



FORMULA DATA DYNAMICS

DATA-DRIVEN RACING PERFORMANCE FACTORS

Our Team



Ana do Amaral

Realist

Responsible for hilarious and embarrassing moments during the project and most of all a passionate Formula 1 fan.



Florian Ludwig

Medium Optimist

Although he prefers cold burgers to cold pizza, Ana and Jaad agreed to collaborate with him on this beautiful project.



Jaad Bishti

Optimist

Passionate about Formula 1 and a great optimist, which is why he accepted this challenge. Over time, he regretted it, but it was too late.

Stakeholder

Pedro de La Rosa,
Aston Martin Team Ambassador

The 51-year-old Spaniard enjoyed a successful Formula One career between 1999 and 2012, racing in 104 Grands Prix for five teams, most notably finishing a fine second in the 2006 Hungarian Grand Prix.

The main objective of this project is to add value to the performance of the Aston Martin Formula 1 team, based on data analysis.



Data analysis in Formula 1: the difference between victory and defeat

150 - 300 sensors

300-400 GB per
car every
weekend

During a two-hour
race, the ECU will
receive and send
more than 750
million data points



How many sensors does an F1 car have?

The ECU processes
in excess of 1,000
input parameters

Transmits more
than 1.5 GB of data
in real time over an
average grand prix
distance of 300 km

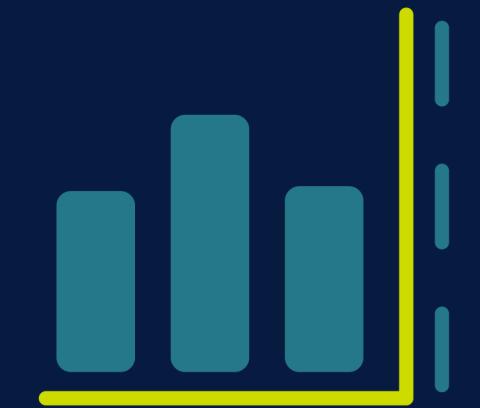
How did we obtain our data?

kaggle

Kaggle

Obtained multiple datasets ranging from points, drivers, and circuits. A total of 14

*CSV files



Meteostat API

Used to obtain precipitation data for each circuit location



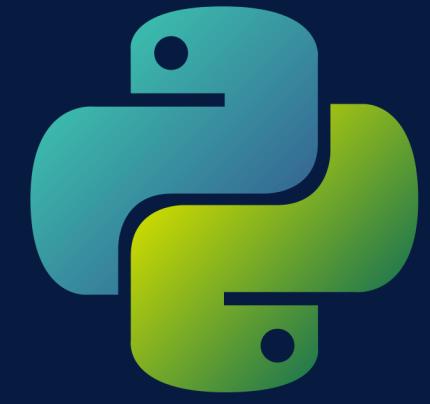
Wikipedia

Used BeautifulSoup to webscrape categorical weather data



CFA

Webscraped tyre data



Python

Pandas, Numpy, Plotly

Racing into the World of Formula One

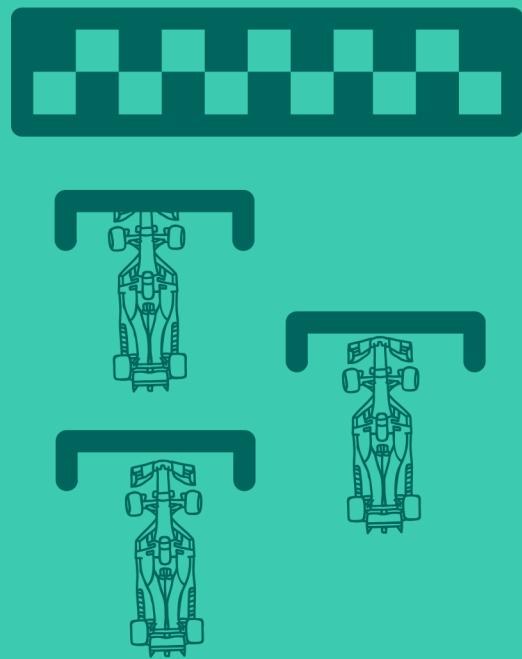
Championships

2 Championships: F1 features World Drivers' and Constructors' Championships.



Qualifying and Grid Position

Drivers compete in Qualifying sessions to determine grid positions. The fastest driver starts at Pole Position.



Tyres and Strategy

Teams strategically change tyres during races to optimize performance.



F1 in Numbers

RACES

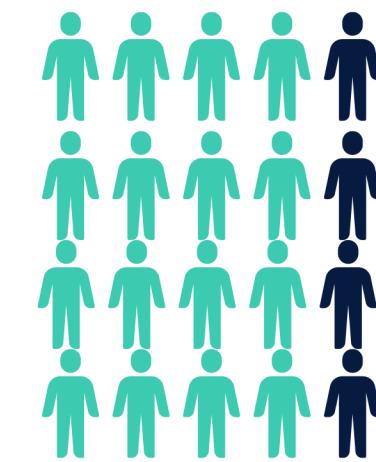
23

TEAMS

10

DRIVERS

20



Hypothesis

Hypothesis 1

On city circuits, softer tyres are more often used.

Hypothesis 2

The ones higher up on the grid (1st 4) are more likely to win.

Hypothesis 3

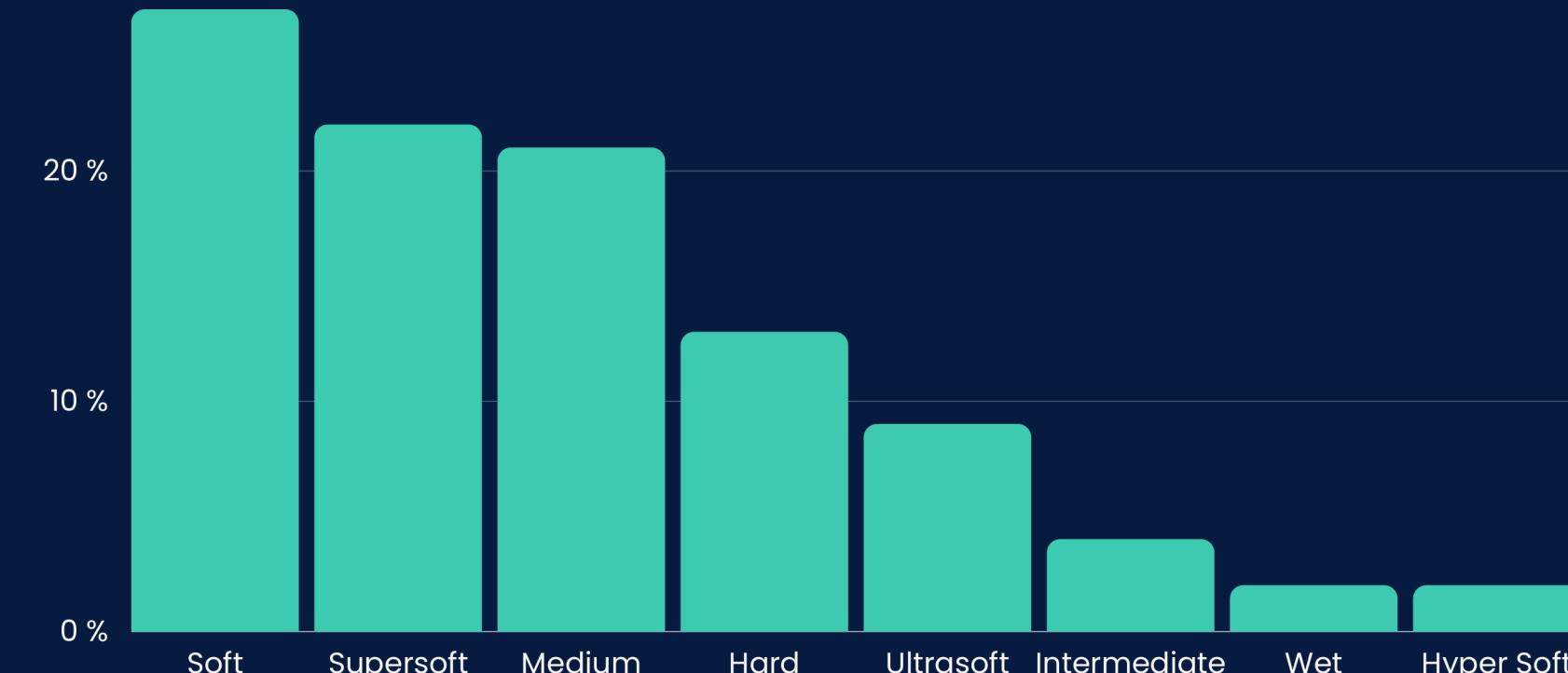
The top three teams in the constructors' championship are more likely to win the drivers' championship the following year.

Circuits

City Circuits:

- Soft, super soft, and medium tires are the most commonly used compounds.
- These tires provide better grip on smooth city tracks and are well-suited for shorter, twisty circuits

Tyre Type Distribution on Street Circuits 2012 - 2023



Race Circuits:

- Medium, soft, and hard tires are prevalent on traditional race circuits.
- These compounds offer a balanced combination of grip and durability for longer races.

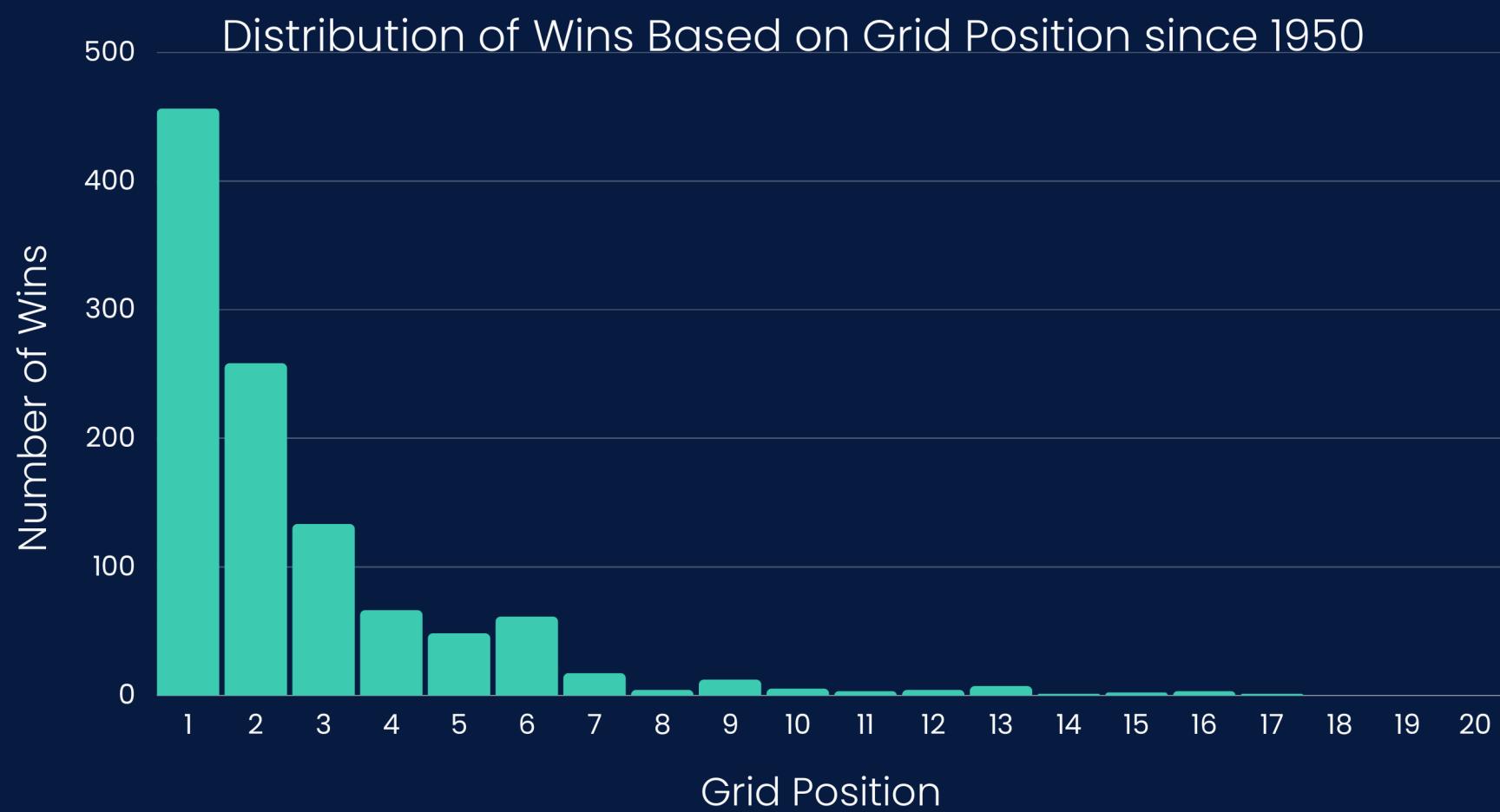
Tyre Type Distribution on Race Circuits 2012 - 2023



Grid Position

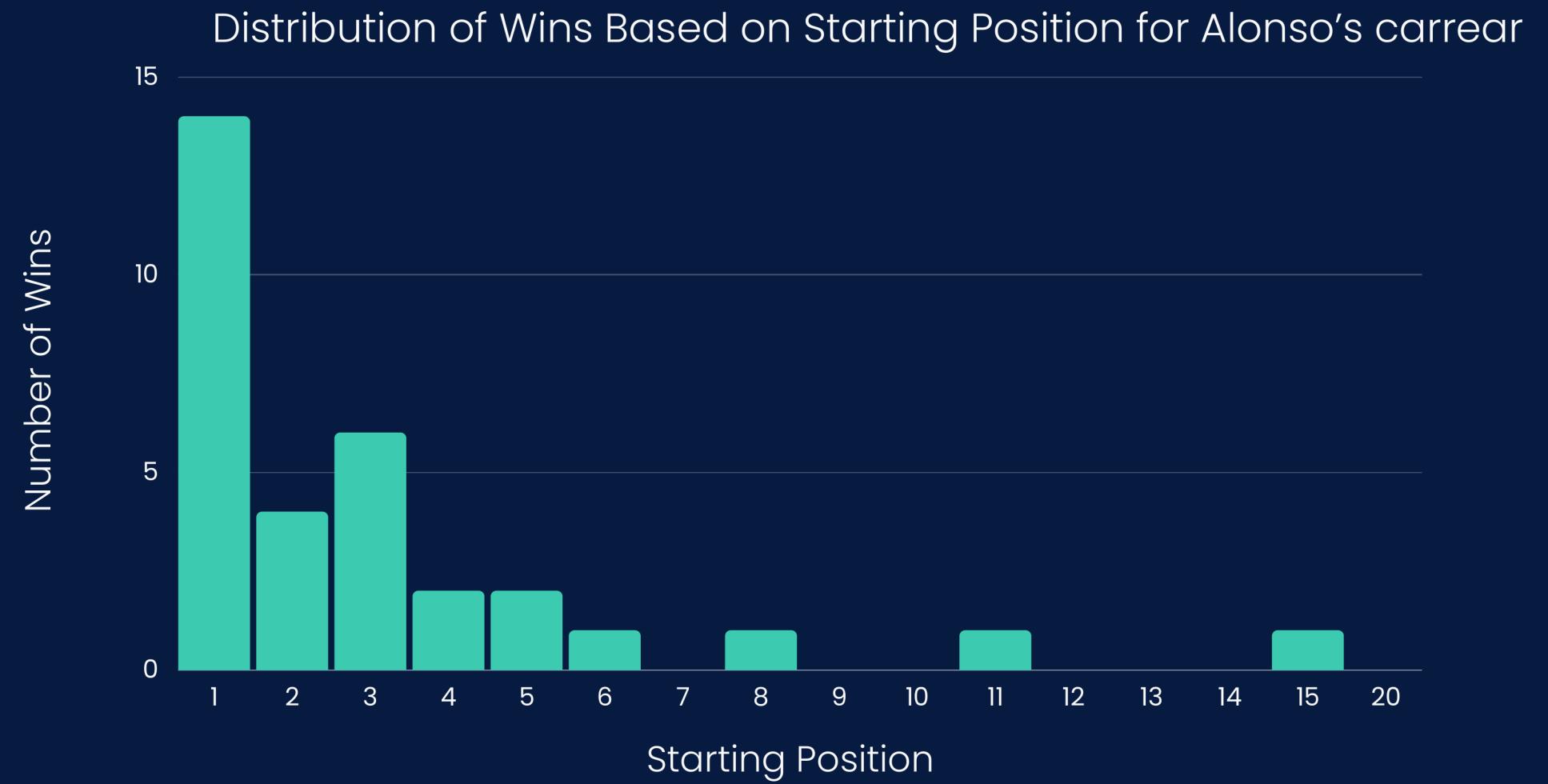
Is Pole Position key to winning a race?

- Most Grand Prix winners start from pole position.
- Most of the winners started in the first two rows.
- Unlikely to win if outside the top 10 on the starting grid.



Fernando Alonso's Pole Positions vs. Wins

- Aston Martin's Fernando Alonso has won a total of 32 Grand Prix
- 14 of those wins come from starting on the grid in pole position



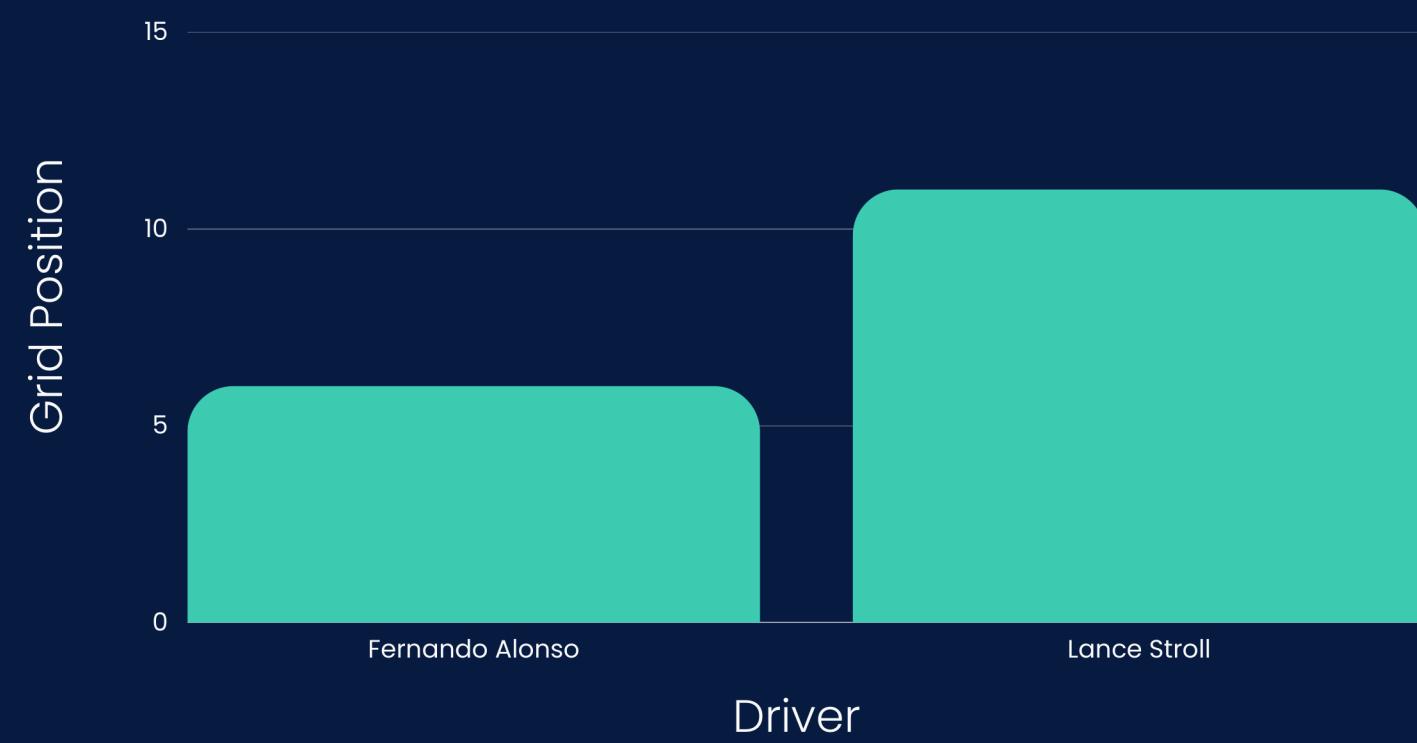
Lance Stroll Grand Prix Numbers

- The best finishing position was 3rd place
- Only the top 10 drivers earn points, adding extra competitiveness to each race

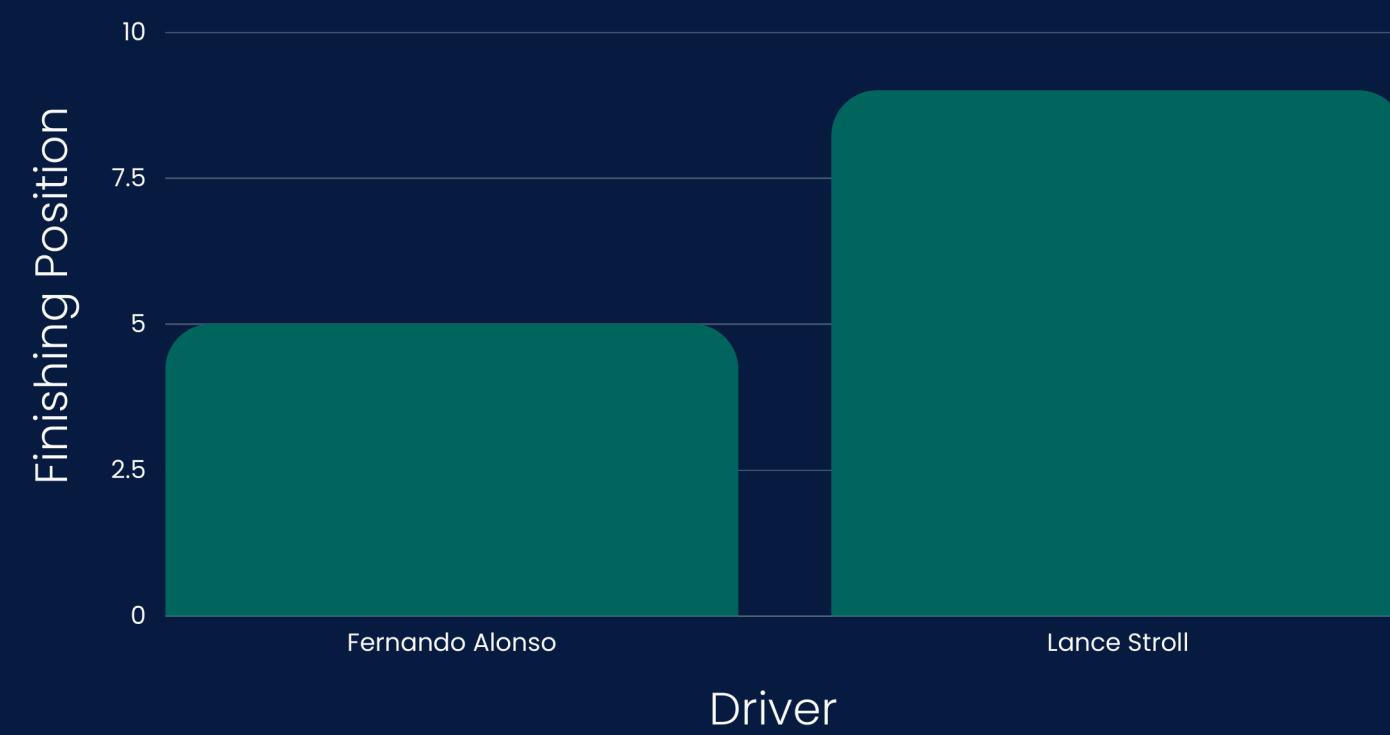


Grid Position, a key to winning races

Average Grid Position - 2023

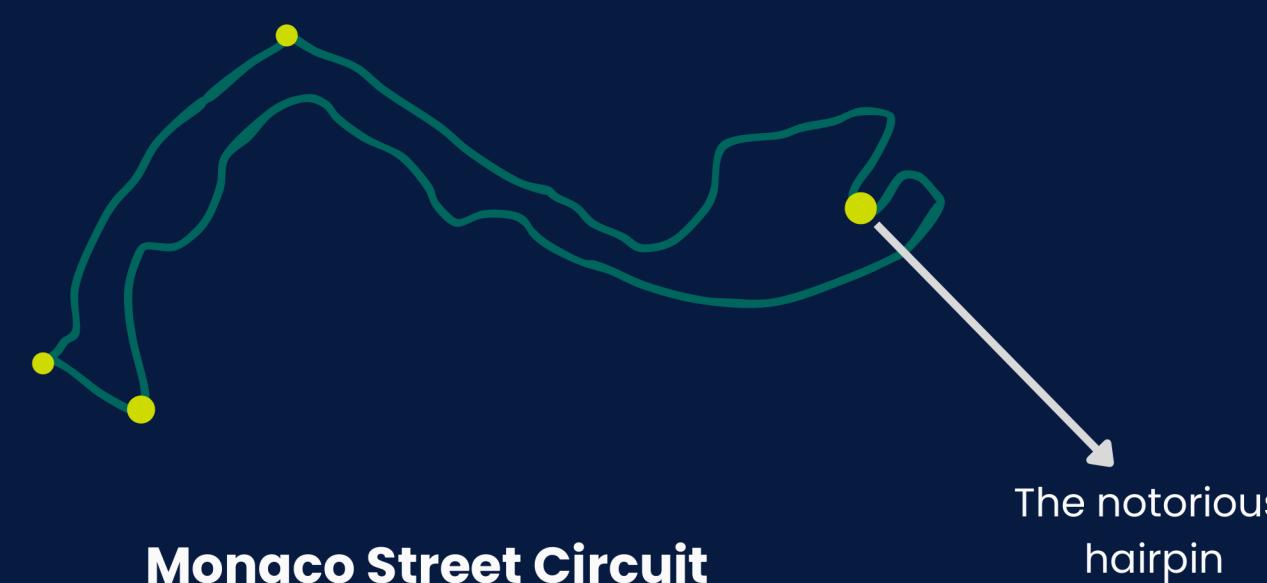


Average Finishing Position - 2023



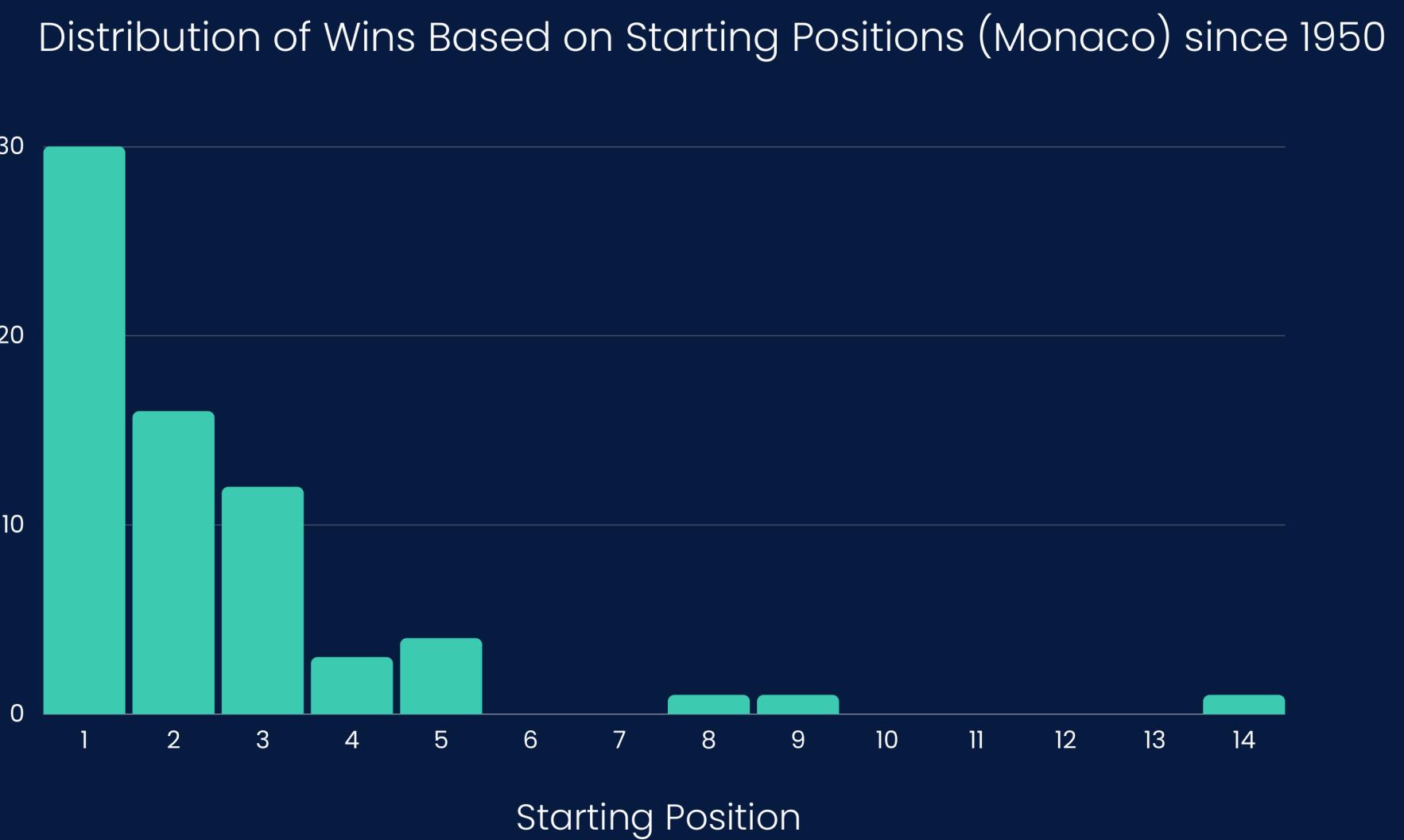
Monaco Circuit numbers

- Incredibly difficult to overtake
- The hairpin is one of the slowest turns on the F1 calendar
- Race outcomes could be “too predictable” because of overtaking difficulties

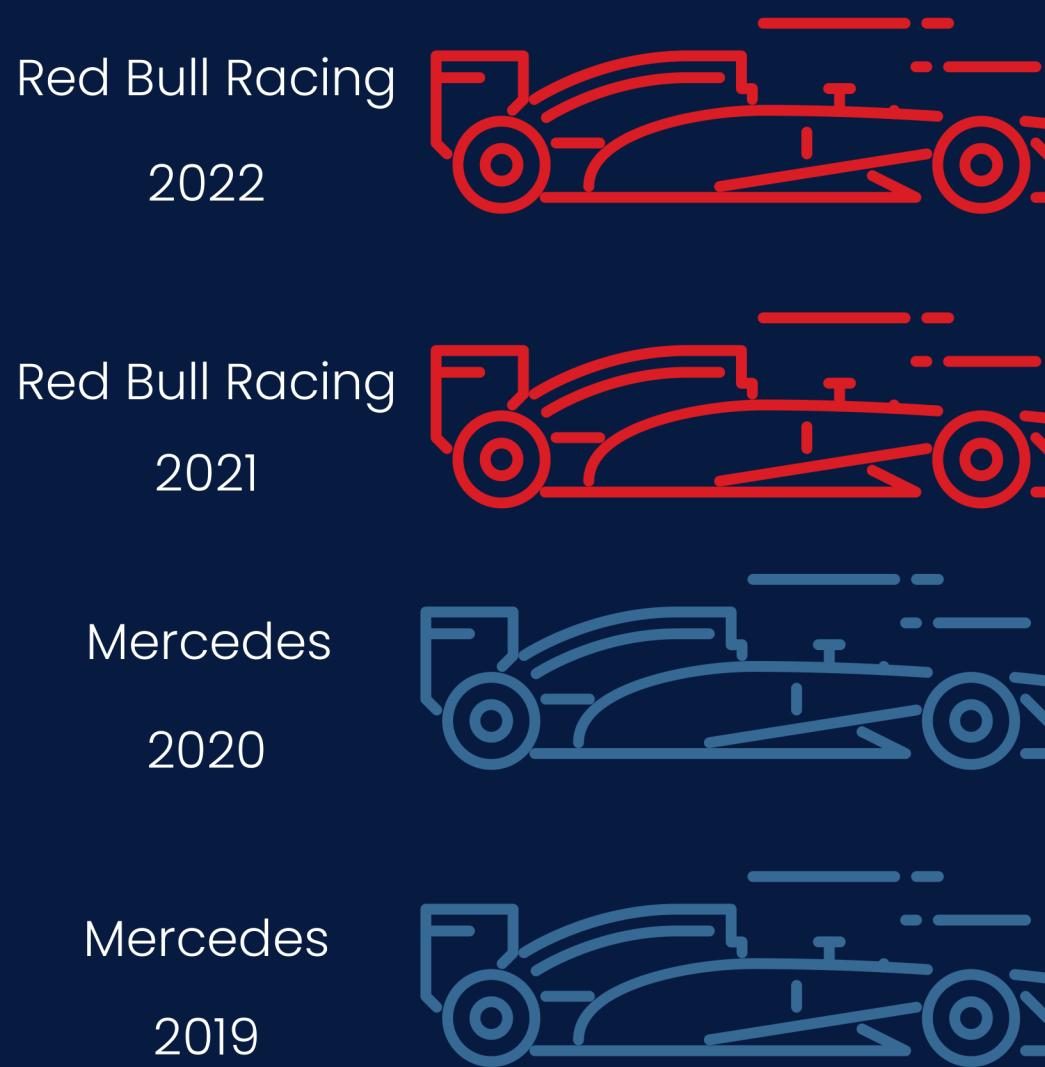


Monaco Street Circuit

The notorious
hairpin

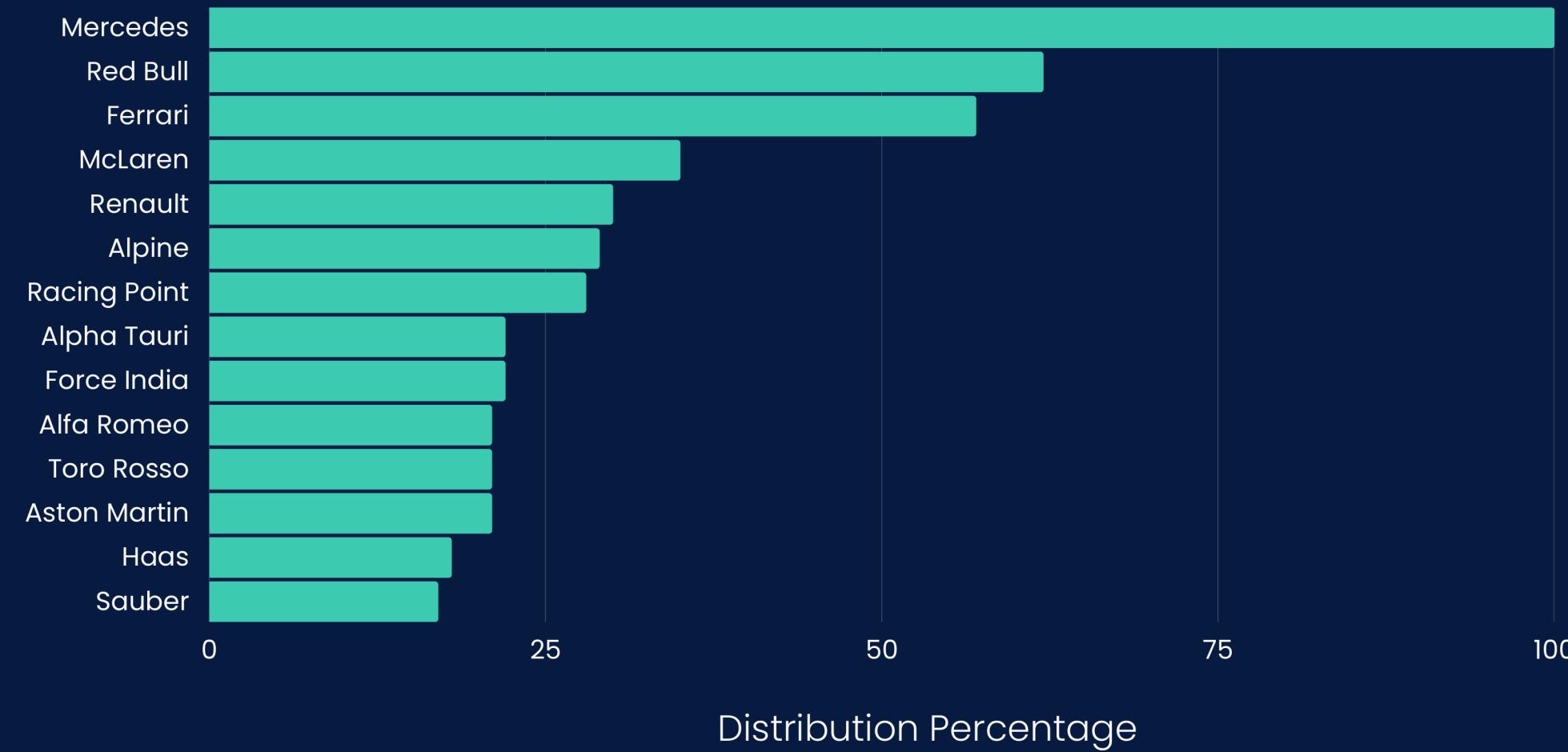


Budget vs Driver's Victories

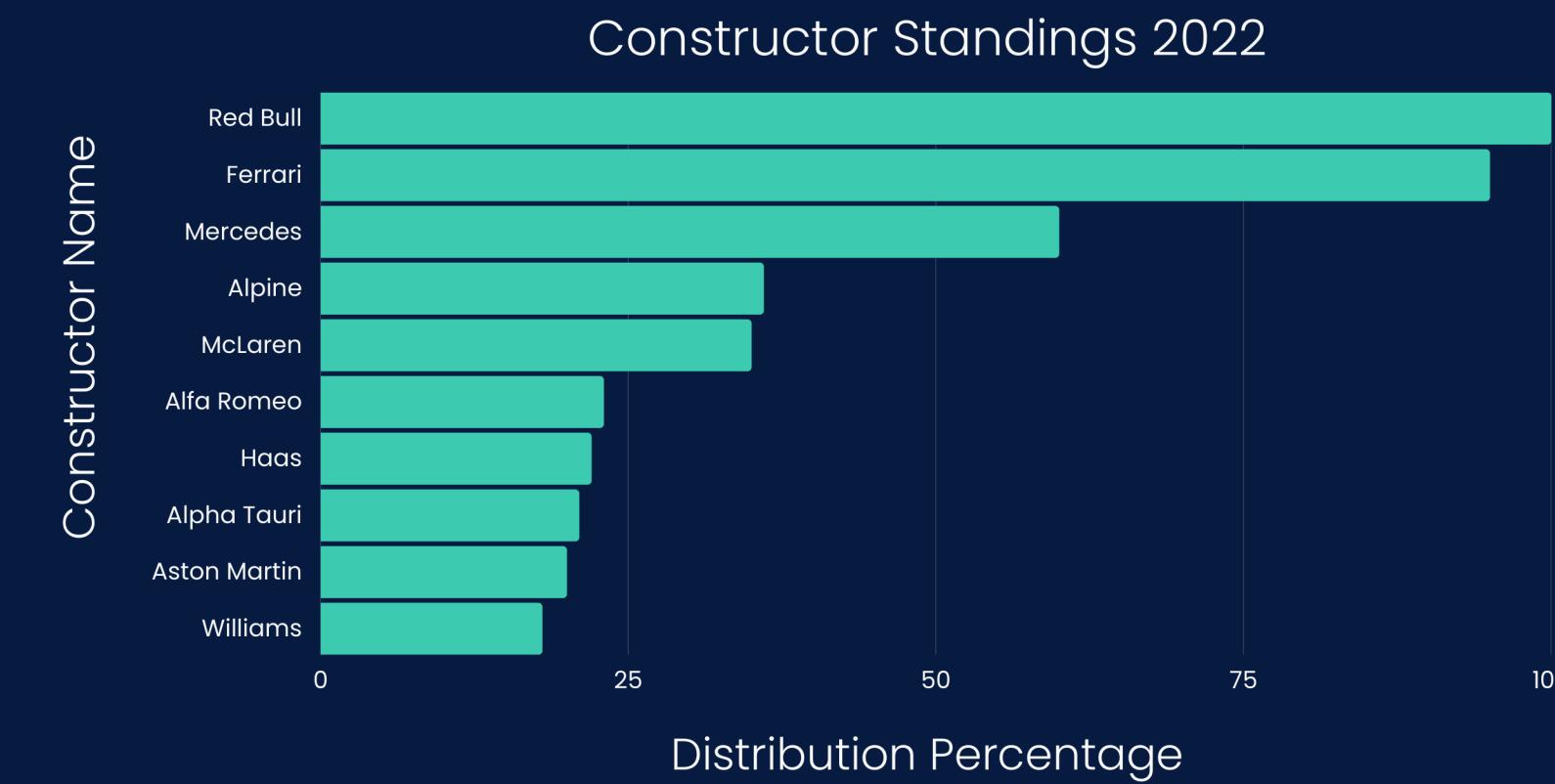
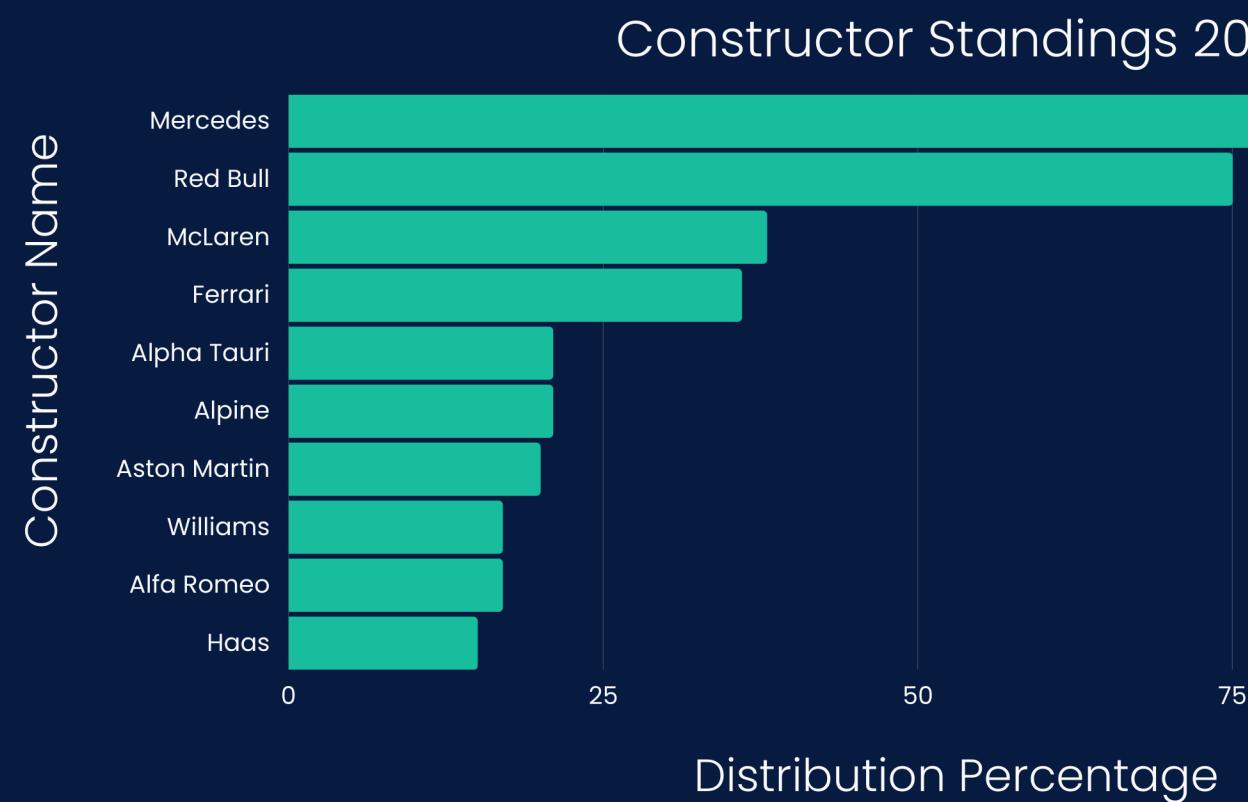


Constructor Names

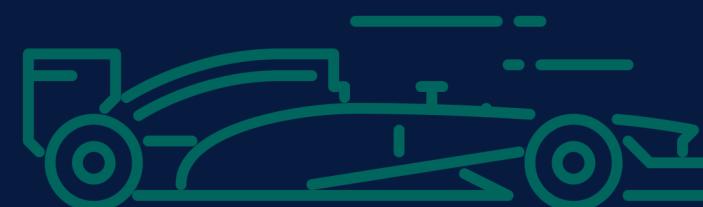
Constructor Standings from 2018 - 2022



Aston Martin Numbers in Constructor Standings



Aston Martin
2022

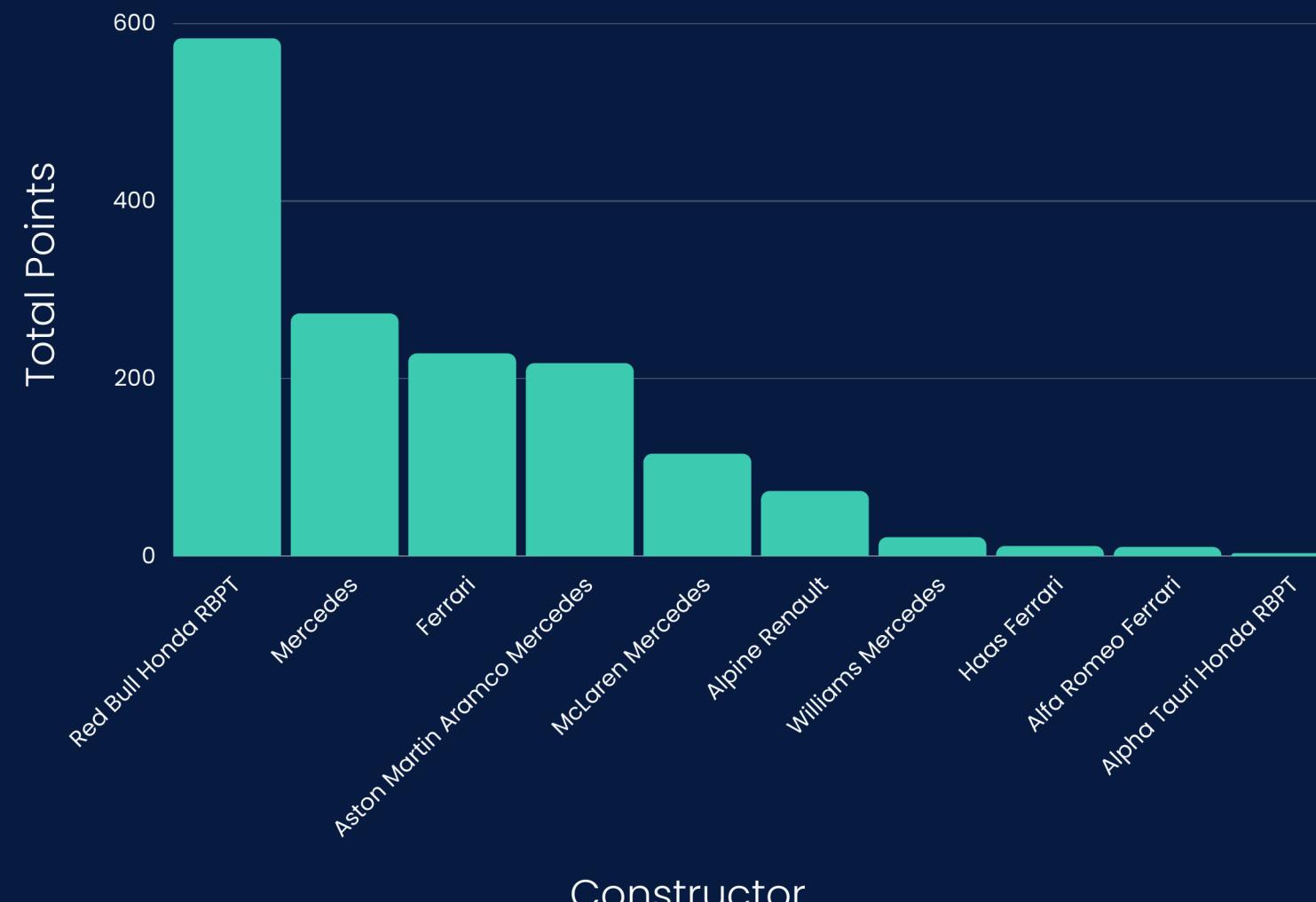


Sebastian Vettel - 12th Position

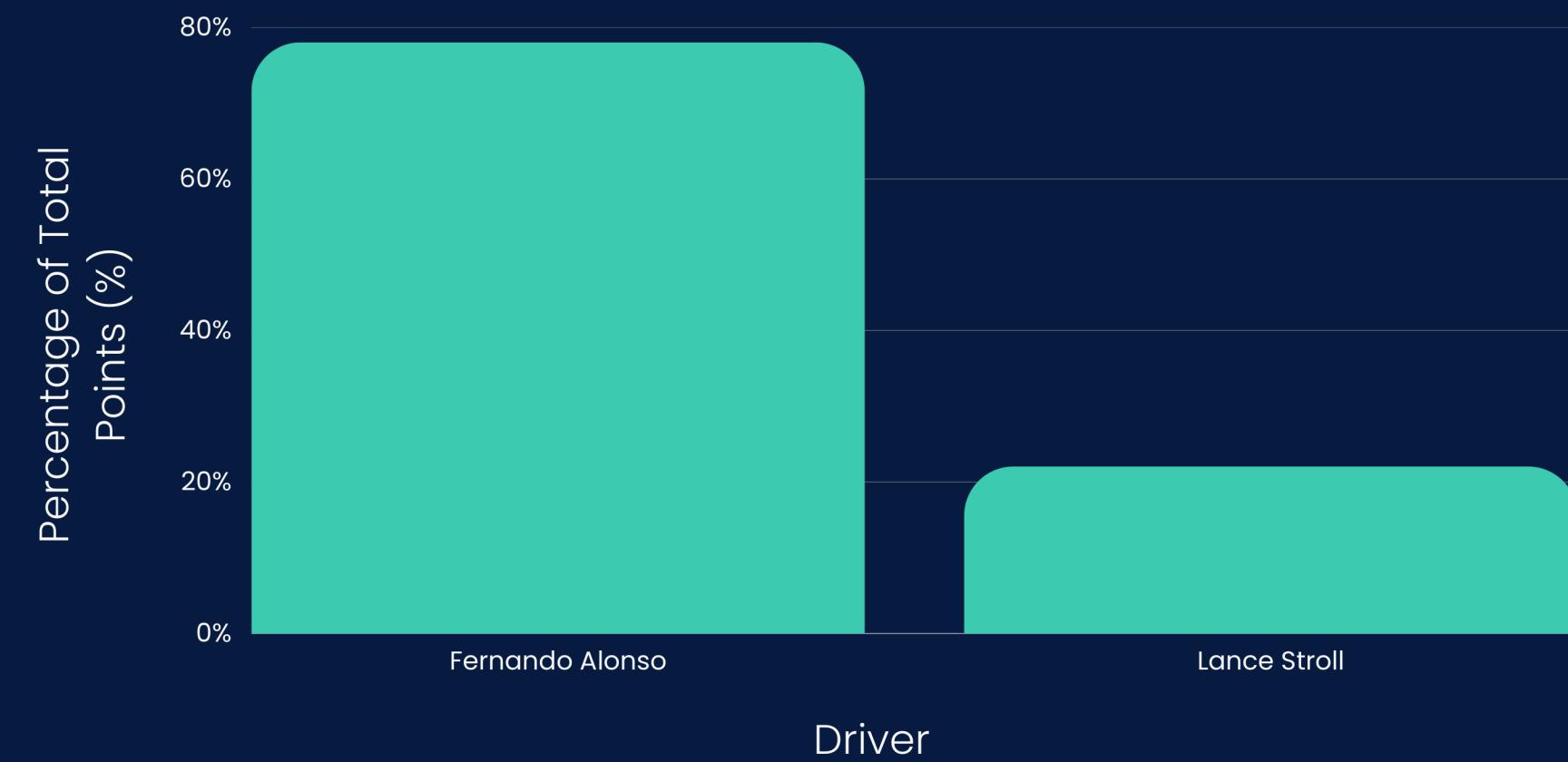
Nico Hülkenberg - 20th Position

The Battle in Constructor Standings 2023

Formula 1 Team Points Breakdown for 2023



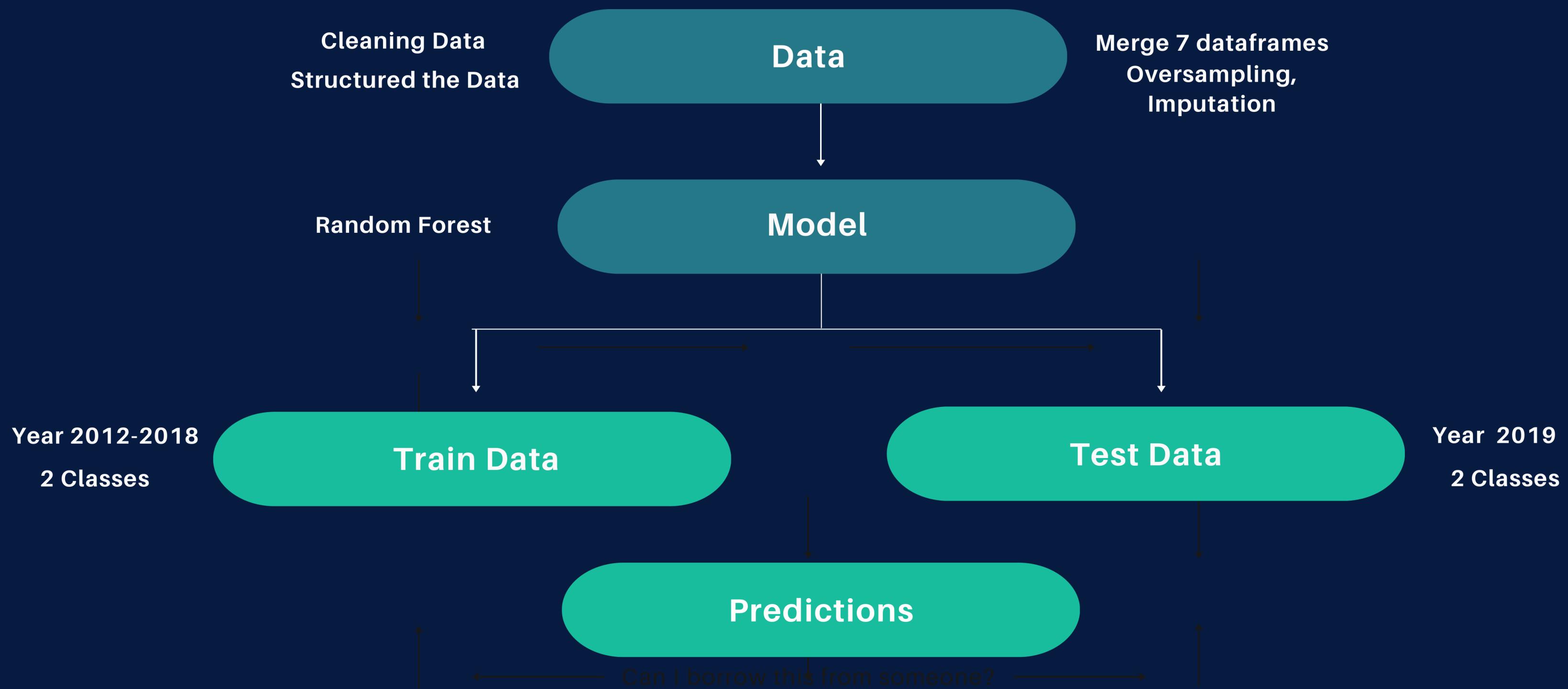
Aston Martin's Dynamic Duo: Points Breakdown for 2023

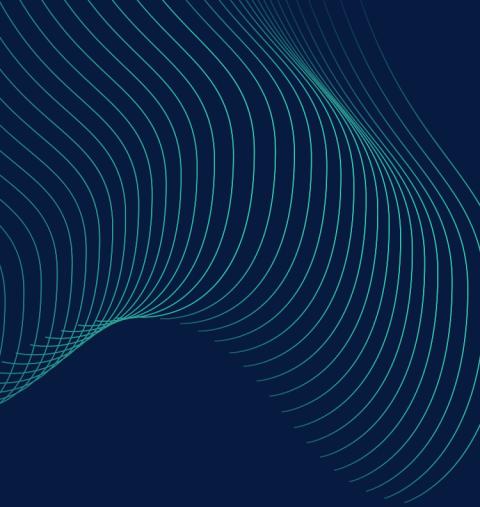


MODELLING



Train our Model to Predict A Winner





Model

Random Forest



Technics

Oversampling, Imputation



Precision

88%

Accuracy

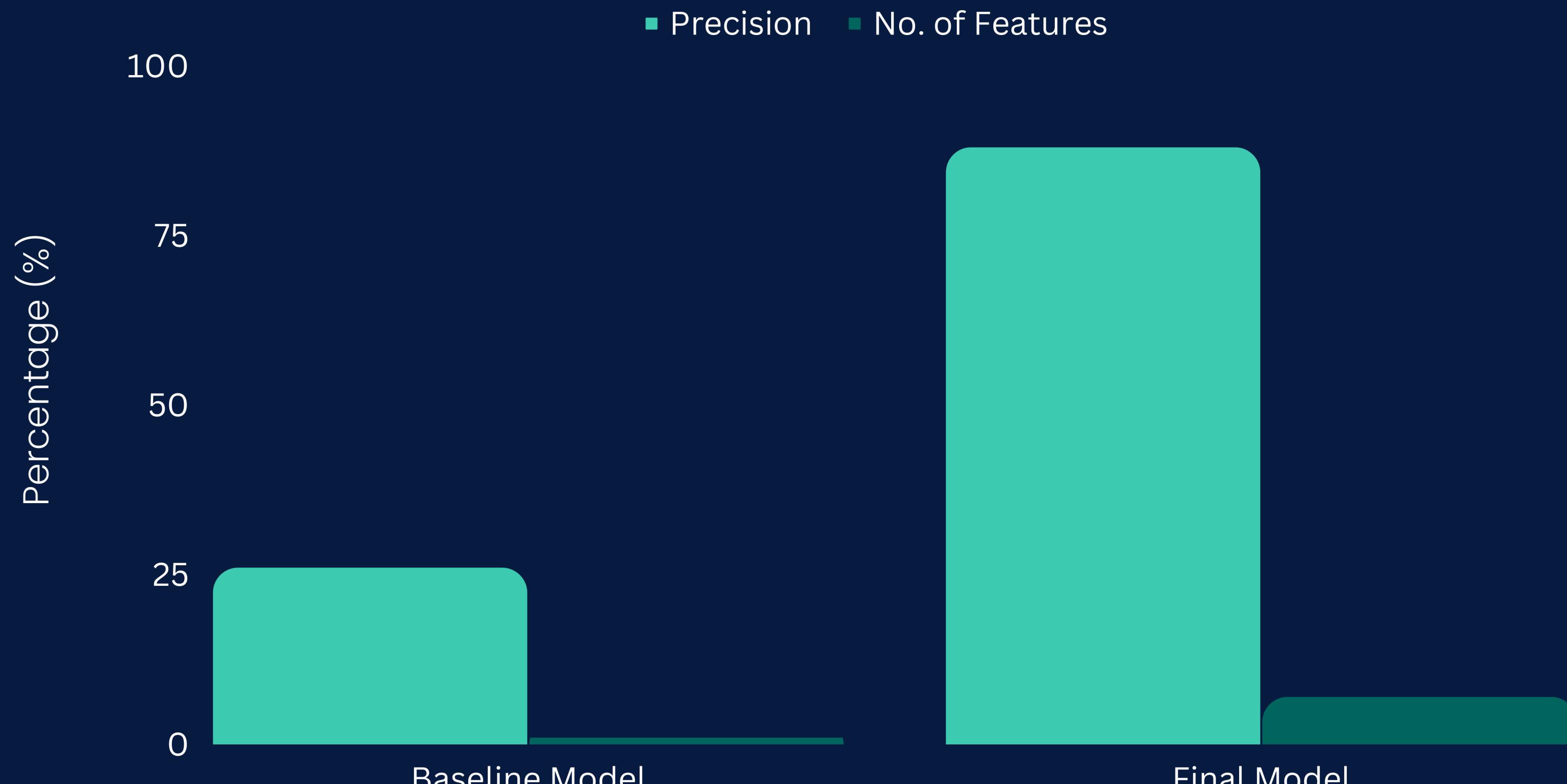
93%



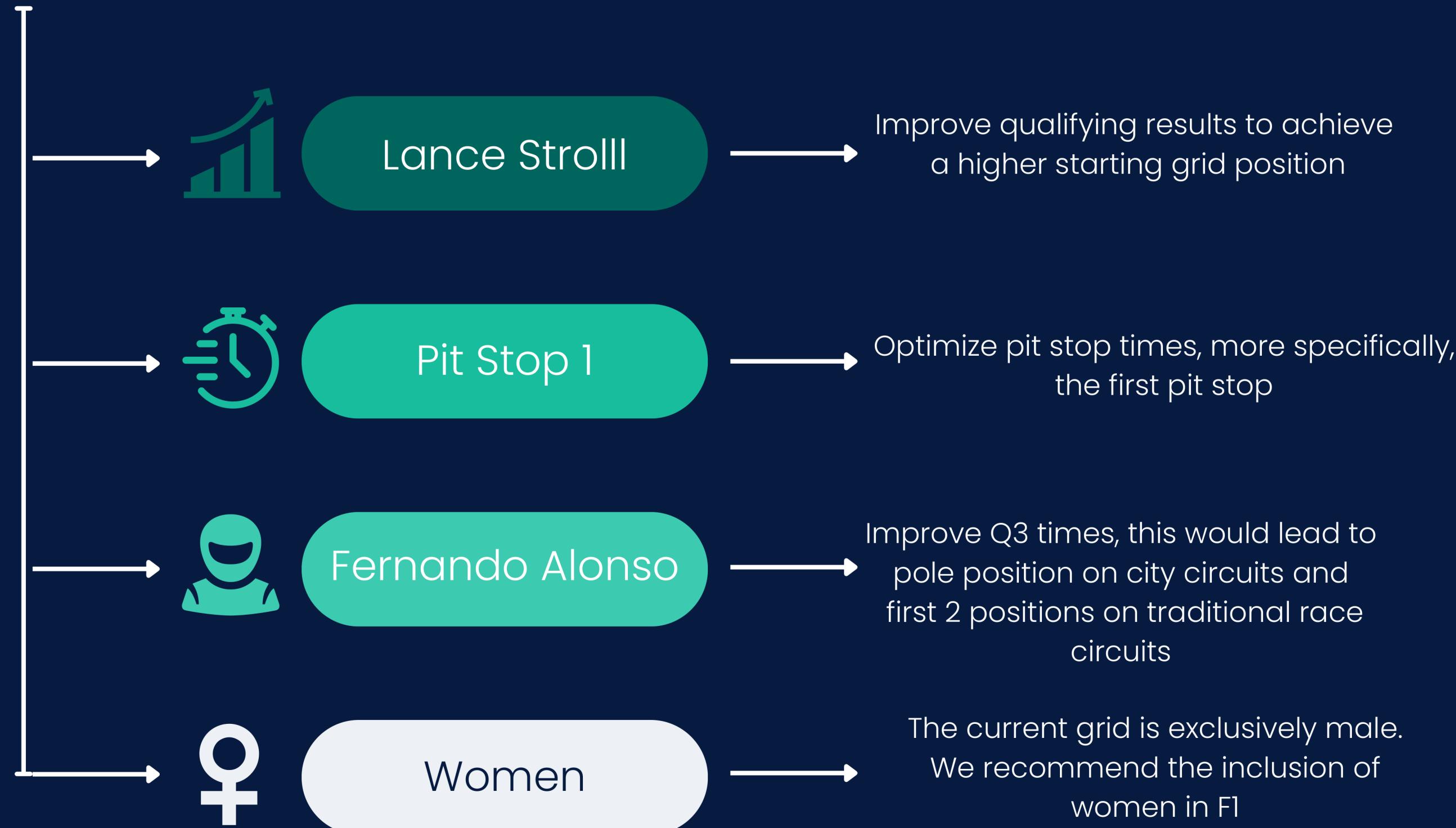
Most Important Features

Grid, Driver and Constructor

Model Performance



Recommendations



Future Work



Obtain Tyre Data

Update the tyre data and include it in the EDA



App and Interactive Dashboard

App available for teams to test race predictions



Obtain Asphalt Data

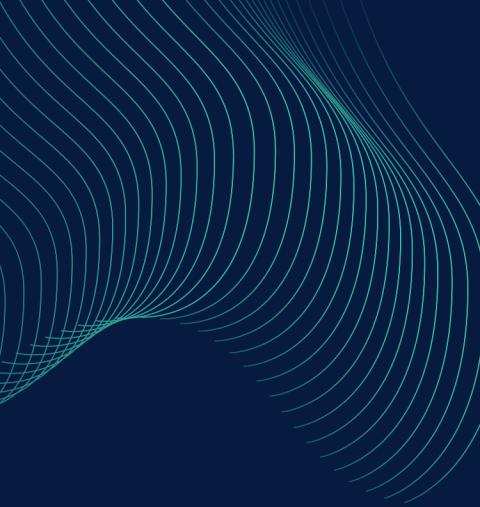
Traction, grip, abrasion, and track evolution.
Include these features in our model



Obtain Historical Weather Data

Air temperature, surface temperature
and precipitation

Behind this presentation, there are hundreds of lines of code written.
Insomnia thinking about debugging.
Dialogues with rubber ducks.
Wives and husbands dining alone.
A son who has spent too many hours in front of the TV.
Postponed beers with friends.



Thank You

Coaches:	Larissa Hubschneider Konstanze Braun Nico Steffen Andreas Dosch Matthias Motl
Stakeholder:	Pedro de La Rosa
Last but not least:	Family, friends, course mates, rubber duck

Formula Data Dynamics

