

Interactive Analysis of Formula 1 Qualifying Data

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What is Formula 1 (F1)?

- F1 is an international motorsport series governed by the Fédération Internationale de l'Automobile (FIA), involving 20 drivers across 10 teams that compete in 18-24 race weekends across a season.
- Each weekend features practice, qualifying, and race sessions, with qualifying laps used to decide the starting order for the race.
- A driver's fastest lap from a qualifying session highlights driver skill, car setup efficiency, and team strategy under peak performance conditions, which provides a baseline to compare with.

Objectives

- Compare driver performance across races/seasons, thinking about historically important or interesting sessions.
- Provide an interactive, visual platform to compare qualifying laps for users.

Methods & Tools

- Using `f1dataR` package. This is an adapted R version of the `fastf1` package for Python, which uses Ergast API to pull data from F1 sessions.
- Creation of a local R package (`f1animateR`) that uses some functions from `f1dataR`, as well as helper functions when using `gganimate`.
- Using Shiny to create the app, hosted on the St. Lawrence University server. Find it at <https://stlawu.shinyapps.io/f1-qualifying-app/>.

Results

- As a case study, we are looking at laps from the São Paulo Grand Prix, both across seasons and across different drivers.

Variable Details

Variable Name	Description
Driver	A 3-letter unique abbreviation of a drivers last name.
Season	The year of the session.
Lap Time	The time (in seconds) of the lap.
Compound	The name of the tire compund the driver is using. Different compounds have different grip levels.

Season Comparison

- The season comparison highlights how wet weather conditions in 2023 led to significantly slower lap times compared to the dry conditions in 2024, as the positions between the two seasons are drastically far from each other.

Tire Performance Degradation for Lando Norris

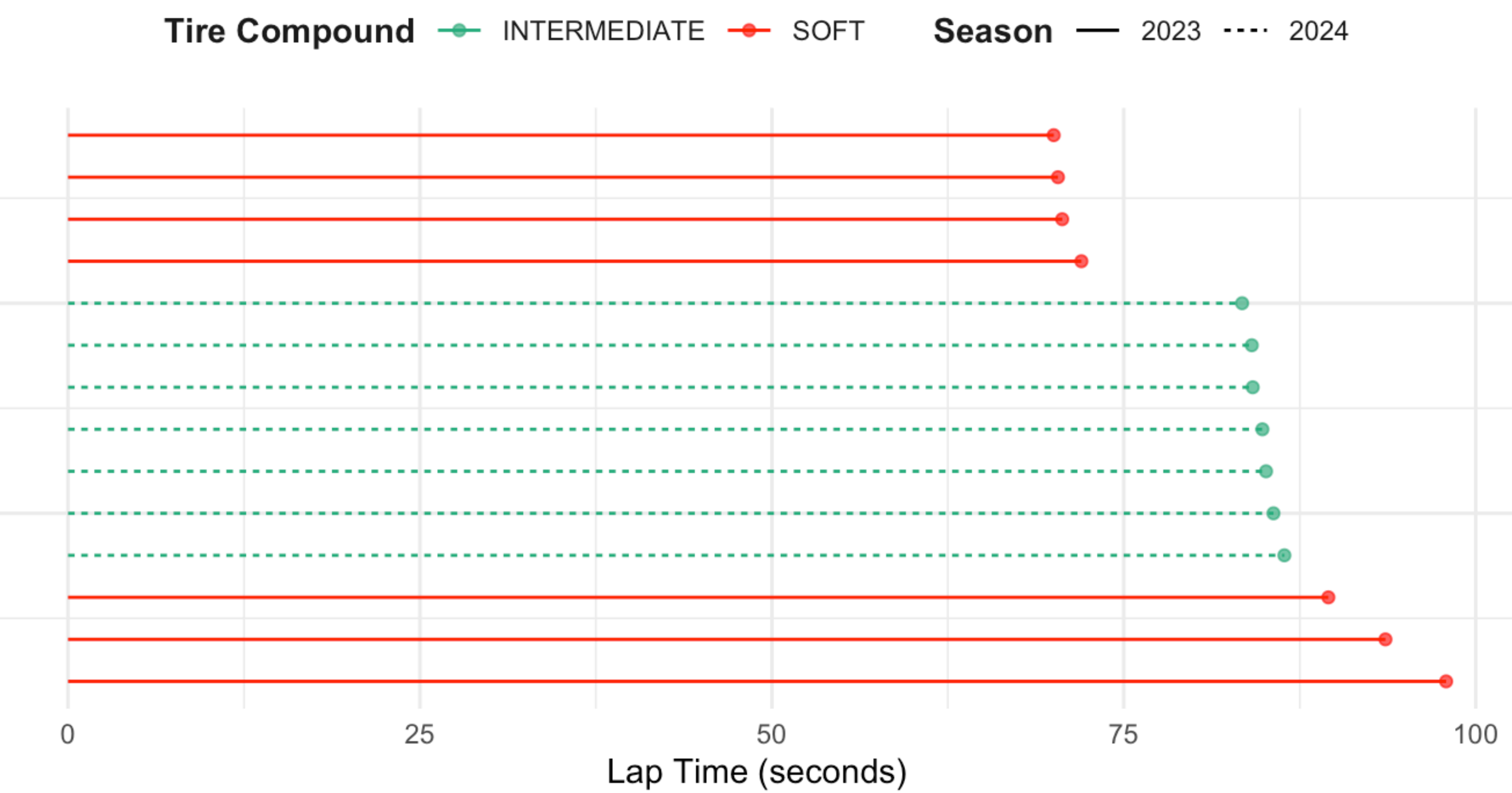


Figure 1: Plot of the five fastest lap times and tire degradation across the two seasons.

Table 1: Qualifying results for Lando Norris.

driver	season	lap_time	compound
NOR	2023	70.021	SOFT
NOR	2024	83.405	INTERMEDIATE

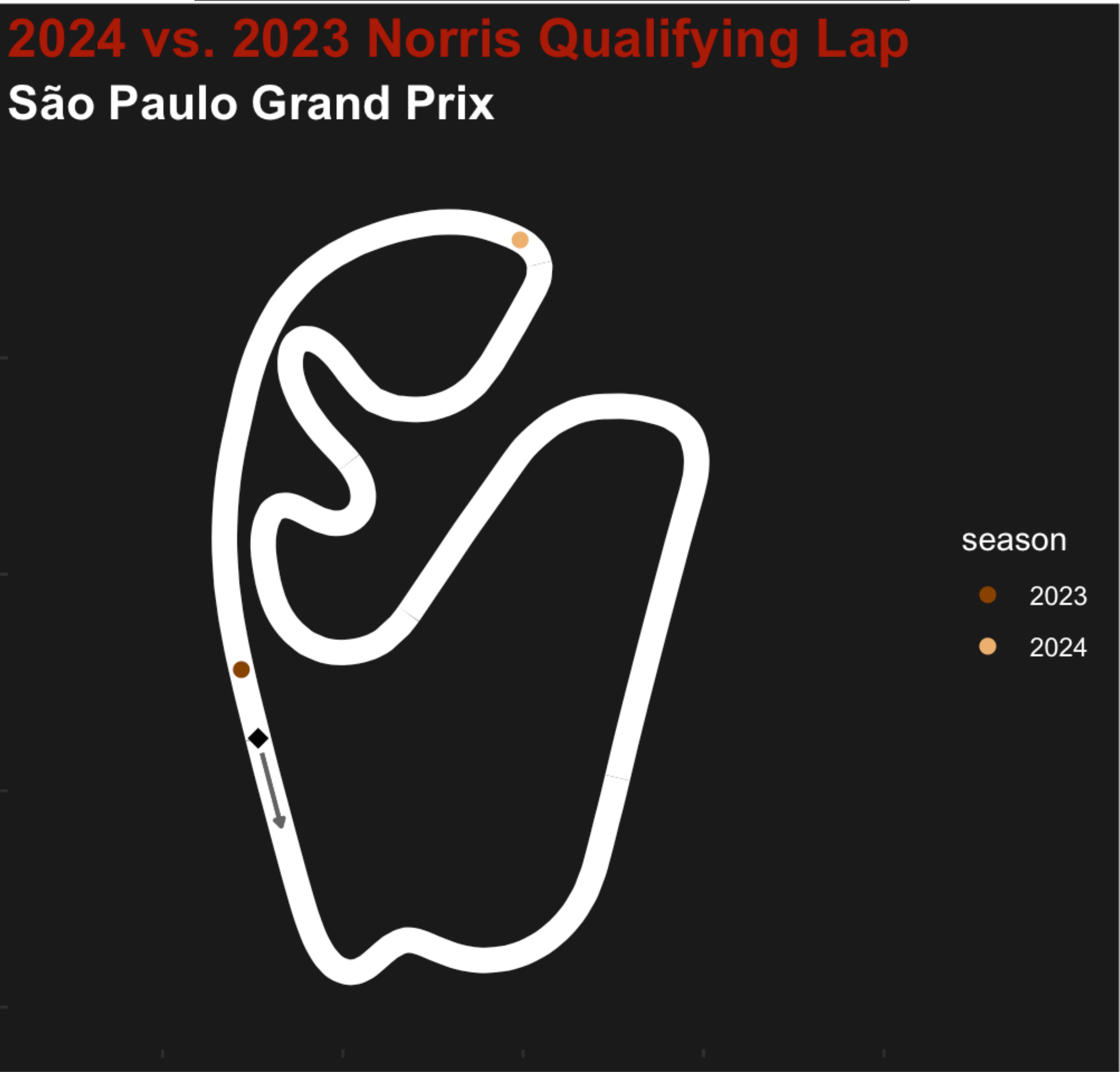


Figure 2: Snapshot of a late point in the lap where cars are very far apart (about 69 seconds in).

Driver Comparison

- The driver comparison shows how in constant conditions, differences in drivers/teams can have drastic effect on qualifying times, but even between 1st and 20th, the margins are very small.

Table 2: Qualifying results for Verstappen and Zhou

driver	season	lap_time	compound
VER	2023	70.162	SOFT
ZHO	2023	71.275	SOFT

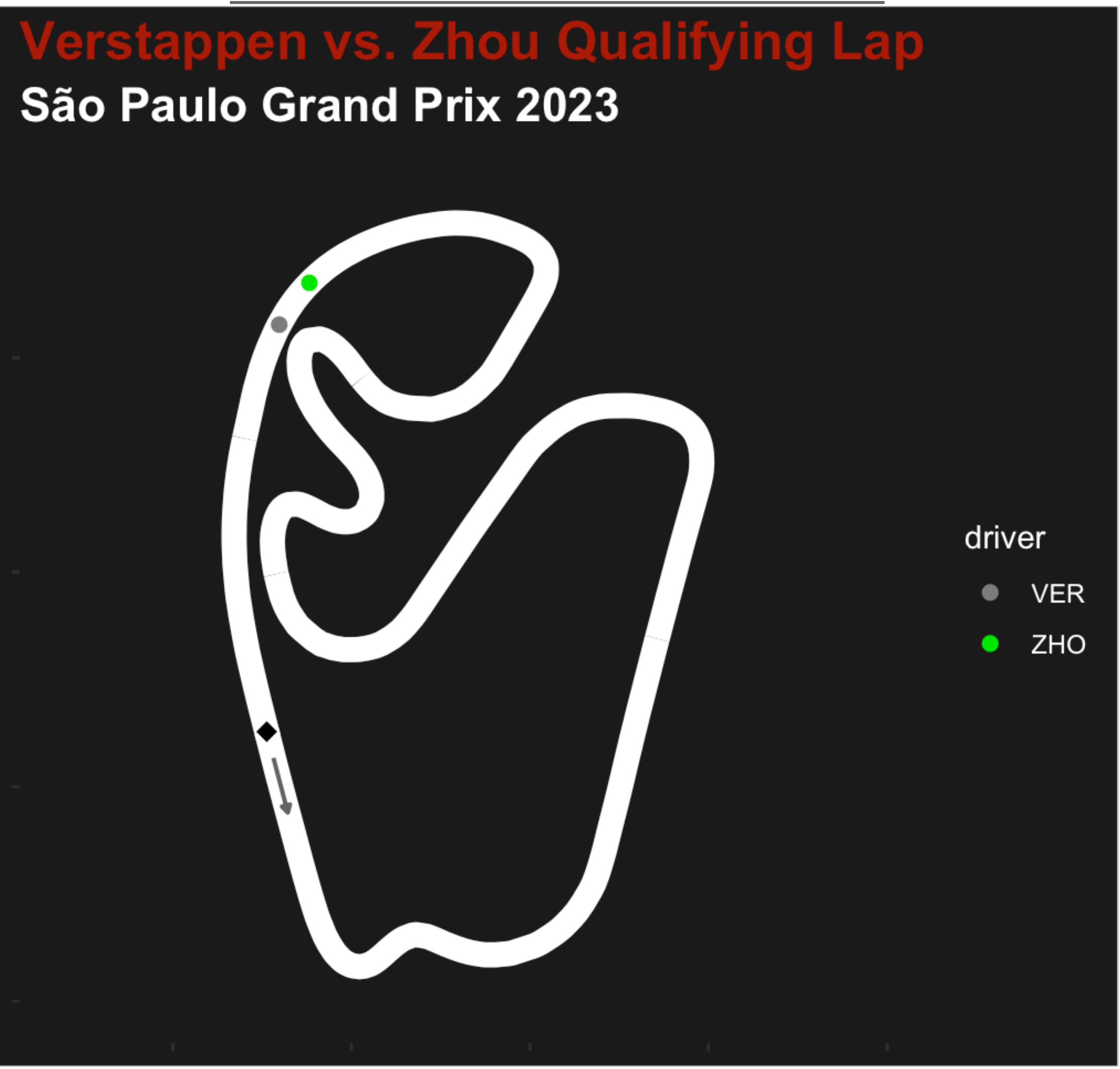


Figure 3: Snapshot of a late point in the lap where the two drivers' cars are far apart (about 63 seconds in).

Conclusion

- Data plays a crucial role in Formula 1, and visual analytics can offer fans a deeper understanding of qualifying performance.
- Interactive tools like Shiny help make F1 data more accessible, insightful, and enjoyable for the average viewer.

References

`f1dataR`: Formula 1 data access package. Available at: <https://cran.r-project.org/package=f1dataR>

What is Formula 1? Available at: <https://www.formula1.com/en/page/what-is-f1>