Politecnico di Torino
Dipartimento di Automatica e Informatica

PhD in Computer and Control Engineering
XXXIV cycle

CITTA' DI TORINO

Supervisor
Silvia CHIUSANO

Urban mobility within the smart city context

PhD Candidate:
Elena DARAIO

1. Context

Smart cities are an enormous source of data that can provide very useful information about the quality of life and the provided services from the governance and from private. In particular, the mobility within the city is a highly important aspect: it is a service for the citizen but also a source of information for the decision makers to improve the urban environment.

2. Methods and results

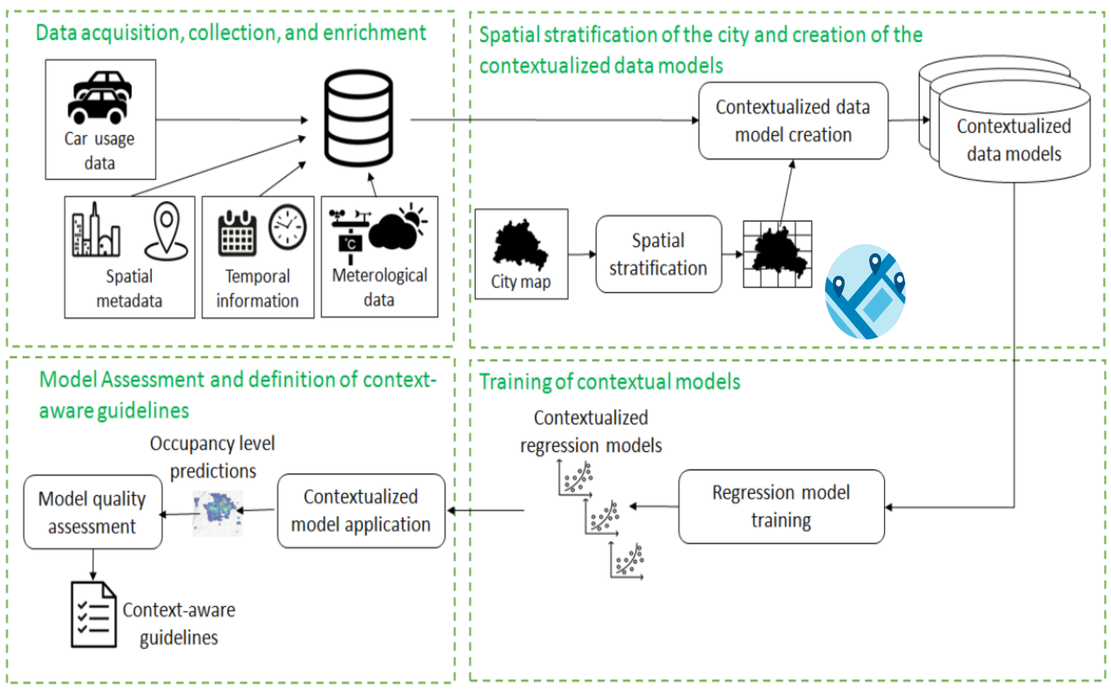
The usage of Machine Learning (ML) techniques allows to analyse mobility data to improve the citizens' urban experience. ML algorithms have been applied to pursue the following objectives:

- Improve the mobility-based services [1-3]
- Enhance the user-perception of the mobility-based services
- Profile user activities based on user mobility data [4-5]

Different techniques are available, and they have been adopted in the following ways:

- Regression techniques, to forecast the future offer of vehicles belonging to the free-floating car sharing system [1-2]
- Classification techniques, to detect the arousal of symptomatic events in the physiology of the user within a vehicle
- Clustering techniques, to evaluate the similarities among conditions described through the pollutants' concentrations and the meteorological conditions [3]
- Pattern extraction techniques, to mine from mobility data citizens' life-style patterns among Points of Interest within the urban context [4-5]

The research activities allowed to define customized methodologies to address each of the afore mentioned objectives, combining in the most suitable way the mentioned techniques. For example, [1-2] addressed the definition of contextualized models based on (i) spatial characteristics and (ii) Points of Interest available in urban areas to forecast in the short term the availability of vehicles. The methodology is represented below.



4. Conclusions

The results confirm that the use of ML approaches allows to mine useful knowledge from the mobility data in complex urban scenarios.

5. References

[1] "CarPredictor: forecasting the number of free-floating car sharing vehicles within restricted urban areas", Cagliero L. et. al., IEEE Intern. Congr. On Big Data (2019)

[2] "Predicting Car Availability in Free Floating Car Sharing Systems: Leveraging Machine Learning in Challenging Contexts", Daraio E. et. al, ELECTRONICS (2020)

[3] "Characterizing Air-Quality Data Through Unsupervised Analytics Methods", Daraio E. et al., Workshop CSADB@ADBIS (2018)

[4] Submitted - "Unifying location-based social network data with urban mobility data: a pattern-based approach", Daraio E. et al., IEEE Trans. On Intelligent Transportation System (2021)

[5] "An explainable data-driven approach to web directory taxonomy mapping", Daraio E. et al., KES (2020)