Detection of Players on a Soccer Team based on Informed Filters using Only Color Features

Takuro Oki[1] and Ryusuke Miyamoto[2]
[1]*Department of Fundamental Science and Technology, Graduate School of Science and Technology, Meiji University, Kanagawa 214-8571, Japan*
[2]*Department of Computer Science, School of Science and Technology, Meiji University, Kanagawa 214-8571, Japan*

1 INTRODUCTION

Semantic analysis of sports videos has become an active research topic. Player detection on the field is a particularly important technique for various applications that are essential for semantic event detection and tactical analysis, such as calculations of the distance covered by a player during a soccer match. Tracab(ChyronHego, 2003) is one of the most famous systems that can visualize the statistics of players' performance during a match. However, the current detection and tracking systems used for Tracab are very large and expensive, so they are only found at large stadiums. Many major teams require this system when they play a match.

To solve this problem, we tackled this task by using a simple monocular camera and developed a highly accurate soccer player detection method using only color features(Miyamoto and Oki, 2016). This method is based on a simple sliding window algorithm, but it does not use background subtraction or inter-frame difference. This is because they are not appropriate for moving cameras, though our system has to operate properly for aerial photographs taken by drones.

In our previous work(Miyamoto and Oki, 2016), we tried to find all humans on the field including coaches and referees. However, for team tactics and player activity analysis, it is more useful to detect only players that belong to a certain team. Therefore, in this paper, we improve the previous method (Miyamoto and Oki, 2016) and try to enable soccer players to be accurately detected on the basis of their teams.

2 INFORMED HAAR-LIKE FEATURES

Informed Haar-like features (Zhang et al., 2014) enables accurate human detection by representing the object boundary properly. They possess two unique points: a well-designed feature pool for construction of a classifier and computation of features using binary and ternary template models. A binary model computes feature values using two types of rectangles as coefficients: -1 and $+1$. Its basic idea is the same as Haar-like features proposed by (Viola and Jones, 2001). A ternary model is applied to represent more complex geometric configurations than the binary model and has three types of rectangle as weights: -1, $+1$, and 0.

Filtered Channel Features(Zhang et al., 2015) using a feature pool including more complex templates has topped the state-of-the-art accuracy for human detection and outperformed recent schemes based on deep learning.

3 DETECTION OF PLAYERS ON A SOCCER TEAM BASED ON INFORMED FILTERS USING ONLY COLOR FEATURES

Our previous proposal(Miyamoto and Oki, 2016) can accurately detect people using only color features if they are appropriately selected, but does not use histograms of oriented gradients. This method targets all people shown in the image without considering to which team they belong. However, to obtain more useful information for tactical analysis, players belonging to a certain team need to be detected. Thus, we construct a classifier that enables detection of players on a certain team. To construct a classifier, we generate training samples and define samples that include a target team's player as positive and the others as negative. In addition, the goal keepers are excluded from the detection target. To calculate feature value, we generate templates and used only color features like in our previous work(Miyamoto and Oki, 2016).

Oki, T. and Miyamoto, R.
Detection of Players on a Soccer Team based on Informed Filters using Only Color Features.
In *Extended Abstracts (icSPORTS 2016)*, pages 27-28

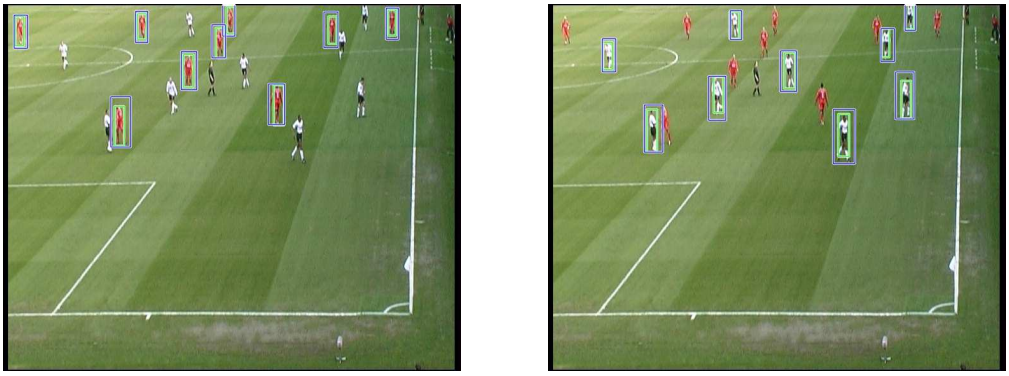

Figure 1: Detection results in the same frame.

4 EVALUATION

In the experiments, miss rate vs false positives per image was measured as a detection error tradeoff (abbr. DET) curve to evaluate the classification accuracy. In addition, processing speed was also measured. For this evaluation, 2000 images were randomly selected for training samples from the PETS2003 dataset, and 500 images not included in training samples were also randomly selected and used as test images.

Fig.1 shows detection examples. Our proposal can extract all players belonging to a certain team in some frames.

Fig.2 shows DET curves. In the fig.2, “Liverpool” and “Fulham” represent the results for both teams. “Liverpool” results shows that the miss rate was about 3.0% at 0.1 FPPI, and “Fulham” results shows that the miss rate was about 5.0% at 0.1 FPPI. These results shows that our proposed method can achieve an acceptable detection accuracy.

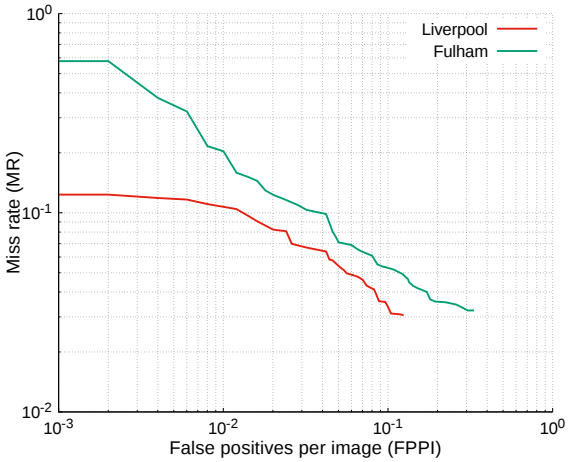

Figure 2: DET curves for both teams.

5 CONCLUSION

In this paper, we have tried to extend our previously proposed method(Miyamoto and Oki, 2016) to the detection of soccer players that belongs to a specific team. If features selection is appropriately operated, experimental results using PETS2003 dataset show that our proposed method can achieve high detection accuracy. In the future, we will try to improve our proposed method by adding an object tracking process using time series information.

ACKNOWLEDGEMENTS

The research results have been achieved thanks to “Research and Development of Innovative Network Technologies to Create the Future”, the Commissioned Research of National Institute of Information and Communications Technology (NICT), Japan.

REFERENCES

ChyronHego (2003). Tracab optical tracking. http://chyronhego.com/sports-data/tracab.

Miyamoto, R. and Oki, T. (2016). Soccer player detection with only color features selected using informed haar-like features. In *Advanced Concepts for Intelligent Vision Systems*. to be published.

Viola, P. and Jones, M. (2001). Rapid object detection using a boosted cascade of simple features. In *Proc. IEEE Conf. Comput. Vis. Pattern Recognit.*, volume 1, pages 511–518.

Zhang, S., Bauckhage, C., and Cremers, A. (2014). Informed haar-like features improve pedestrian detection. In *Proc. IEEE Conf. Comput. Vis. Pattern Recognit.*, pages 947–954.

Zhang, S., Benenson, R., and Schiele, B. (2015). Filtered channel features for pedestrian detection. In *Proc. IEEE Conf. Comput. Vis. Pattern Recognit.*, pages 1751–1760.