# ICT4SM Laboratory 3 Description 2024/25

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## Accessing the data

For lab 3 you will use the data collected from UnipolTech:

- In **dropbox** `Laboratories/LAB3/Data/Unipoldata_lab3.zip`

## Preliminary Analysis

To get familiar with the dataset and remove the outliers.

- What is the distribution of trip distance of different types of roads? Plot ecdf and make comments.
- What is the distribution of trip duration? Plot ecdf and make comments.
- What is the relationship between trip duration and distance? Can you spot any difference among trips with different road types?
- Filter the dataset, remove outliers (e.g. distance 0, impossible distance wrt duration) and report your filter criteria. How many valid trips are recorded in the dataset?

## Tasks

1. Analysing behaviours of vehicles. For each vehicle, aggregate the data on daily basis, compute following values: **(i)** number of trips; **(ii)** total travel distance; **(iii)** utilization percentage, i.e. fraction of driving time in the 24 hours.
   a. Compute the statistics and distribution of the values on workdays and weekends/holidays. Can you find any difference? Can you find some vehicles behave consistently?
   b. For each vehicle, compute the fraction of its trips with different road types. Choose a meaningful way to show the results and make comments.
   c. According to the characters you find, categorize and cluster the vehicles into 3-5 types based on their behaviours.
2. Choose at least three EV model from the [EV database](#). Choose and define the evaluation metrics that you want to monitor. The mandatory one is the percentage of feasible trips.
3. Implement the replicator of trips and simulator of EV. Report it with diagram and/or pseudocode.
4. Conduct the simulation of all the vehicles, with different parameters (types of EV and charging power) and analyse the results.
   a. Report and comment how many trips are unfeasible (the SoC is or arrive at 0)
   b. Report and comment the distribution of performance metrics over vehicles.
   c. Is there any difference for different EV models? What about their consumption or charging power?
   d. If slow AC charging is performed, how the performance change with respect to fast DC charging?
   e. Report and comment the difference in performance among the clusters of vehicles found at step 1.
5. Estimate charging costs and EV costs and comments on the tradeoff between performance and costs.
6. (Optional) Using the same dataset, implement a more realistic scenario for the simulation (different policy for charging), perform the simulation and analyse the results.

# Report

- Max 7 pages which describes what you have done and the findings.
- Add one header page with the group number, members, etc.
- You can add additional results, figures, etc. in the appendix (might not be evaluated).
- <span style="color:red">Max 2 additional pages for the optional task</span>
- Code, scripts, etc., must be added as separate files.