Quantifying Pitch Control in Soccer Project Work II Presentation

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"It is statistically proven that players actually have the ball 3 minutes on average. So, the most important thing is what you do during those 87 minutes when you do not have the ball. That is what determines whether you're a good player or not."

- Johan Cruyff

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- Soccer analytics has traditionally focused on on-ball events, such as passing and shooting efficiency or dribble success rate
- Quantifying the pitch control ratio is crucial for analyzing teams' tactical approaches and evaluating players' abilities
- The methods discussed in this report were developed for soccer analytics; they also have potential applications in other fields, such as traffic management, marketing, and healthcare

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- Pitch control refers to the ownership of space by teams
- In regions controlled by Team A, the players of that team can react quicker and occupy space before their opponents
- Last semester: We aimed to implement two approaches to pitch control:
 - A basic method using Voronoi tessellation
 - A more advanced method based on Javier Fernandez and Luke Bornn's concept of player influence area

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• This semester: We aim to acquire data for analytics

- One of the main challenges in this project is the limited availability of publicly accessible high-quality tracking data
- In the last semester, the dataset was provided by Metrica Sports
 - The GitHub repository contained three anonymized soccer matches
- Generating new data is beyond the scope of this project due to the complexity of the game
- The world of video games offers plenty of opportunities to acquire data
- The final choice was Sports Interactive's Football Manager 24 game

Data Acquisition - Recording and Frame Extraction

- FM24 provides an opportunity to replay previously played matches in 2D mode
- The soccer pitch is viewed from above, and players are represented by circles containing their shirt numbers
- The plan was as follows:
 - 1. Record the match
 - 2. Identify each player individually
 - 3. Locate each player in each given frame

Video settings:

► Format: mp4, Resolution: 1920×1080, FPS: 24

Game settings:

- Highlight Mode: Full Match, Camera: 2D Classic,
- Match Speed During Highlights: Very Fast,
- Match Speed During Text-Only Highlights: Very Fast,
- Match Speed Between Highlights: Very Fast.

Data Acquisition - 2D Classic Camera in FM24



Data Acquisition - Player Detection using Hough Circles

- In soccer each team has 11 players, substituted players cannot return
- ► To detect participants I captured three key frames per match
 - 1. After first half kickoff
 - 2. After second half kickoff
 - 3. Just before full-time
- Apply the Hough Transform to identify players as circular shapes
- The Hough Transform maps the points of the image to a parameter space
- Local maxima in the parameter space reveal the most likely shape candidates using a voting system

Data Acquisition - Hough Transform Image Space



Data Acquisition - Hough Transform Parameter Space



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Data Acquisition - Identified Players



- Template matching is a method for searching and identifying the location of a template within a given image
- It slides the template across the input image and compares the template to each corresponding region of the image
- ► To locate all players, I used the identified players as templates

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I used OpenCV's matchTemplate() function with the TM_CCOEFF_NORMED metric

- Some problems arose during template matching and data extraction:
 - Similar player numbers
 - Overlapping circles
- Solutions:
 - Introducing a threshold during template matching

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Filling missing values using linear interpolation

Data Acquisition - Result



Basic Visualization



Figure: Player's Average Positions

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Voronoi Tessallation Visualization



Figure: Voronoi Regions Visualization

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Player Influence Areas Visualization



Figure: Player's Influence Regions

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Match Analysis Visualization



Figure: Pitch Control Ratio - Match Analysis

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- Gather more FM24 match data
- Use computer vision on real match footage

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Analyze pitch zones to measure value

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