From Kick-off to Glory: Visualizing the Evolution of FIFA World Cups

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1 Introduction

Our project, "From Kick-off to Glory: Visualizing the Evolution of FIFA World Cups," aims to delve into the historical development of national teams' performances, strategies, and the overall evolution of the FIFA World Cup since its inception in 1930. The project's motivation lies in uncovering insights into the tournament's growth, team dynamics, and global influences. We will utilize the FIFA World Cup dataset available on Kaggle to conduct our analysis.

We plan to illustrate the tournament's historical development in terms of the diversity of participating teams, the number of matches played, and the tally of goals scored. Additionally, we aim to link the tournament's expansion to global socio-economic trends, such as audience numbers. Through visualizing data on the number of podium finishes by country, goal counts, audience figures, and home versus away team performances, we aspire to accurately depict the progression of World Cup events over the years. We propose employing various visualization techniques, including but not limited to interactive bar charts, line graphs, histograms, box plots, and pie charts, based on our preliminary project review. We are considering several analytical angles, such as Timeline Analysis, Performance Metrics, Team and Player Network Analysis.

2 Related Work

In our exploration of related work, we have identified key papers that guide and inspire our project's approach. "PassVizor: Toward Better Understanding of the Dynamics of Soccer Passes" [3] focuses on enhancing the understanding of the dynamics of soccer passes. The paper emphasizes the importance of passing as a frequent interaction between players and its role in creating scoring chances. The proposed visual analytics system, PassVizor, enables the comprehensive analysis of passing dynamics, allowing users to detect changing patterns in passing tactics. Through a glyph-based design, PassVizor represents multivariate information related to passing tactics in different phases of attacks, including player identity, spatial context, and formation. This work contributes to the exploration of dynamic changes in a team's passing tactics throughout a match.

Additionally, "A survey of competitive sports data visualization and visual analysis" [1] provides a holistic overview of competitive sports data visualization and visual analysis. The paper introduces a taxonomy for sports data visualization, classifying data into spatiotemporal and statistical categories. It identifies three main tasks for competitive sports data visualization: feature presentation, feature comparison, and feature prediction. The survey classifies visualization techniques into five categories based on data characteristics, establishing a relationship between major tasks and visualization approaches. Additionally, the work delves into visual analysis research, covering features and limitations of competitive sports data, multimedia visualization, and visual analysis evaluation. This survey serves as a comprehensive resource for researchers seeking to understand and apply visualization techniques in the context of competitive sports data.

The paper on "Feature-Driven Visual Analytics of Soccer Data" [2] introduces a sophisticated system for analyzing high-frequency position-based soccer data, recognizing the widespread popularity and scientific significance of soccer. The Visual Analytics method presented accommodates single-player, multi-player, and event-based analytical views, offering a comprehensive approach to exploring movement features and game events. Through a semi-automatic process, the system selects, processes, and visualizes the most promising features tailored to specific analytical tasks, with the overarching goal of assisting soccer analysts in identifying crucial and interesting events within a match. The system is characterized by its flexible, modular, and expandable layer-based architecture, facilitating in-depth analysis of soccer data. The integration of Visual Analytics techniques enhances the analyst's ability to identify significant events based on classification, utilizing custom views to communicate the results. The paper validates the approach through the evaluation of real-world soccer matches, collecting expert feedback and presenting various use cases and findings that exemplify the system's capabilities, ultimately contributing to the advancement of soccer data analysis and Visual Analytics in the sports domain.

3 Design Considerations

Design Sketch

Our design focuses on creating an interactive dashboard with the following key visualizations:

- Historical Team Performances: A timeline visualization showcasing podium finishes by country over different World Cup editions, providing an overview of each nation's historical performance
- Tournament Evolution: Line graphs illustrating the growth in the number of participating teams, matches played, and goals scored, allowing users to track the tournament's expansion.
- Global Trends Connection: Interactive bar charts linking the tournament's development to socio-economic trends, offering a visual connection between football and global influences
- Player Diversity and Tactics Impact: Pie charts and box plots representing player diversity and changes in football tactics over the years, contributing to a deeper understanding of evolving strategies
- Commercial Impact: Visualizations analyzing the commercial aspects of the World Cup, including revenue and sponsorship trends, highlighting the tournament's global economic impact
- Audience Engagement: Histograms and line charts displaying audience figures and trends, providing insights into the growing global audience engagement with the World Cup

User Interface Design

- Filtering Options: Allow users to filter visualizations based on specific World Cup editions, teams, and performance metrics

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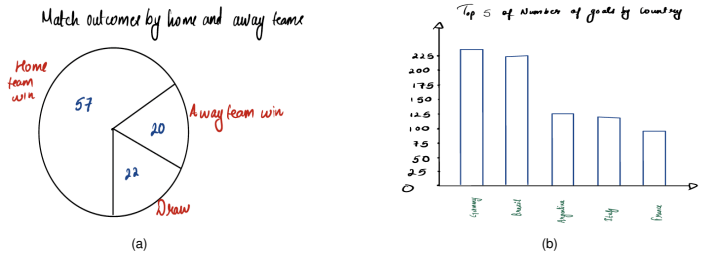
Table 1: Task Mapping

Overview Task	Solution	Why?
How does the evolving team count in the FIFA World Cup reflect its expansion?	Bar charts illustrating the growth in the number of participating teams, highlighting the tournament's expansion.	Visually communicate the FIFA World Cup's expansion and growth scale.
How does the evolution of the FIFA World Cup mirror global soccer trends and its international influence?	Box plots show match growth, highlighting tournament expansion	Summarizes key statistics, revealing annual match trends.
How has the FIFA World Cup's competitiveness evolved, as shown by goal scoring trends?	Line graphs illustrating the growth in the number of goals scored, providing insights into the tournament's increasing competitiveness	Line graphs compare tournaments, spotlighting key shifts in goal scoring and competitiveness.
Examine the impact of home-field advantage on international sports competition dynamics.	Pie chart illustrating and comparing the performances of home and away teams	It visually clarifies the impact of home-field advantage on international sports dynamics by showing team performance.



(a) (b)

Fig. 1: Proposed Visualization

- Comparative Analysis Tools: Include tools for users to compare the evolution of multiple teams and tournaments side by side
- Interactive Widgets: Implement widgets for dynamic filtering and user interaction, enhancing the overall user experience

Table 1 maps the overview tasks, with its solution and its requirement. Figure 1 shows two of the proposed visualizations.

REFERENCES

[1] M. Du and X. Yuan. A survey of competitive sports data visualization and visual analysis. *Journal of Visualization*, 24:47–67, 2021. doi: 10.1007/s12650-020-00687-2 1

[2] H. Janetzko, D. Sacha, M. Stein, T. Schreck, D. Keim, and O. Deussen. Feature-driven visual analytics of soccer data. 09 2014. doi: 10.1109/VAST.2014.7042477 1

[3] X. Xie, J. Wang, H. Liang, D. Deng, S. Cheng, H. Zhang, W. Chen, and Y. Wu. Passvizor: Toward better understanding of the dynamics of soccer passes. *CoRR*, abs/2009.02464, 2020. 1