

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_kmh 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?