Racing Through Data: A Formula 1 Analysis

Team - Pixels and Patterns

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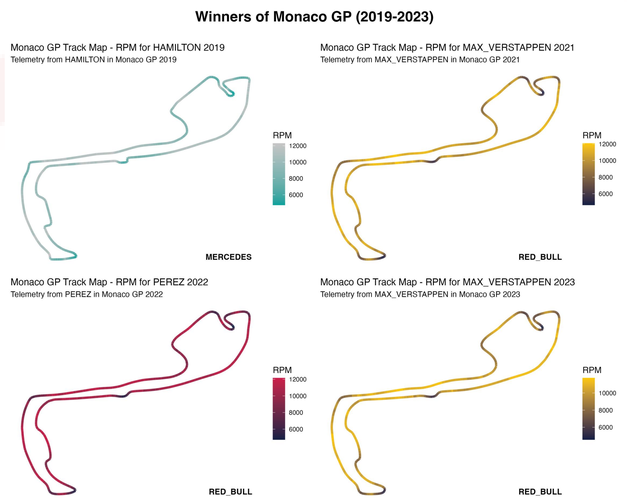
Introduction:

- Objective: Analyze and visualize Formula 1 race data to extract insights on performance, trends, and circuit characteristics.
- Data Source: Historical race results, driver details, and circuit information accessed through the f1DataR package which keeps updating to ongoing seasons.
- Focus Areas:
  - Seasonal insights across multiple years.
  - Performance analysis for specific tracks and teams.
  - Visualization of race times, driver positions, and circuit influences.
- Key Goals:
  - Understand race outcomes and driver performance.
  - Identify trends across seasons and Grand Prix events.
  - Highlight the impact of circuit characteristics on race success.
- Applications:
  - Enhanced strategies for teams.
  - Insights for fans and enthusiasts.
  - Data-driven opportunities for potential sponsors.

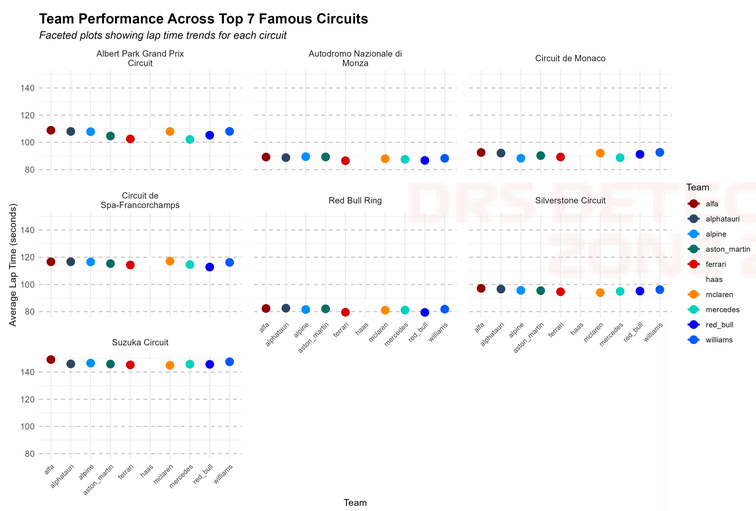
Analysis of Monaco GP Winners' Telemetry (2019-2023):

- **Track Visualization by Driver and Year**:
  - The graph displays telemetry-based track maps for the Monaco Grand Prix winners from 2019 to 2023. Each plot represents a driver's fastest lap, with the path color-coded by RPM (engine speed).
- **Team Representation**:
  - The bottom-right of each plot includes a label of the winning driver's team (e.g., Mercedes or Red Bull), with unique team-specific color gradients emphasizing the driver's performance.



Performance Trends of Top 7 F1 Teams on Iconic Circuits:

- **Consistent Performance by Top Teams:**
  - Teams like Red Bull, Mercedes, and Ferrari consistently achieve lower average lap times across circuits, reflecting their well-optimized setups and race pace.
- **Circuit-Specific Variations:**
  - High-speed circuits like Monza and Red Bull Ring exhibit smaller performance gaps between teams, while technical circuits like Suzuka show broader lap time differences, emphasizing the impact of car setup and driver skill.



Acknowledgement:

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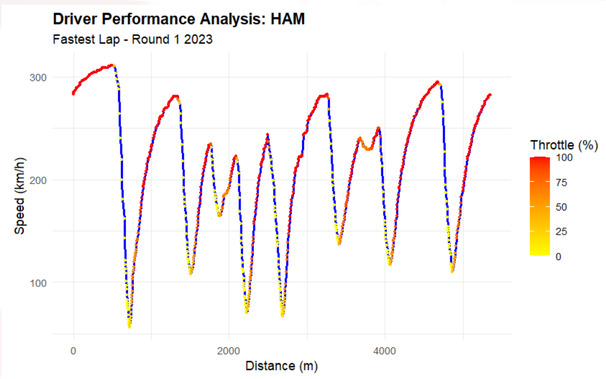
References:

- FastF1 Package

Driver Performance Analysis: Fastest Laps at Bahrain Grand Prix:

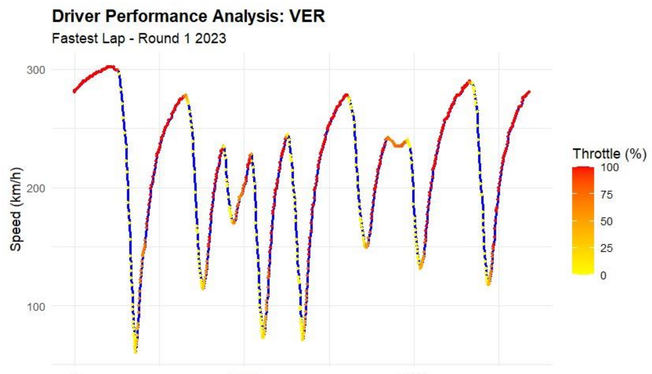
Driver: HAM (Lewis Hamilton)

- **High-speed management**:
  - Hamilton sustains high speed on straights (~310 km/h) with quick transitions to heavy braking zones, visible in steep speed drops.
- **Throttle transitions**:
  - Consistent throttle modulation is observed during corner exits, where throttle gradually increases from ~50% to 100%.
- **Performance insight**:
  - Hamilton's precision in throttle control and braking reflects his mastery of car balance, aiding in consistent lap performance.



Driver: VER (Max Verstappen)

- **Maximizing speed**:
  - Verstappen demonstrates the highest speeds (~315 km/h) on straights, leveraging red bull's superior top speed performance.
- **Aggressive braking**:
  - Sharp throttle reductions (~100% to 0%) before corners highlight Verstappen's aggressive braking strategy.
- **Performance insight**:
  - Verstappen's high-speed control and aggressive cornering approach optimize his fastest lap, capitalizing on the car's strengths.



How does pitstop time affect the race outcome:

- **Position stability before and after pitstops**:
  - Drivers with shorter pitstop times (<22 seconds) tend to maintain or improve their race positions.
  - Longer pitstop times (>23 seconds) are often associated with significant position drops, especially in the mid-field pack (positions 6–15).
- **Top drivers and short pitstops**:
  - Drivers in the top 5 positions consistently perform shorter pitstops (e.G., ~22 seconds) to retain their lead.
- **Consistency among champions**:
  - Champions maintain pitstop times within a range of **20–30 seconds** across most circuits, reflecting their team's ability to deliver consistent performance under pressure.