Exploring Ball Recovery Times in Professional Football: Insights and Patterns

Author: Mahbod Tajdini | m.tajdini@student.vu.nl
Supervised by: Dr. Mauricio Verano Merino

A. Motivation

Problem Statement:

- Limited understanding of how key match events (e.g., substitutions, injuries) influence ball possession [1-3].
- Coaches still depend on handwritten notes to develop and archive strategies, creating inefficiencies [4].
- The vast volume of raw match data prevents extraction of clear, actionable insights, underscoring the need for a digital, simple, and interactive dashboard [5].

Solution:

- Interactive visual dashboard that consolidates and displays match events and ball-possession data.
- Delivers novel insights into how ball possession correlates with goals, substitutions, injuries, and other pivotal scenarios.

B. Research Question

⚽ What **match key events**[1] impact the time required to **recover ball possession** in elite football?

1. events include goals, own goals, substitutions, yellow/red cards, injuries, and tactical shifts

C. Methodology

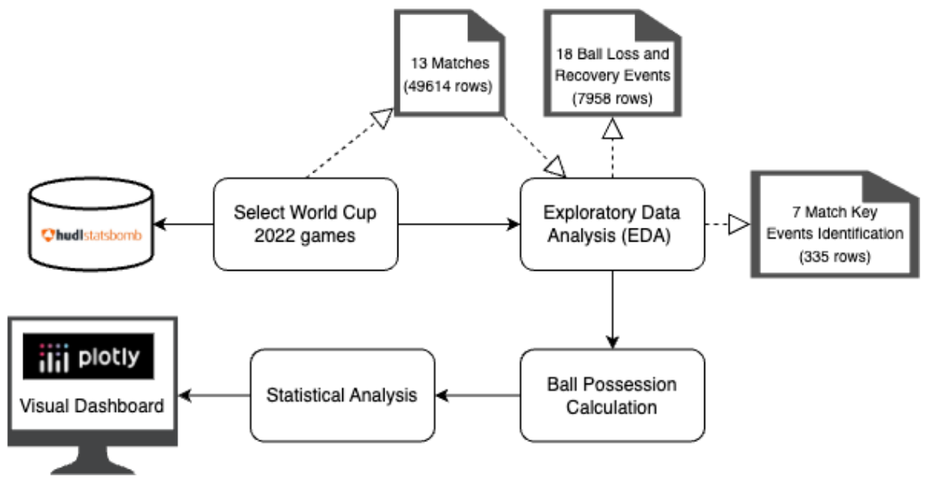

Figure 1. Overview of the research workflow

1. Rule-based Event Classification Algorithm
2. Statistical Analysis:
   - Shapiro-Wilk (normality)
   - Mann-Whitney U (group difference)
   - Cliff's Delta (effect size and direction)
3. Visual Dashboard

D. Results

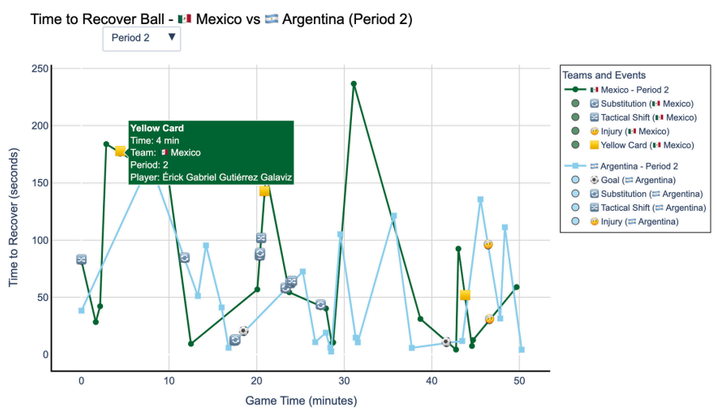

Figure 2. Recovery-game time curve

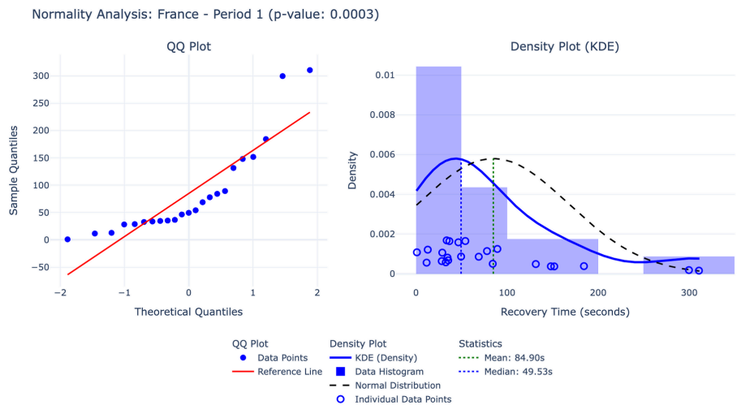

Figure 3. Normality assessment for the time to recover the ball

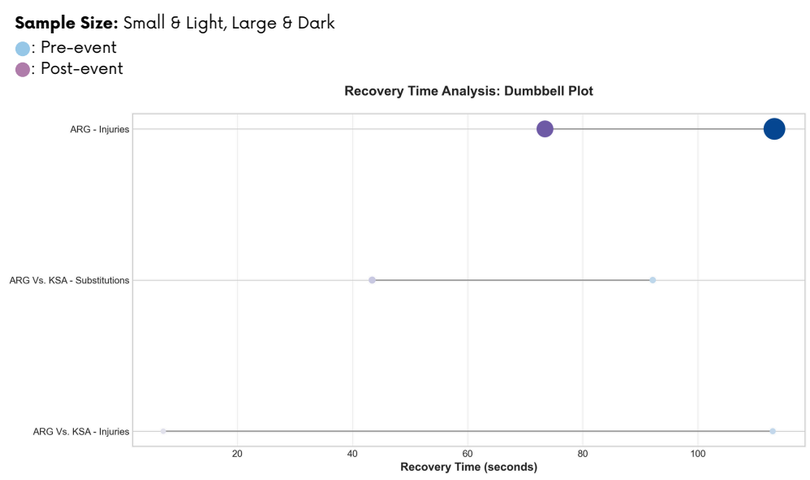

Figure 4. Statistically significant events dumbbell plot

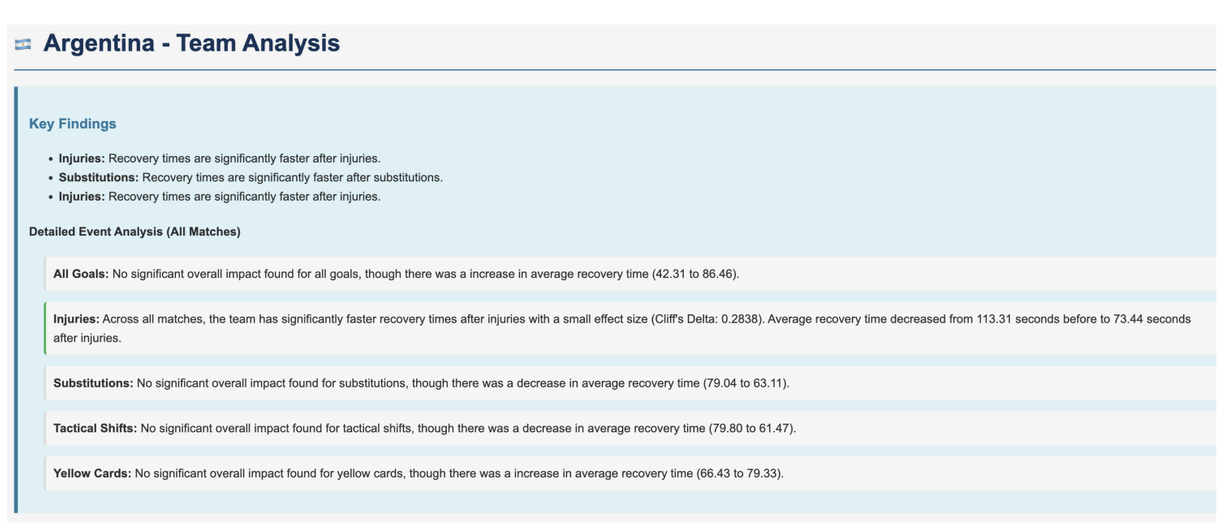

Figure 5. Statistical analysis key findings

Statistical Summary: Recovery Time Analysis

Analysis	N (pre → post)	Δ (mean)	Cliff's δ	95% CI	p(BH)
ARG – Injuries	79 → 60	-39.9 s	0.28	[0.11, 0.46]	0.021
ARG Vs. KSA – Substitutions	14 → 18	-48.7 s	0.49	[0.13, 0.79]	0.030
ARG Vs. KSA – Injuries	12 → 6	-105.9 s	1.00	[1.00, 1.00]	0.003

Table 1. Events with statistically significant impact

References

[1] Rance, J. J. "Examination of Goals Scored in the 2022 World Cup Football Tournament in Qatar." 2023, https://efsupit.ro/images/stories/november2023/Art336.pdf

[2] Xiao, Zheng, and Hui Zhang. "More Substitutions Changed Team Substitution Strategy? An Analysis of the FIFA World Cup 2002–2022." BMC Sports Science, Medicine and Rehabilitation, vol. 16, Aug. 2024, p. 165. PubMed Central, https://doi.org/10.1186/s13102-024-00956-9.

[3] Wang, Si hang, et al. "A Systematic Review about the Performance Indicators Related to Ball Possession." PLOS ONE, vol. 17, no. 3, Mar. 2022, p. e0265540. PLoS Journals, https://doi.org/10.1371/journal.pone.0265540.

[4] Prakoso, Muhammad Lintu Aji, and Ria Lumintuarso. Analysis of the Use of Statistical Data in the Formulation of Strategies, Tactics and Evaluation of Football Matches: 2021. DOI.org (Crossref), https://doi.org/10.2991/ahsr.k.210707.009.

[5] Staff, Sr. "Enhancing Performance: The Impact of Data Visualization in Sports." VDG Sports, 18 Dec. 2024, https://vdgsports.com/enhancing-performance-the-impact-of-data-visualization-in-sports/.