Akkenapalli Maheshwari, 2026, 14:3
ISSN (Online): 2348-4098
ISSN (Print): 2395-4752

International Journal of Science, Engineering and Technology
An Open Access Journal

Road Cycling Race

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Abstract- This project focuses on the analysis and visualization of a Road Cycling Race dataset using Tableau. The dataset contains information about race winners, teams, nationalities, average speeds, distances, stages, entrants, and finishers. Various visualization techniques such as line charts, bar charts, box plots, maps, funnel charts, and timeline charts were used to explore patterns and trends in the data. The analysis helped identify performance variations, winner distributions, and historical race.

Keywords: Road Cycling Race, Tableau, Data Visualization, Sports Analytics, Dashboard.

I. INTRODUCTION

Road cycling is a demanding endurance sport characterized by sustained physical effort, varied terrain, and dynamic environmental conditions. Performance in this domain arises from a complex interaction of physiological capacity, energy management, tactical decision-making, and team coordination. Cyclists must continuously adapt strategies such as drafting, pacing, and breakaways, making performance evaluation inherently complex.

Conventional analytical methods often fail to capture this multidimensional nature. However, recent advances in sensing technologies and data analytics have significantly enhanced performance assessment. Physiological metrics such as heart rate, cadence, and power output provide detailed insights into endurance, fatigue, and efficiency during races. Moreover, machine learning techniques enable predictive modeling and the discovery of hidden patterns within large datasets, improving the understanding of performance outcomes. The integration of geospatial data further strengthens analysis by incorporating environmental factors such as elevation, terrain variability, and gradient, which critically influence race dynamics.

This study proposes a data-driven framework that integrates performance, environmental, and race-specific variables to provide a comprehensive evaluation of road cycling performance. The research contributes to sports analytics by enabling more accurate analysis and supporting data-informed.

II. LITERATURE REVIEW

Janssens et al. (2024) introduced a geospatial road cy-cling race results dataset that integrates race outcomes with geographical route information. This dataset enables researchers to analyze how terrain, elevation, and route characteristics influence cyclist performance. The study highlights the importance of structured datasets for applying machine learning and data analytics techniques to predict race outcomes and study race dynamics.[1]

Kholkine et al. (2021) proposed a learn-to-rank machine learning approach for predicting road cycling race outcomes. Their research used historical race results and cyclist performance indicators to rank participants according to their expected finishing positions. The results demonstrated that machine learning algorithms can effectively assist in predicting race re-sults and understanding the key factors influencing cyclist success.[2]

Peeters, Barrett, and Podlogar (2025) reviewed differ-ent cycling race simulation protocols designed to evaluate cyclist durability and endurance. The study emphasized that laboratory simulations that replicate real race conditions help researchers analyze fatigue patterns and performance sustainability during long-distance cycling competitions.[3]

Gallo, Barrett, and Podlogar (2022) examined race de-mands across junior, under-23, and professional cy-clists. Their study identified significant differences

in race intensity, pacing strategies, and workload between competition levels. The findings suggest that training programs should be specifically designed according to the cyclist's competitive cate-gory.[4]

Jobson et al. (2009) analyzed the collection and use of cycling training data in performance evaluation. The authors highlighted the role of monitoring physi-ological variables such as power output, heart rate, and cadence to optimize athlete training programs. Their research emphasizes that effective analysis of training data can significantly improve cycling perfor-mance.[5]

Fernández-García et al. (2000) investigated the exercise intensity during professional road cycling compe-titions. Their results showed that cyclists often per-form at high intensity levels throughout races. The study emphasized the importance of aerobic endur-ance and energy management strategies to sustain performance during long competitions.[6]

Sagi et al. (2024) studied team cyclist assignment strategies for upcoming races. The research introduced an optimization model that assists professional teams in selecting riders based on performance met-rics, race conditions, and team objectives. This ap-proach helps teams maximize their chances of success in competitive events.[7]

Impellizzeri et al. (2002) explored exercise intensity during off-road cycling competitions and found that terrain variability significantly affects cyclist workload and physiological demands. Although focused on off-road cycling, the findings contribute to understanding how environmental factors influence race intensity in cycling competitions.[8]

Phillips and Hopkins (2020) reviewed the determinants of cycling performance in elite competitions. Their study identified several critical factors affecting performance, including aerobic capacity, power-to-weight ratio, tactical decision-making, and environmental conditions such as wind and terrain.[9]

Martin et al. (2001) examined the physiological characteristics of competitive female road cyclists and the demands of competition. The research highlighted the importance of endurance capacity, physiological adaptation, and specialized training programs for fe-male cyclists.[10].

III. MATERIAL AND METHOD

Material

The material used in this project is a structured dataset related to road cycling races. It contains historical in-formation about races, participants, locations, and performance metrics. This dataset helps in analyzing participation trends and understanding how different factors influence race outcomes. The data is organized in a way that includes both categorical details for grouping and numerical values for analysis.

Dimensions are Year (Start Date),Starting CityFinishing, CityStarting Country,Winner,Winner's Nationality,Winner's Team.

Measures are Finishers,Entrants,Number of Stages,Total Distance (km),Winner's Average Speed,Latitude (Generated),Longitude (Generated).

IV. METHODOLOGY

The methodology of this project is carried out using Tableau Public for data visualization and analysis. Initially, the dataset is imported into Tableau, where data cleaning and preparation are performed by checking for missing values and ensuring correct data types. The dimensions and measures are identified and or-ganized in the data pane. The visualization is created by dragging the Year (Start Date) into the Rows shelf and using SUM(Finishers) as the main measure. The Marks card is used to apply color and size encoding, allowing better visual representation of variations in the number of finishers. A gradient color scale is used to differentiate between lower and higher values. Additional Tableau features such as Show Me, filters, and formatting options are utilized to improve clarity and presentation. Finally, the visualization is analyzed to observe trends and patterns in road cycling data.

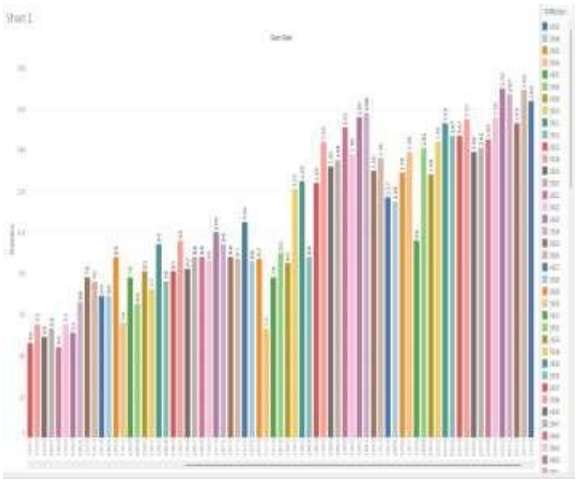


Chart -1: Trend of Race Finishers Over Time

Description:

This visualization presents the total number of race finishers across different years using a bar chart in Tableau. The X-axis represents the year, while the Yaxis shows the total number of finishers. Each bar cor-responds to a specific year and displays the exact fin-isher count. The chart helps identify participation trends over time and shows that the number of finish-ers generally increased in the later years. Overall, the visualization provides a clear understanding of how race completion rates have changed throughout the history of the cycling event.

Chart -2: Annual Finisher Heat Map

Description:

The color legend represents the total number of fin-ishers per year, ranging from 10 to 174.Light green in-dicates years with the lowest finisher counts (around 10), while dark blue marks the highest (up to 174).

Intermediate shades show finisher numbers between these extremes. This gradient helps quickly identify years of low and high participation. Combined with mark size, the color scale enhances visual comparison of yearly trends.

Overall, the legend provides clear insight into the dis-tribution of race finishers over time.

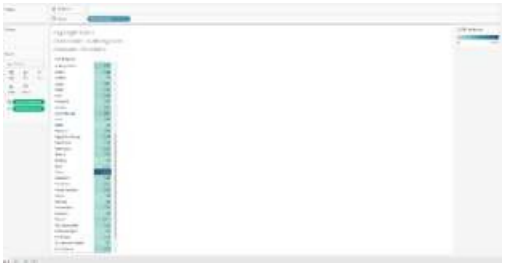


Chart-3: Starting City-wise Distribution of Race Fin-ishers.

Description:

This visualization shows the distribution of race finish-ers across different starting cities. Paris records the highest number of finishers, while other cities display varying participation levels. The color gradient helps distinguish between higher and lower finisher counts, making comparisons clear and effective.

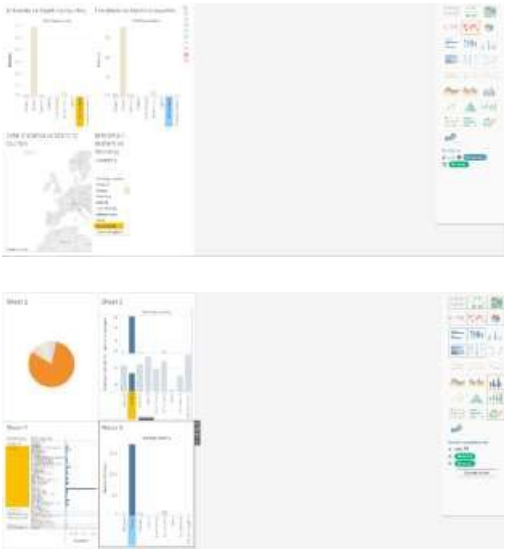


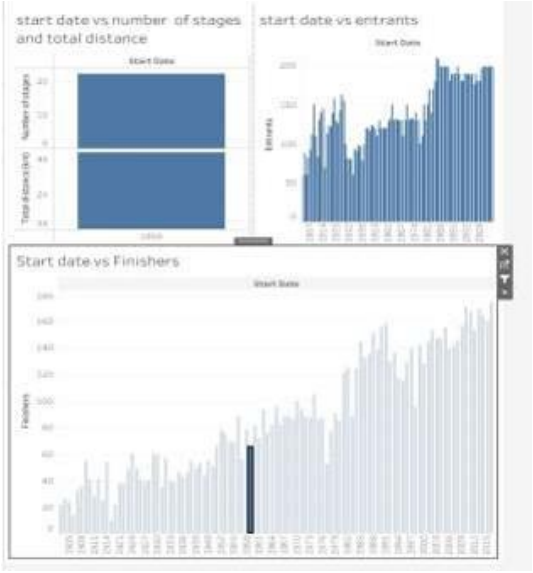
Chart 4,5 – Country-wise Entrants and Finishers

Description:

This dashboard in Tableau compares entrants and fin-ishers across different starting countries. France

clearly has the highest number of entrants and finish-ers, dominating all other countries. Countries like the Netherlands and Germany show moderate participa-tion, while smaller nations contribute fewer entrants. The finishers chart follows a similar trend to entrants, indicating consistent completion rates. The map visu-alization highlights geographic distribution, showing participation concentrated in Western Europe.

Overall, the dashboard effectively shows participation patterns and performance differences by country.



Chat 6 - Year-wise Race Trend Analysis Description:
This visualization analyzes race trends over time using Start Date (Year) as the key dimension. It shows changes in the number of stages, total distance, en-trants, and finishers, highlighting growth in participa-tion and improved race completion rates over the years.

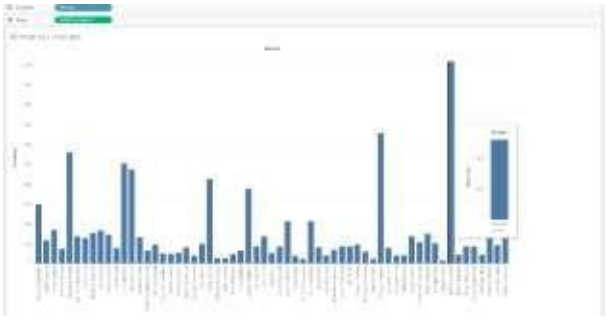


Chart 7 - Tool tip added top 10

Description:
This visualization compares the total number of finish-ers associated with different race winners. The chart highlights variations in participation levels, with cer-tain winners linked to significantly higher finisher counts than others, enabling easy comparison of race outcomes and participation trends.

Chart 8 - Winner-wise Participation Analysis

Description:
This visualization compares race winners with the total number of entrants and finishers. It highlights differ-ences in participation levels across winners, showing that some winners are associated with significantly higher entrant and finisher counts than others. This helps identify participation trends and variations in race scale.

Chart 9 -Geographical Distribution of Finishers

Description:
This visualization presents the geographic distribution of race finishers across European countries. The color intensity represents the total number of finishers, with darker shades indicating higher participation levels. The map enables easy comparison of race participa-tion across regions and highlights countries with the highest finisher counts, particularly France.

Chart 10 -Winner Nationality vs Stage Wins

Description:
This box plot visualizes the distribution of stage wins across different winner nationalities. It highlights var-iations in performance and consistency, showing how stage victories are distributed among cyclists from dif-ferent countries. The chart enables easy comparison of stage-winning patterns across nationalities.

Chart 11 - Waterfall Chart of Number of Stages by Winner's Nationality

Description:
This waterfall chart illustrates the contribution of each winner's nationality to the total number of stages won. Each bar represents the increase in the cumulative stage count contributed by a particular nationality. The chart helps identify which nationalities have the greatest impact on overall stage victories and enables comparison of their individual contributions. It pro-vides a clear view of how stage wins accumulate across different countries.

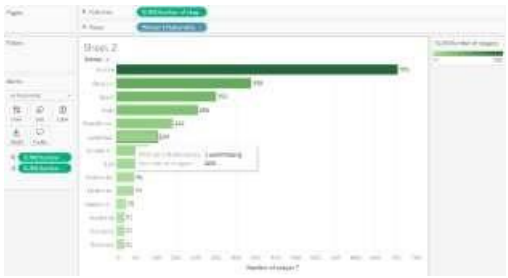


Chart 12 – Funnel Chart of Stage Wins by Winner's Nationality

Description:
The funnel chart represents the distribution of stage wins across different winner nationalities. The width of each section corresponds to the total number of stages won by cyclists from a particular country. Wider sections indicate higher contributions, while narrower sections represent fewer stage victories. This visuali-zation helps identify the dominant nationalities and compare their contribution to overall race success.

V. CONCLUSION

This study analyzed the Road Cycling Race dataset us-ing Tableau and revealed valuable insights into race participation, performance, and historical trends. Var-ious visualizations helped identify patterns in finishers, entrants, winners, and geographic distribution. The re-sults demonstrate that Tableau is an effective tool for transforming complex sports data into meaningful in-sights, supporting better analysis and decision-mak-ing in sports analytics.

Acknowledgement
The authors express their sincere gratitude to the De-partment of Artificial Intelligence and Data Science for providing the necessary facilities and support to carry out this project. We are thankful to our project guide and faculty members for their valuable guidance, en-couragement, and constructive suggestions through-out the study. We also acknowledge the developers of Tableau Public for providing an effective platform for data visualization and analysis. Finally, we thank our institution and team members for their continuous

support and cooperation in the successful completion of this work.

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