Driver Coaching Tool - Opportunity Corner analysis

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Overview

The Driver Coaching Tool is designed to systematically identify performance improvement opportunities by analysing how drivers navigate the most demanding corners on a circuit. Rather than focusing on overall lap times, this tool takes a granular, corner-by-corner approach to pinpoint specific areas where technique refinements can yield measurable time gains.

The underlying philosophy is that significant corners—those demanding substantial changes in speed, direction, and vehicle control—represent the greatest opportunities for performance differentiation between drivers. By benchmarking individual driver performance against the fastest recorded corner completions, the tool provides actionable, data-driven coaching insights.

Core Assumptions

The model operates under two fundamental assumptions:

Significant corners offer the greatest improvement potential. Corners requiring substantial driver input—heavy braking, aggressive steering, significant speed reduction—are where skill differences become most apparent. These complex manoeuvres demand precise coordination of multiple inputs, creating opportunities for both errors and excellence.

Vehicle parity eliminates mechanical variables. All vehicles in the analysis share identical specifications, meaning power output, traction characteristics, and aerodynamic properties are constant across the field. This ensures that any performance differential observed between drivers can be attributed to technique and decision-making rather than equipment advantages.

Telemetry Data Inputs

The model ingests four primary telemetry channels to characterise driver behaviour through corners:

Braking Data captures front and rear brake pressure (`pbrake_f` and `pbrake_r`), measured in bar. This data reveals braking intensity, balance, and modulation patterns—critical factors in corner entry technique.

Lateral Acceleration is recorded via the `aaccy_can` channel, measured in G-forces. This metric indicates how aggressively the driver is loading the tyres laterally, reflecting cornering commitment and the grip being extracted from the vehicle.

Steering Angle is measured in degrees, where zero represents straight-ahead travel, negative values indicate counterclockwise rotation, and positive values indicate clockwise rotation. This channel reveals the driver's line choice and steering input precision.

Vehicle Speed is recorded in kilometres per hour, providing the fundamental metric for understanding corner entry, minimum, and exit velocities.

Corner Identification and Scoring Methodology

Not all corners warrant analysis—the tool focuses computational resources on corners of sufficient complexity where performance gains are most likely.

Corner Score Calculation

Each corner is assigned an integer score based on a weighted combination of telemetry signals:

Corner Score = (Lateral G Signal × 3) + (Steering Signal × 2) + (Speed Reduction Signal × 1.5) + (Brake Signal × 0.5) + (Deceleration Signal × 0.5)

The weighting scheme reflects the relative importance of each factor:

Factor	Weight	Rationale
Lateral G	3	Primary indicator of cornering intensity and commitment
Steering Angle	2	Reflects corner severity and line requirements
Speed Reduction	1.5	Indicates braking zone significance and time-loss potential
Brake Pressure	0.5	Supporting indicator of corner demand
Deceleration	0.5	Confirms speed scrubbing requirement

Corners exceeding the threshold score of 2 are flagged as "corners of significance" and included in the analysis. This filtering ensures coaching insights focus on corners where meaningful improvements are achievable, rather than diluting attention across minor direction changes or kinks that have minimal impact on lap time.

Benchmarking Methodology

Establishing the Performance Reference

A critical distinction in this model is that **the benchmark is not derived from the fastest overall lap**. Instead, the fastest recorded completion time for each individual corner becomes that corner's benchmark, regardless of which driver or which lap produced it.

This approach acknowledges that a single driver rarely executes every corner optimally within the same lap. Driver A might produce the fastest sector one but lose time in sector three, while Driver B shows the inverse pattern. By extracting the best performance at each corner independently, the tool constructs a theoretical "perfect lap" composed of the fastest corner segments observed across all drivers and all laps.

Comparative Analysis

For each corner of significance, the tool compares the subject driver's telemetry against the benchmark using **average values** calculated across the duration of the corner. This averaging approach provides a representative summary of driver behaviour through each phase of the corner, enabling meaningful comparison against benchmark metrics.

The comparison evaluates the following dimensions:

- **Average brake pressure** — The mean braking force applied through the corner's braking zone, indicating overall braking intensity
- **Average speed** — The mean velocity maintained through the corner, reflecting the balance between entry commitment and minimum speed management
- **Average steering input** — The mean steering angle magnitude through the corner, characterising line choice and directional demand
- **Average lateral G loading** — The mean lateral acceleration sustained, indicating the level of grip being extracted from the tyres
- **Gear selection** — Ensuring the driver is in the optimal gear for the corner phase

Data Granularity Considerations: It is important to note that the quantity of data points captured for each driver through a given corner is not equal. For example, Driver A navigating a corner in 3.2 seconds may have significantly more data points captured than Driver B who completes the same corner in 2.8 seconds.

Coaching Insights

The tool generates coaching feedback by identifying discrepancies between driver performance and benchmark metrics. Insights fall into several categories:

Opportunity Corners vs. Optimal Corners

The model classifies each significant corner into one of two categories for each driver:

Opportunity Corners are those where the driver's completion time exceeds the benchmark by a meaningful margin, indicating potential for improvement.

Optimal Corners are those where the driver's performance matches or approaches the benchmark, confirming effective technique that should be maintained.

Specific Coaching Scenarios

Insufficient Braking Intensity: The driver applies less brake pressure than the benchmark, resulting in excessive entry speed that compromises the steering angle required to position the car on the ideal racing line. This manifests as a wide entry, a compromised apex, and suboptimal exit trajectory—ultimately costing time through the corner and onto the following straight.

Excessive Braking / Over-Slowing: The driver applies more brake pressure than necessary or maintains braking longer than the benchmark, reducing the corner's minimum speed below optimal. While the car may be well-positioned, time is lost through conservative speed management. This pattern often indicates a driver who lacks confidence in the car's grip capability or is prioritising safety margin over outright pace.

Telemetric Inconsistency Detection: When braking, speed, steering, gear, and lateral G data present contradictory patterns—such as high brake pressure combined with high speed, minimal steering angle, low gear selection, and low lateral G—the model flags this as an anomaly. Such inconsistencies typically indicate:

- An incident such as contact with another vehicle or track furniture
- A mechanical issue such as brake failure, puncture, or suspension damage
- A driver error such as a missed braking point leading to a lock-up or off-track excursion
- Track condition changes such as debris, fluid, or weather transitions

These anomalies are excluded from performance benchmarking but are surfaced to engineers and coaches for investigation.

Additional Coaching Dimensions

Beyond the core scenarios, the tool can identify:

- **Inconsistent corner execution** across multiple laps, suggesting the driver has not yet optimised their approach

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Summary

The Driver Coaching Tool transforms raw telemetry into targeted, corner-specific coaching insights by identifying where each driver deviates from the fastest observed performance at each significant corner. By focusing on high-impact corners and benchmarking against the best-recorded segment times rather than overall lap performance, the tool provides precise, actionable guidance that drivers and coaches can use to systematically improve lap times through deliberate technique refinement.