

Soccer Video Analysis summary

D. Tsitsimis, Prof. Ioannis Pitas
Aristotle University of Thessaloniki
pitas@csd.auth.gr
www.aiia.csd.auth.gr
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- Introduction
- Playfield Detection
- Ball Detection and Tracking
- Players Tracking
- Referee Assistance
- Tactics Analysis

Introduction

- Extract from soccer videos information that is useful for the fans and the professionals:
 - Tactics Analysis
 - Highlight Extraction
 - Referee Assistance.
- Interpretation of ball and players movements provides the desired information.
- Ball and players tracking is the most fundamental element of soccer video analysis.

Introduction

- Background subtraction is required for objects detection and tracking

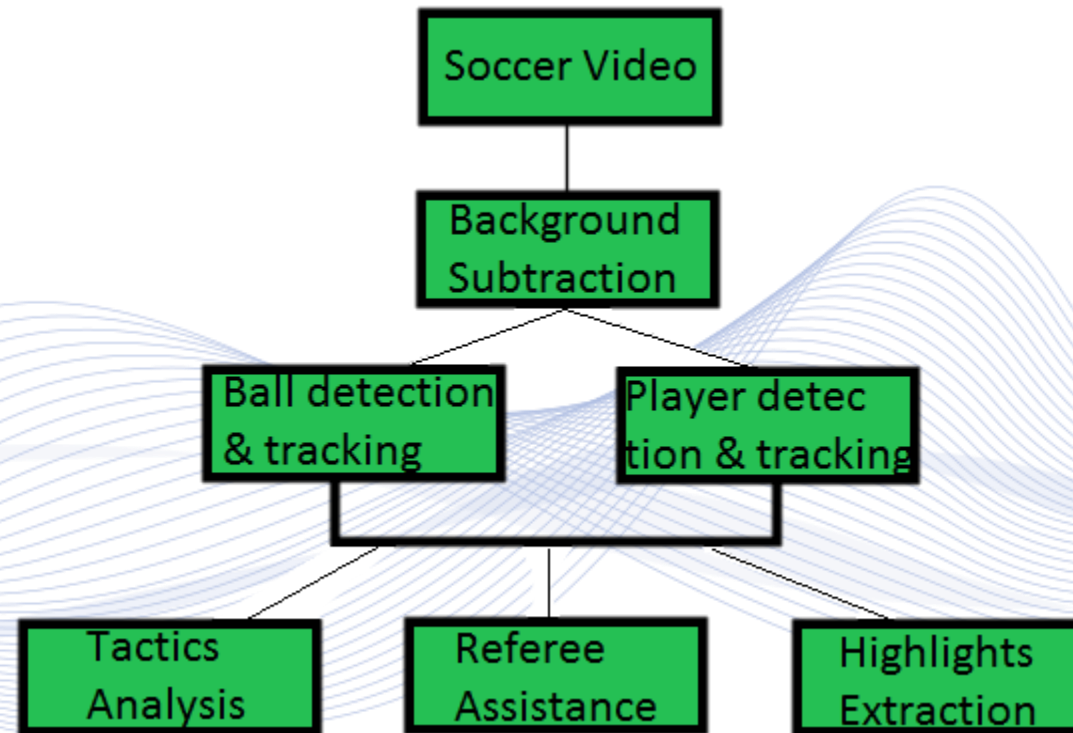


Figure 1: Video Analysis Process

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Playfield Detection

- Segmenting each frame into background and foreground.
- Background corresponds to the playfield.
- Binarized image: 0 for playfield, 1 for moving objects.

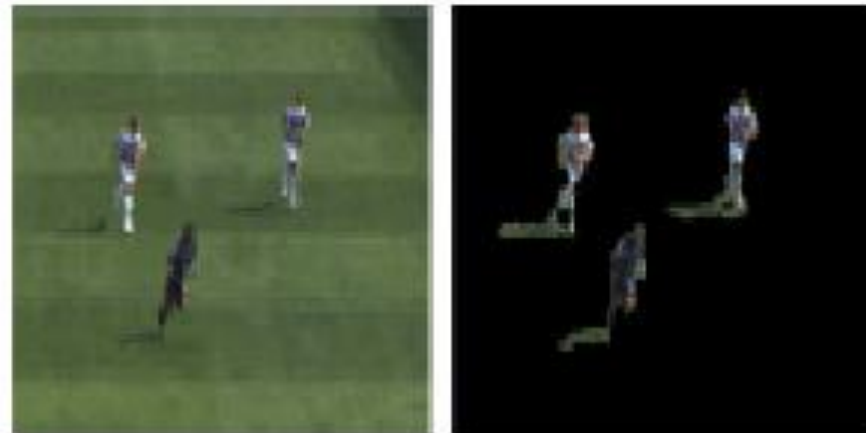


Figure 2: Frame Binarization

Source: T. D'Orazio et al., "An Investigation Into the Feasibility of Real-Time Soccer Oside Detection From a Multiple Camera System," in IEEE Transactions on Circuits and Systems for Video Technology, vol. 19, no. 12, pp. 1804-1818, Dec. 2009.

Color-based method

- Assumption: In a frame the dominant color range is the field color range.
- A color is assumed to be a field color, if it is in the field color range
- Region segmentation methods can be used.



Figure 3: Unconnected field regions

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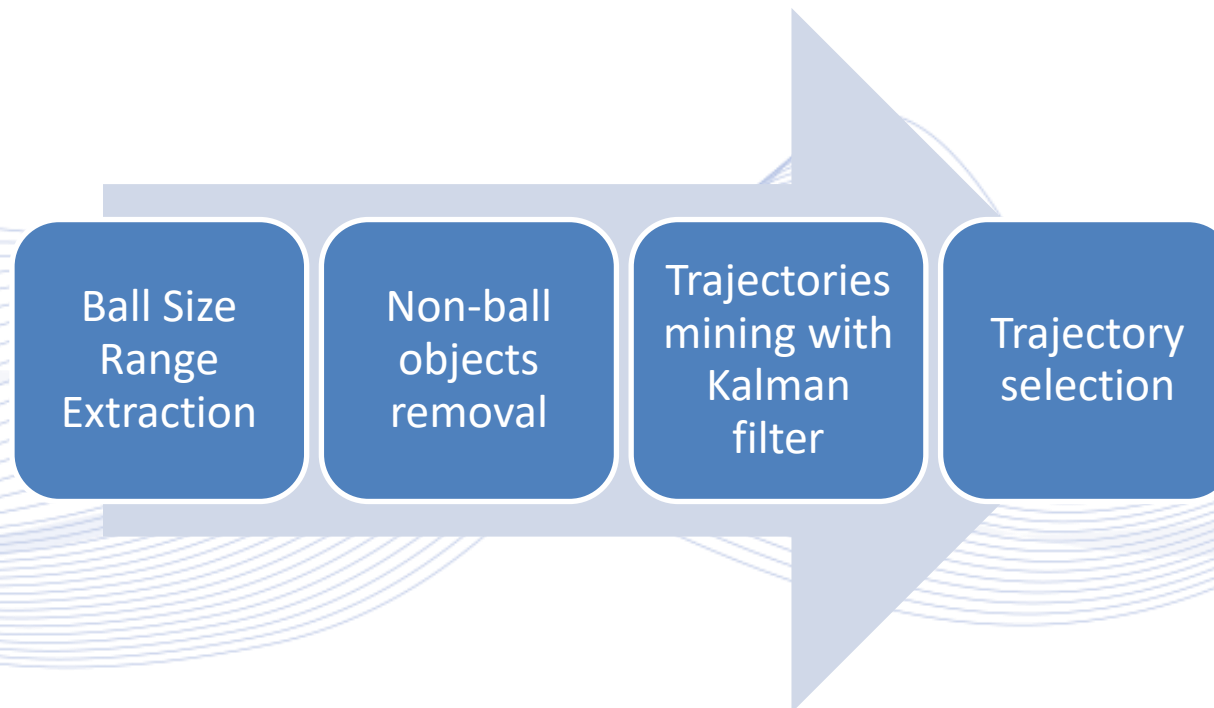
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Challenges in ball detection

- The appearance of the ball (size, shape, color) varies irregularly over frames.
- Other objects like players are similar in appearance to the ball.
- The ball image is very small.
- The ball is often merged with lines or occluded by people.
- There is virtually no property to distinguish the ball from other objects within the same frame.

Ball trajectory method

- Detection of ball trajectories instead of ball objects.
- Use of extra constraints necessary to form a trajectory
- Procedure:



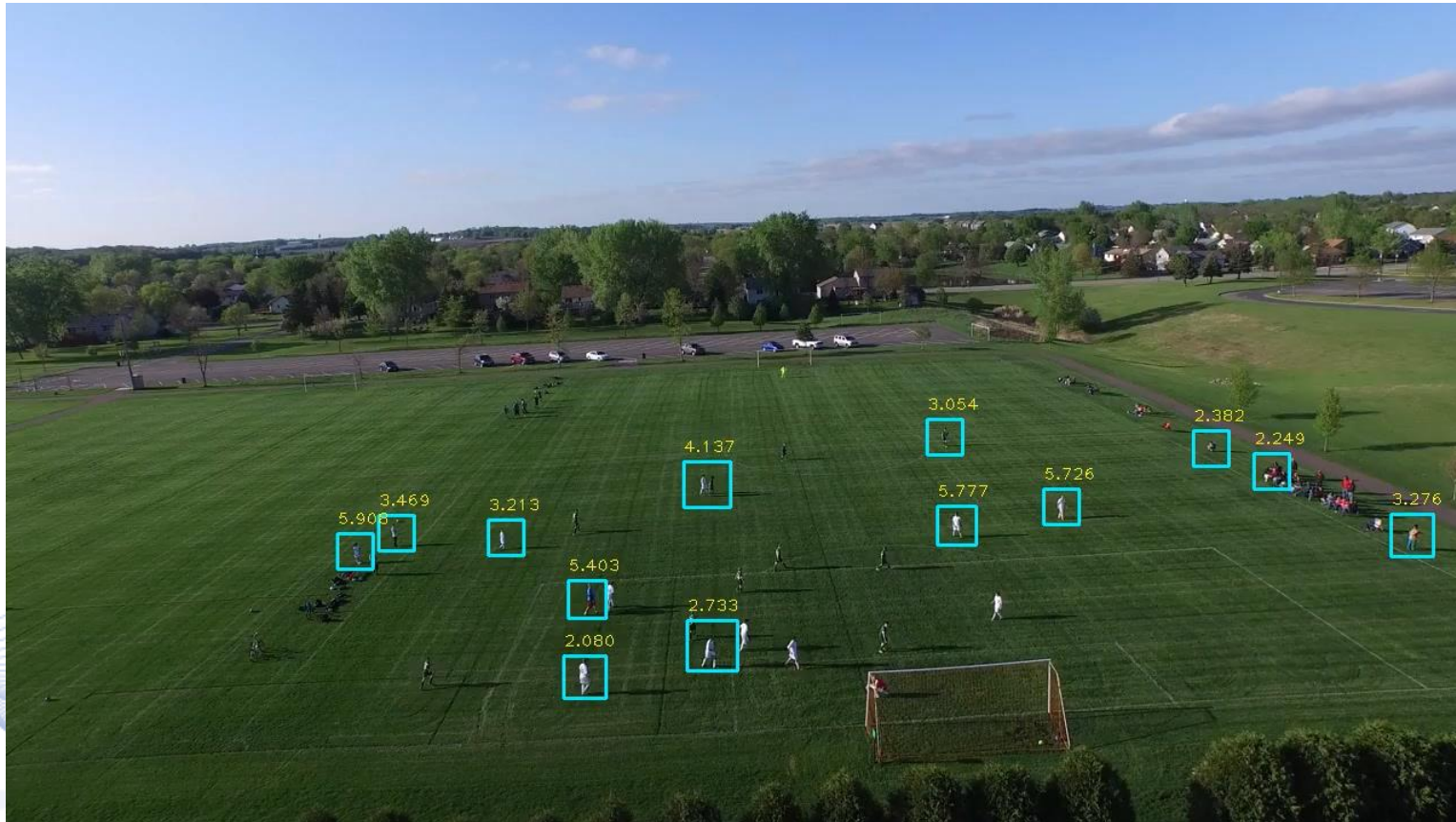
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Tracking soccer players

- Problem: Tracking players during a soccer game through the use of multiple cameras
- Occlusion and players congestion especially during free kicks and corners
- Tracking of multiple objects
- Nonlinearity of motions, abrupt velocity change
- Small size of objects

Tracking soccer players



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Offside Detection

- A player is in an offside position if any of their body parts, except the hands and arms, are in the opponents' half of the pitch, and closer to the opponents' goal line than both the ball and the second-last opponent.

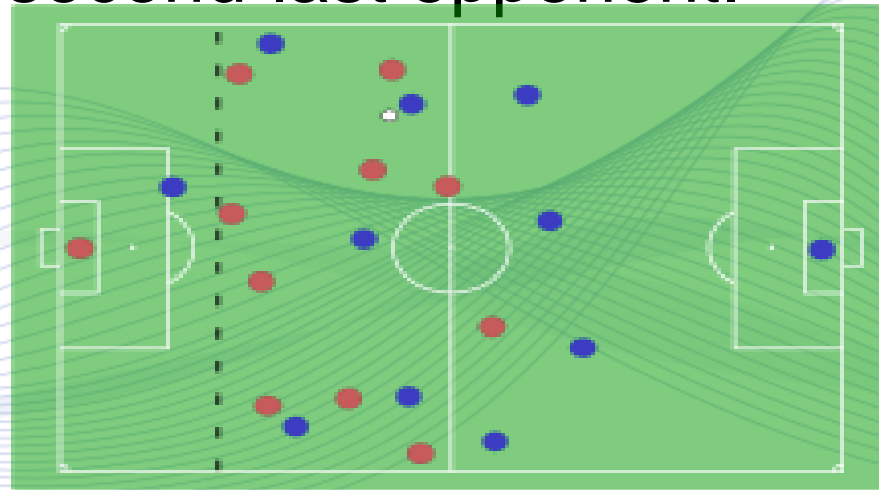


Figure 7: The Offside rule

By NielsF - Image:Offside.jpg, CC BY 2.5,
<https://commons.wikimedia.org/w/index.php?curid=983103>

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Event Tactics Analysis

Tactics: understand the process and patterns of attacks to improve the team performance.

- Tactics is characterized by:
 - Individual players behavior.
 - Interaction among players and ball.
 - Trajectories of players and ball.
 - Active field regions of event occurrence.
- Focus on offense events.

Temporal and Spatial Interaction Analysis

- Segments of passing: ball trajectories into a **play region**.
- Segments of dribbling: dribbling-player trajectory into a play region.
- Concatenation of selected segments into aggregate trajectory.
- Attack event consists of **passing** and **dribbling** periods.



Figure 8: Dribbling

By Dean Jones - Flickr: Sturridge v Swansea, CC BY 2.0,
<https://commons.wikimedia.org/w/index.php?curid=24785112>



Figure 9: Passing

By Football.ua, CC BY-SA 3.0,
<https://commons.wikimedia.org/w/index.php?curid=20186516>

Tactic Pattern Analysis

- Use of the extracted information (ball segments, dribbling segments, active play regions) to classify the attack events.

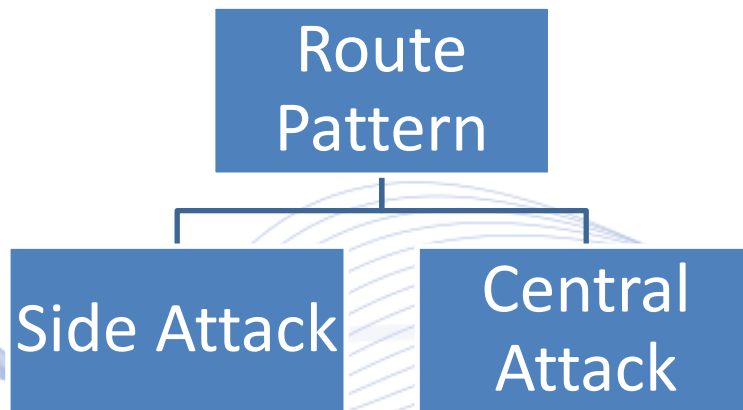


Figure 10: Route Pattern

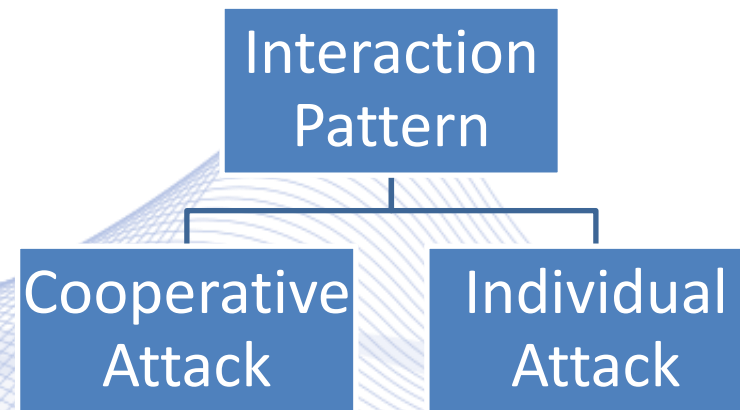


Figure 11: Interaction Pattern

- Route pattern and interaction pattern are complementary information.

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Q & A

Thank you very much for your attention!

**More material in
<http://icarus.csd.auth.gr/cvml-web-lecture-series/>**

**Contact: Prof. I. Pitas
pitass@csd.auth.gr**