Visual Tracking for Application to AFL Football

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Introduction

Visual object tracking is a fundamental problem in the field of computer vision, with the case of tracking AFL football yet to be researched. Factors such as occlusion, pose variability, lighting differences, player movement, and similarity in appearance of players, make the problem more difficult than the well studied pedestrian tracking problem.

This work investigated and adapted current state-of-the-art methods for better performance in the AFL case.

Data Collection

Both testing and training data needed to be collected:
- 5 static HD cameras film entire field from grandstand
- Approximately 50 hours of footage collected in total
- Different lighting conditions (sunny, overcast, night)
- Seven different teams plus officials
- Over 15,000 players and officials manually annotated and clasused based on team, pose and occlusion

Detection

The detection framework consisted of:
- Histograms of Oriented Gradients (HOG) [4] feature
- Local Binary Pattern (LBP) additional feature [5]

Team Classification

Each AFL team has their unique uniform, generally with different colours and patterns. The team classification framework:
- Support Vector Machine (SVM) [6], single team vs all
- Colour (HSV) histograms with weighted spatial maps as features

The promising team classification results show that:
1. Using spatial weight has significant improvement
2. Teams with higher contrasting uniforms are classified more accurately
3. Classification performance degrades when in sunny conditions where shadowing and overexposure occur

Tracking

The tracking process links detections across frames:
- Discrete-continuous energy minimisation approach [7]
- Additional Kalman Filter approach used as initial guide for the energy minimisation algorithm

Conclusion

- Off the shelf pedestrian detectors don’t work for AFL
- Using AFL training data is vital for a reliable detector
- Significant pose and lighting variation able to be handled
- SVM on colour histograms sufficient for team classification

References