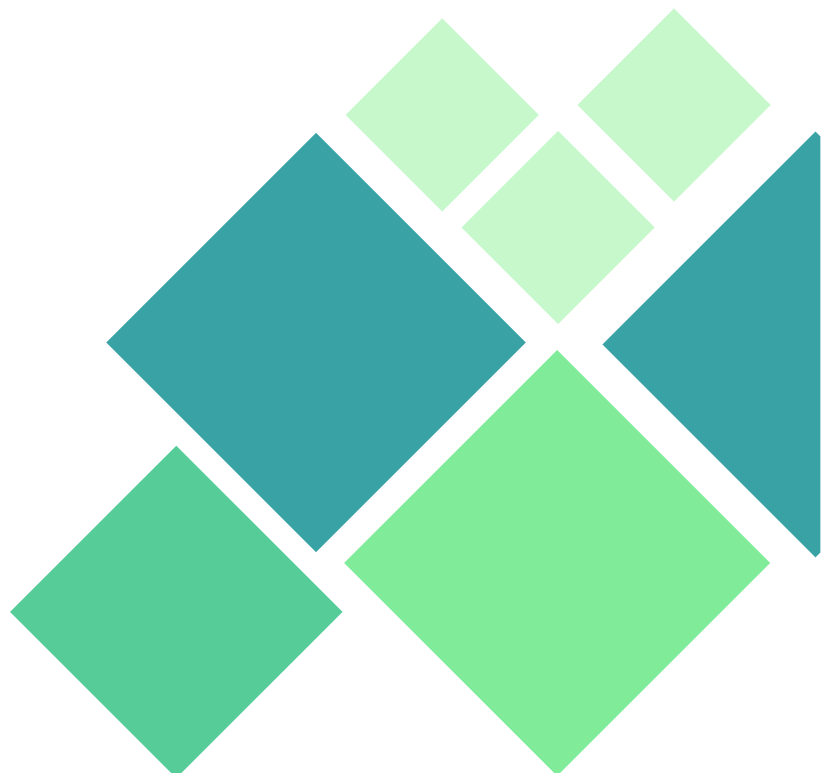


**Data Science**

# **Vehicle Analysis**



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# Introduction

This project focuses on vehicle analysis. It leverages data generated by sensors to find important insights into vehicle performance, maintenance requirements and operational efficiency. By analyzing important indicators such as speed, fuel consumption, engine temperature and tire pressure, the project will identify patterns and irregularities. Enables data-driven decision-making in vehicle friction management.

The dataset used in this project will capture essential telemetry data and vehicle context information, such as real-time sensor readings, vehicle identifier and maintenance records. The main objective is to assess performance trends, detect abnormalities and recommend additional insights to optimize vehicle usage, and reduce operating costs.

## Imports and Setup

To achieve the project's objectives, a wide array of libraries and tools are employed:

- **NumPy** and **Pandas**: Used for numerical computations and data manipulation, allowing efficient handling of large IoT datasets.
- **Matplotlib** and **Plotly**: These visualization libraries enable the creation of insightful graphs and interactive dashboards to display telemetry data trends, machine health, and prediction results.

## **Data Collection**

The dataset contains telemetry and contextual data from multiple vehicles. Key features include:

### **Telemetry Data:**

- speed: Indicates the vehicle's real-time velocity, useful for analyzing driving patterns.
- fuel\_consumption: Tracks fuel usage, providing insights into efficiency and consumption trends.
- Engine\_temperature: Monitors the engine's thermal state, flagging overheating issues.
- Tire\_pressure: Tracks tire pressure, highlighting maintenance needs.

### **Contextual Data:**

- vehicle\_id: Unique identifiers for each vehicle, enabling per-vehicle analysis.
- vehicle\_type: Categorizes vehicles, allowing for comparative analysis between types.
- Maintenance Logs: Captures historical maintenance activities and associated costs.

This data provides a comprehensive foundation for understanding vehicle performance and identifying areas for improvement.

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## **Data Loading and Preprocessing**

### **Telemetry Data:**

- Key features like speed, fuel\_consumption, engine\_temperature, and tire\_pressure are normalized and cleaned to remove outliers.

### **Datetime Parsing:**

- Ensures accurate time-series alignment by standardizing the datetime format.

### **Vehicle-Specific Analysis:**

- Data is segmented by vehicle\_id, allowing for individualized performance analysis.

### **Feature Engineering:**

- Derived features include:
  - Fuel Efficiency: Calculated as distance traveled per unit of fuel.
  - Average Speed: Aggregated over time for trend analysis.
  - Temperature Deviation: Indicates unusual engine temperature fluctuations.
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## **Cost-Benefit Analysis :**

The analysis quantifies potential savings and efficiency improvements:

- Fuel Savings: Insights into fuel consumption trends lead to optimized driving practices.
- Reduced Maintenance Costs: Early anomaly detection minimizes emergency repairs.
- Improved Vehicle Lifespan: Proactive interventions enhance vehicle durability.

## **Key Insights and Conclusion**

- Performance Trends: The analysis highlights patterns in speed, fuel consumption, and engine temperature.
- Anomaly Detection: Dual-model approach ensures accurate identification of irregularities.
- Actionable Insights: The dashboard provides a clear view of vehicle health and maintenance needs.
- Efficiency Gains: Demonstrates the financial and operational advantages of data-driven fleet management.
- This project showcases the power of vehicle telemetry data and machine learning to revolutionize fleet management, enabling smarter, data-driven decisions for enhanced performance and cost-efficiency.