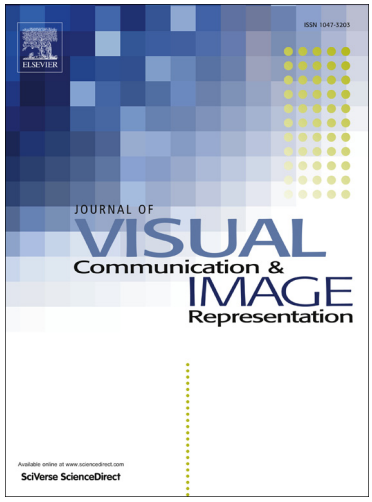

Robust player detection and tracking in broadcast soccer video based on enhanced particle filter

Ying Yang, Danyang Li

PII: S1047-3203(17)30064-0
DOI: http://dx.doi.org/10.1016/j.jvcir.2017.03.008
Reference: YJVCI 1978

To appear in: *J. Vis. Commun. Image R.*

Received Date: 26 September 2016
Revised Date: 20 February 2017
Accepted Date: 3 March 2017

Please cite this article as: Y. Yang, D. Li, Robust player detection and tracking in broadcast soccer video based on enhanced particle filter, *J. Vis. Commun. Image R.* (2017), doi: http://dx.doi.org/10.1016/j.jvcir.2017.03.008

Robust player detection and tracking in broadcast soccer video based on enhanced particle filter

Ying Yang[a], Danyang Li[b]

[a] College of Information and Electrical Engineering, China Agricultural University, Beijing, 100083, China (Corresponding Author, E-mail: hbxtyy@126.com; Address: No. 27 Qinghua East Road, Haidian District Beijing, China; Postcode: 100083; Tel: (8610)62600655)

[b] College of Information and Electrical Engineering, China Agricultural University, Beijing, 100083, China (E-mail: 276437131@qq.com; Address: No. 27 Qinghua East Road, Haidian District Beijing, China; Postcode: 100083; Tel: 18811703255)

ABSTRACT: It is significant to detect and track soccer players in broadcast sports video, which is helpful to analysis player activity and team tactics. However, it is challenging to efficiently detect and track soccer players with shots switched and noise caused by auditorium and billboards. And for multi-player tracking how to treat the increase or decrease of player are also difficult. In this paper, a robust player detection algorithm based on salient region detection and tracking based on enhanced particle filtering are proposed. Salient region detection is used to segment sports fields, and then soccer players are detected by edge detection combined with Otsu algorithm. For soccer players tracking, we use an enhanced particle filter which we improve the algorithm in sample and the likelihood function combing the color feature and edge feature. Experimental results show the proposed algorithm can quickly and accurately detect and track soccer players in broadcast video.

Keywords: object tracking, particle filter, salient region detection, Otsu algorithm

1 INTRODUCTION

Player detection and tracking in broadcast soccer video plays an important role in multimedia analysis [39, 40, 42, 44, 45], which contributes to players observation and analysis, and player tracking can help coach observes each player in frames [22, 27, 28, 29, 31]. And a variety of applications are based on the algorithm such as player running diagram, give a good account of match containing possession, shots, pass combinations and so on. Object detection and tracking is a hot research topic in computer vision research field, which is widely applied in broadcast sports video field [25, 30, 32, 36, 38].

In soccer player tracking, tracking resorts to results of player detection, and it is important to determine the position of each player. In related work, some researchers detect players in frames of broadcast sports video [3, 21, 23, 24, 26, 43]. Heydari et al. proposed the player detection algorithm that uses k-means clustering by clustering the players in similar color [1]. Liu et al. detected players by a boosted algorithm, and trained classifier by cascade of haar features for different training datasets [5].The detection algorithms based on cascade classifier segment players directly in frames. In the method, it is easy to be affected by complex background that noise from auditorium and shot switching. Some researches detect players by feature attributes such as SIFT, color, and edges in sports field. Min et al. proposed the football players detection and tracking algorithm based on SIFT [2], and the players position based on the scale-invariant feature detection, which is accurate and efficient. Zhang et al. use canny operator and Morphology detect the field in soccer game [4], and segment players by the threshold. However, soccer player detection algorithm may result in error when there are many lines in the frames. Although there are many approaches for player detection, in the broadcast sports video, it is so much noise that influences player detection such as lines in sports field, Goalmouth with many grids, audience on the grandstand.

Many tracking algorithms based on particle filter have been presented [9-13, 33, 34, 35], which are adaptive to nonlinear and non-Gauss dynamic systems. Yu et al. proposed an improved particle filter algorithm, which proposed the hybrid proposal distribution of adaptive optimization, considering current observed information to optimize sample distribution in the particle filter. The algorithm adaptively generates annealing parameters in hybrid proposal [6]. However, with particles propagation