects and SLAM with detection and tracking of moving objects (DATMO) respectively. The separate solutions lower the computation dimension obviously and the algorithms feasibility has been proven by the data collected from the CMU Navlab11 vehicle at high speeds in crowded urban environments.[2]

Moving Object Tracking

Kalman filter can estimate the current and previous step status, even predict future status without model details. The core of Kalman filter is to regard minimum mean square error as the best estimation rule, then update the status parameters with the status information of last moment and current moment. With the estimation of current moment, the algorithm can estimate the signal under the rule of minimum mean square error according to the system formula and observation formula.

An article has applied the Kalman filter into moving object tracking. First step is to track and divide the video into frames which made up of a piece of picture. Then, identify the moving targets with color recognition. After identification of center coordinates, put the coordinates of previous and current frame to find out the location of moving target. Kalman filter is used to subtract pixel wise in current frame and figure out the error between actual and estimated locations.[3]

References

[1] Tito. Nfl baseline, Simple Helmet Mapping, 2021. https://www.kaggle.com/its7171/nfl-baseline-simple-helmet-mapping#validation.

[2] Chieh-Chih Wang, Charles Thorpe, Sebastian Thrun, Martial Hebert, and Hugh Durrant-Whyte. Simultaneous localization, mapping and moving object tracking. *The International Journal of Robotics Research*, 26(9):889–916, 2007.

[3] Pramod R Gunjal, Bhagyashri R Gunjal, Haribhau A Shinde, Swapnil M Vanam, and Sachin S Aher. Moving object tracking using kalman filter. In *2018 International Conference On Advances in Communication and Computing Technology (ICACCT)*, pages 544–547. IEEE, 2018.