

## Soccer analysis system

### Overview

In order to create semantically meaningful metadata for sports content, content specific analysis modules are needed. The soccer analysis system combines several such analysis steps, either existing modules (e.g. for event detection, camera view classification) as well as newly developed modules for player detection and tracking.

### In depth description

The main contribution for soccer analysis made during the project is development of an adaptive player detection and tracking system. Player detection in team sports videos is slightly different from other application scenarios where person detection and tracking is needed: Usually, a pan-tilt-zoom camera is used, introducing motion artefacts into the signal that make detection and tracking more difficult than with static cameras e.g. in surveillance scenarios. The fact that colour distributions within players of one video are quite similar within the players of a team can be utilized to improve detection performance. Here, an adaptive approach is proposed that performs an unsupervised generation of training samples for each match to be analysed. Therefore, different colour features, namely colour histograms, colour spatiograms and a colour and edge directivity descriptor (CEDD) are evaluated. While the colour features alone did not yield better results than a pure HOG detector, a classifier fusion with an HOG based detector improved detection results. In terms of maximum  $F_1$  score, an improvement from 0.79 to 0.81 is reached using block-wise HSV histograms. The average number of false positives per image (FPPI) at two fixed recall levels decreased by approximately 23 %. The results are plotted in Figure 20, with the baseline HoG approach plotted with a black line and the other lines representing colour adaptive approaches using different colour features.

While a uniform colour distribution helps detecting players, it makes tracking occluded players of the same team more difficult. Here, a grid filter tracking using a variety of cost terms is proposed. It utilizes bounding box sizes, colour features, distance from the predicted position, SVM player detection scores and the overlap with existing trajectories to generate a tracking hypothesis.

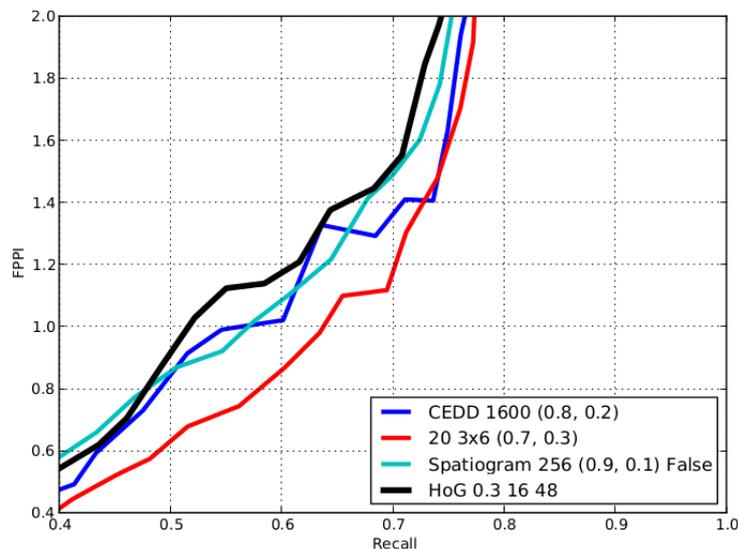


Figure 20. Results for color adaptive player detection approaches.

### Potential fields of Application

The soccer analysis system allows for searching for player specific parts of sport content and serves as a foundation for additional, more high-level analysis such as player identification or highlight detection. Soccer analysis in general can be applied in broadcast sports production as well as in broadcast archives, where additional metadata is needed. Additionally, it can be used for sports clubs to support video scouting and match preparation by facilitating quick navigation within soccer videos.

**Possibilities for exploitation**

It is intended to further exploit results in a national research project with two private partners which is currently under negotiation. Additional exploitation in the form of collaborative projects and licencing is targeted.

**Further Information**

Further technical information is available in TOSCA-MP deliverables D2.2 and D2.3 on "Automatic Metadata Extraction and Enrichment".

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