Driver Performance in Formula 1_ A Data-Driven Approach

Formula 1: Pinnacle of Motorsport

Formula 1 is one of the most heated sports or rather 'motorsport' in the world right now. This sport has only one aim to become the 'Best'. Not only the sport heads but enthusiast follow the rich culture. Th emodern-day Formula 1 or F1 has lots of data produced in a single race. Today's F1 cars have around 300 sensors producing 3TB data per race. Here are a few stats on overall drivers in Formula 1.

Problem Statement

Formula 1 racing is a complex sport where driver skill plays a critical role in determining success. However, evaluating driver performance objectively can be challenging due to factors like car differences, race strategy variations, and external conditions. This project aims to develop a data-driven approach to quantify driver performance in Formula 1.

Project Planning

Data Acquisition: Collecting and integrating relevant data points from various sources, including car telemetry (sensor data), race results, weather conditions, and driver historical performance.
Data Preprocessing and Feature Engineering: Cleaning, transforming, and creating new features from the raw data to best capture aspects of driver skill.
Model Development: Employing data analytics techniques like machine learning or statistical modeling to build a model that isolates driver performance from external influences.
Model Evaluation: Assessing the accuracy and effectiveness of the developed model in quantifying driver performance through validation techniques.

Implementation

The code focuses on several driver performance metrics:

- Race Winners: It identifies drivers with wins, then filters to those with multiple wins, potentially to reduce the influence of luck and highlight consistent performance.
- Pole Sitters: Similar to race winners, it analyzes drivers with the most pole positions, indicating strong qualifying performance.
- Champions: It identifies drivers who have won championships, signifying overall success.

Driver	Nationality	Seasons	Championships	Race_Entries	Race_Starts	Pole_Positions	Race_Wins
Carlo Abate	Italy	[1962, 1963]	0.0	3.0	0.0	0.0	0.0
George becassis	United Kingdom	[1951, 1952]	0.0	2.0	2.0	0.0	0.0
Kenny Acheson	United Kingdom	[1983, 1985]	0.0	10.0	3.0	0.0	0.0

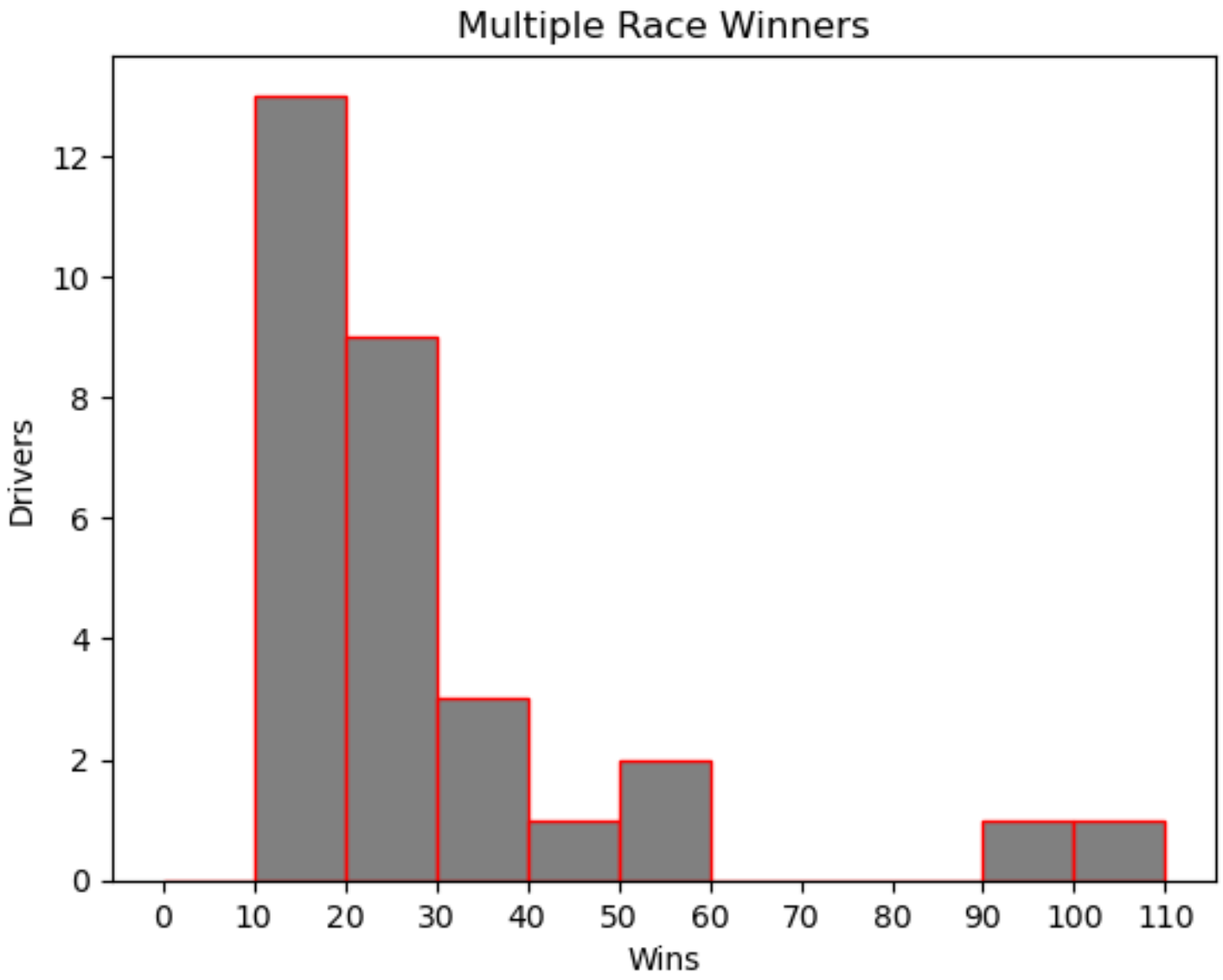
- Win Rate: It calculates and analyzes win rate (wins divided by race starts) to assess driver consistency in converting starts into victories.

This metric is particularly useful when comparing drivers across eras with different race lengths per season.

Formula 1 Race Winner

Winning a Formula 1 is the most basic dream of every participant of the sport yet only a handful get their foot on the top of the podium.

Out of 863 Drivers only 113 are race winners. But winning a single race might come out of luck, but doing it multiple time isnt luck. 113 race winners only 30 have won multiple times.



Lewis Hamilon

Lewis Hamilton is the most decorated driver in terms of Race Wins. The British driver himself has won 103 races.

Winning a Championship

Every Driver in Formula 1 comes with one dream that is to win a Championship but not everyone has a caliber to get themselves the Championship trophy up their sleeves. No luck or timing could make a person a championship all it takes it to be the 'Best' is the actually perform like one.

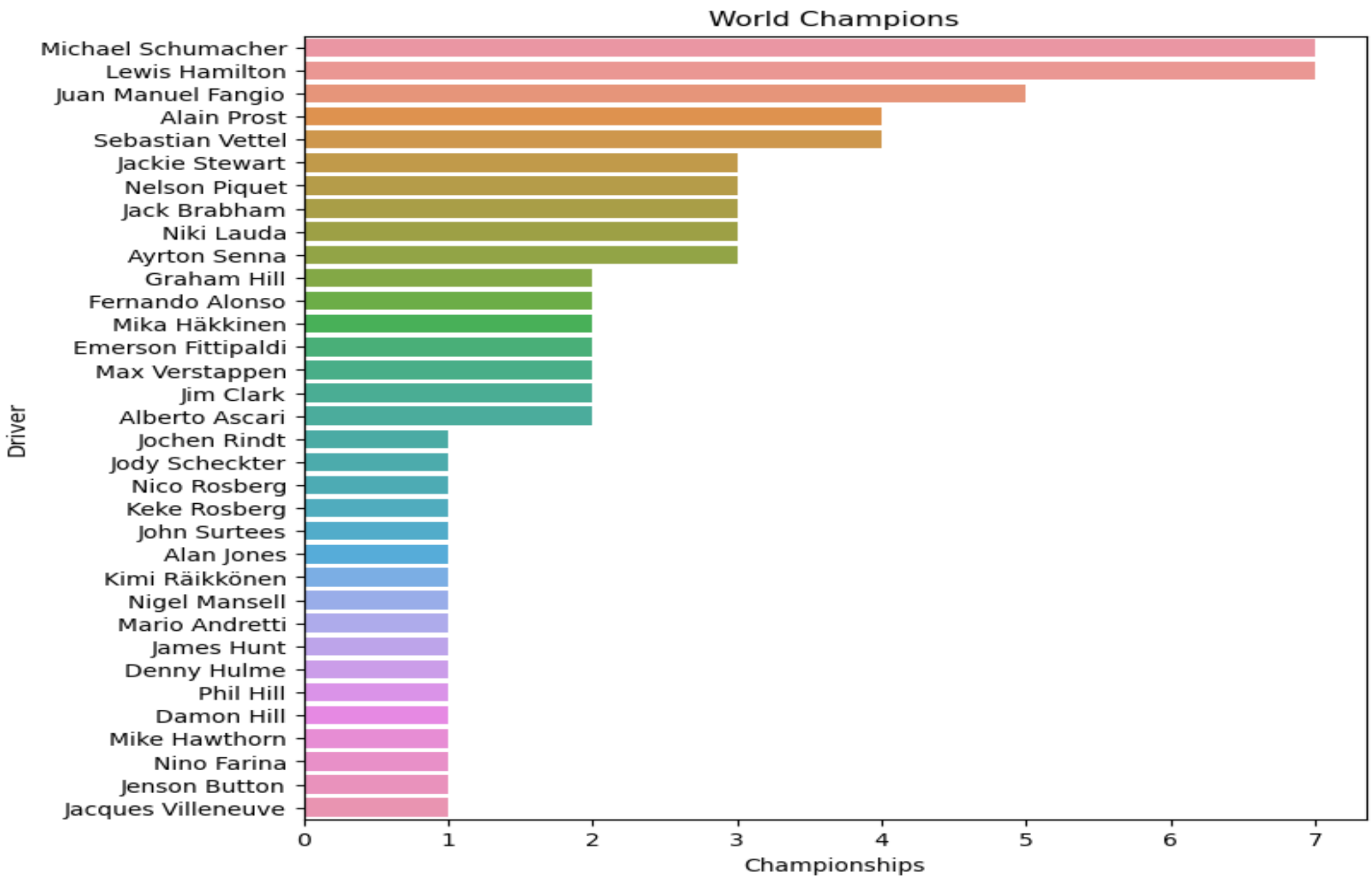
Out of 868 drivers that has ever participated in a Formula 1 Gran Prix or a season not 34 of them have won the Championship trophy thats only 3% of the total drivers.

Driver with the most championships

Sorting out the values we could find the driver/drivers with the most championship or hence the greatest of all drivers.

Lewis Hamilton and Michael Schumacher are equaled with the most number of Driver Championships 7.

The bar plot in the next slide shows all 34 drivers with world championships. While Lewis Hamilton and Michael Schumacher won 7 titles, Fangio won 5 titles. Sebastian Vettel and Alain Prost won 4 titles each and multiple drivers won 3,2, and 1 titles.


World Champions
Michael Schumacher
Lewis Hamilton
Juan Manuel Fangio
Alain Prost
Sebastian Vettel
Jackie Stewart
Nelson Piquet
Jack Brabham
Niki Lauda
Ayrton Senna
Graham Hill
Fernando Alonso
Mika Häkkinen
Emerson Fittipaldi
Max Verstappen
Jim Clark
Alberto Ascari
Jochen Rindt
Jody Scheckter
Nico Rosberg
Keke Rosberg
John Surtees
Alan Jones
Kimi Räikkönen
Nigel Mansell
Mario Andretti
James Hunt
Denny Hulme
Phil Hill
Damon Hill
Mike Hawthorn
Nino Farina
Jenson Button
Jacques Villeneuve
Driver
0
1
2
3
4
5
6
7
Championships

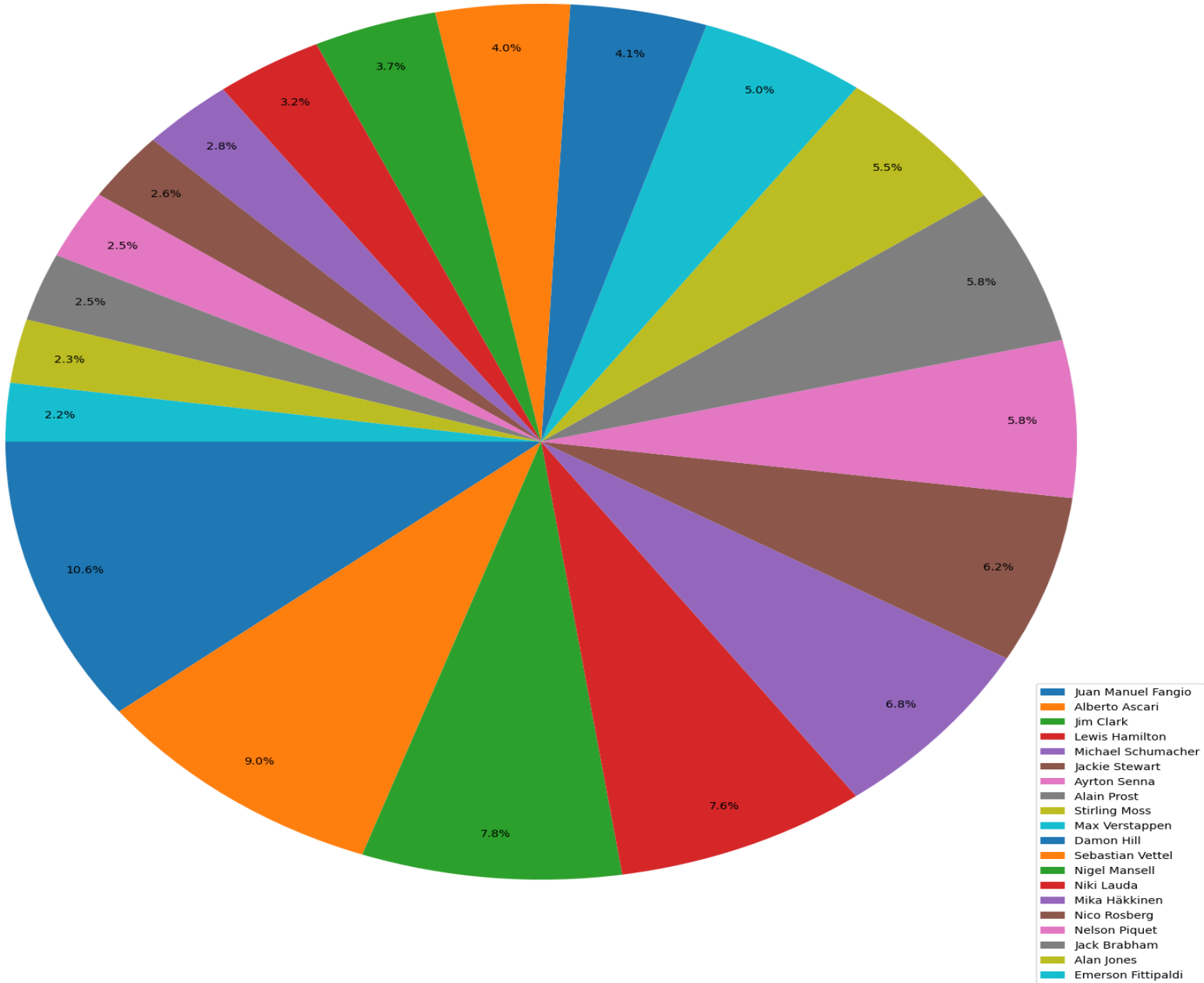
Driver with the best win percentage

Championships,Race Win,Pole Sittings, Podiums define things but what really matters is the win percentage. With modern day F1 seasons having more and more races Drivers past retirement didnt have this in their consideration of becoming the best. Here the data helps us in sorting the driver with the best win rate.

Juan Manuel Fangio being a clear best in terms of win rates. Fangio won 5 titles with a win rate of 46% that is 24 races won in 51 race starts.

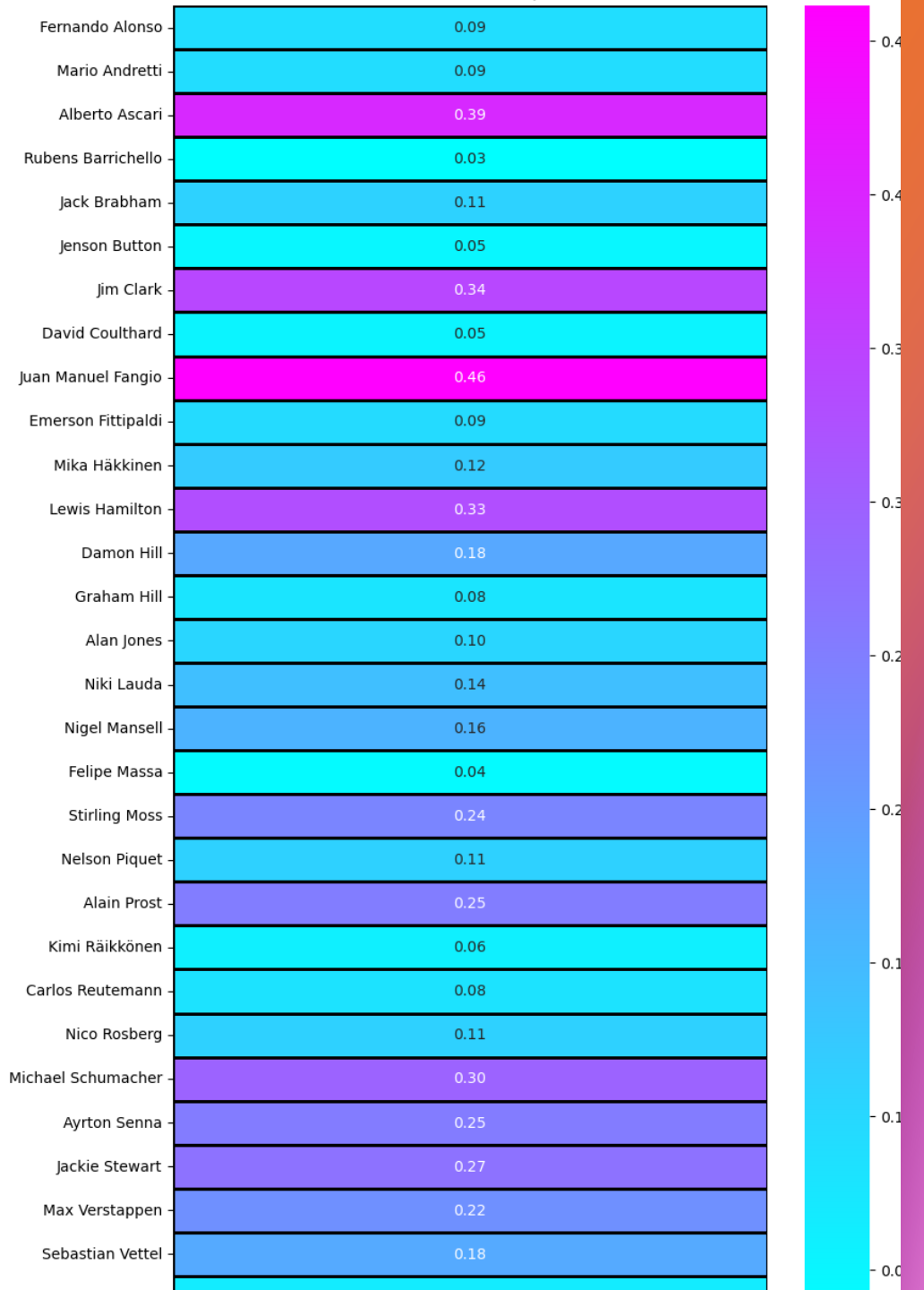
Win Percentage is the overall wins of driver compared to the total numbers of races.

Drivers with highest winning percentage



Lewis Hamilton and Michael Schumacher have won 7.6% and 6.8% of wins respectively. One question here people might ask is the low percent of wins Fangio has. Fangio only particiapted on 52 races and won only 24 of them. Though his conversion rates here is 46% in overall history of race winners he won bare minimum of 10.6% of races only due to less participation of races back in the days.

Heatmap of the Win Rate on the basis of races all the driver participated in and have won with respect to that.



Future Scope

The future of Formula 1 driver data analysis is brimming with exciting possibilities. Machine learning algorithms can be trained on historical data to predict future race outcomes, potential championship winners, and even identify rising stars. This could revolutionize scouting and race strategy development.

Advanced data analysis can be used to create personalized driver performance models. These models could identify areas for improvement, suggest optimal race strategies, and even predict potential equipment failures to maximize a driver's chances of success.

By analyzing data from sensors on the car and driver biometrics, we can gain insights into factors that contribute to accidents and improve safety measures for drivers and track design.

Conclusion

With the records summarized above multiple racers could get hold of the title being called Greatest of all Time but Lewis Hamilton ,Michael Schumacher and Juan Fangio are definitely the best of all other drivers who have won races and titles. But Formula 1 world is changing with the upcoming technologies and new generational talents like Max Verstappen, Charles Leclerc ,George Russell and many more are all set to keep their toes on the top of the Formula 1 podium.

The future projects the data could be given backa on regular race basis and could be helped in analyzing evdriver'svers pace on to-lap lap basis helping them to find their mistakes in comparison to the best driver of that race. This would also help the team to get the bset-upt up for the car in the next race.