# Tire pressure forecasting

## Description

Consider a vehicle fleet in Medellin, Colombia of a rental company. The company wants to understand if their vehicles are driven with the appropriate tire pressure. Furthermore, the company wants to investigate whether it is possible to schedule tire maintenance smartly based on time evolution of tire pressure and tire temperature. In order to realize this, Continental has equipped the vehicles with telemetry units (logger) connected to board computers, which send data to the cloud. A board computer consolidates information from tire sensors, gps module among others.

## Data sources

The company maintains which telemetry unit and tires are mounted in which vehicle.

As sample of the data is provided in **'tires\_vehicle\_logger\_operations.csv'**.

|  |  |
| --- | --- |
| **field** | **description** |
| vehicle\_licence\_plate |  |
| tireid | tire id |
| wheelpos | wheel position [1L, 1R, 2L, 2R]  [1= front or 2=rear, L=left or R=right] |
| tire\_mounted | mounting date of the tire |
| tire\_demounted | demount date of the tire |
| loggerno | logger id |
| logger\_mounted | logger mounting date |
| logger\_demounted | logger demount date |

Attached, you will find sample data generated by two vehicles over between 2021-12-01 until 2022-02-18. Naming convention:

'W1K1770841V108072\_0000000008750076\_202112\_Blackbox.parquet'

**'<VIN>\_<loggerno>\_yyyyMM\_Blackbox.parquet'**

VIN is 'vehicle identification number'; ‘loggerno’ is the logger id of the telemetry unit mounted on the vehicle and yyyyMM refers to the year and month in which the data was generated.

The suffixes [fl, fr, rl, rr] refer to the wheel position [f=front or r= rear, l=eft or r=right].

|  |  |
| --- | --- |
| **field** | **description** |
| gps\_long | gps longitude |
| gps\_lat | gps latitude |
| alt | gps altitude |
| temp\_outside | ambient temperature |
| tachometer\_km | total vehicle distance |
| steeringwheel\_angle |  |
| wheelspeed\_rr |  |
| wheelspeed\_rl |  |
| wheelspeed\_fr |  |
| wheelspeed\_fl |  |
| speed | vehicle speed |
| tiretemperature\_rr |  |
| tiretemperature\_rl |  |
| tiretemperature\_fr |  |
| tiretemperature\_fl |  |
| tirepressure\_rr |  |
| tirepressure\_rl |  |
| tirepressure\_fr |  |
| tirepressure\_fl |  |
| ts | timestamp in milliseconds |
| ts\_sec | timestamp in seconds |
| ts\_int | timestamp as int |
| highres | internal counter of the telemetry unit |

## Tasks

A data scientist needs your help to analyze the data.

Task 1: Understandable table and views   
The data scientist would like to perform time series analysis on tire pressure for the individual tires for the two vehicles you have data for. Prepare a general table which the data scientist can use for tire temperature, pressure and speed analytics.   
**Hint**: Is your table sufficiently general, that could support trucks, which have more than 4 tire/wheel positions?

### Task 2: Data relevance

Unpivoting creates a very big table with lots of redundant data. The data scientist is only interested in tire pressure and temperature analytics. Is there anything you can do about it?

**Hint:** Check the update frequency of the individual parameters.

### Task 3: Data plausibility and data quality

Wheelspeed, temperature and pressure data are generated by tire sensors.

The speed as well as the gps coordinates are created by a gps module.

The source of the parameter tachometer\_km is on-board diagnostics (OBD).

What can you do to check the plausibility of different parameters?

**Hint:** Elaborate rules to check their veracity. What is the underlying physics?