AI-based approaches for mobility data sharing and human dynamics understanding

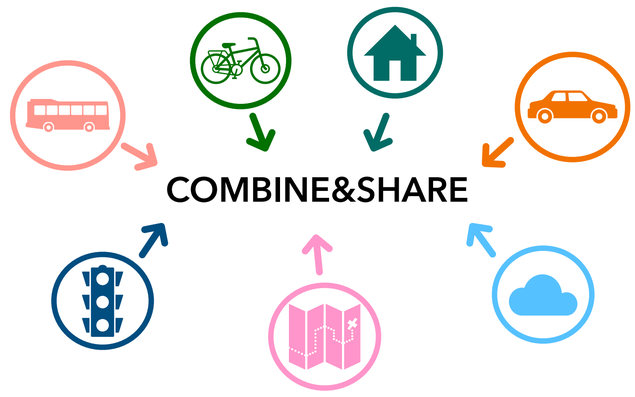
Chiara Pugliese[1,2], Giulio Loddi[3], Francesco Lettich[1], Fabio Pinelli[1,3], Chiara Renso[1]

(1) *HPC Laboratory, ISTI-CNR, Pisa, Italy*
name.surname@isti.cnr.it

(2) *University of Pisa, Pisa, Italy*
name.surname@phd.unipi.it

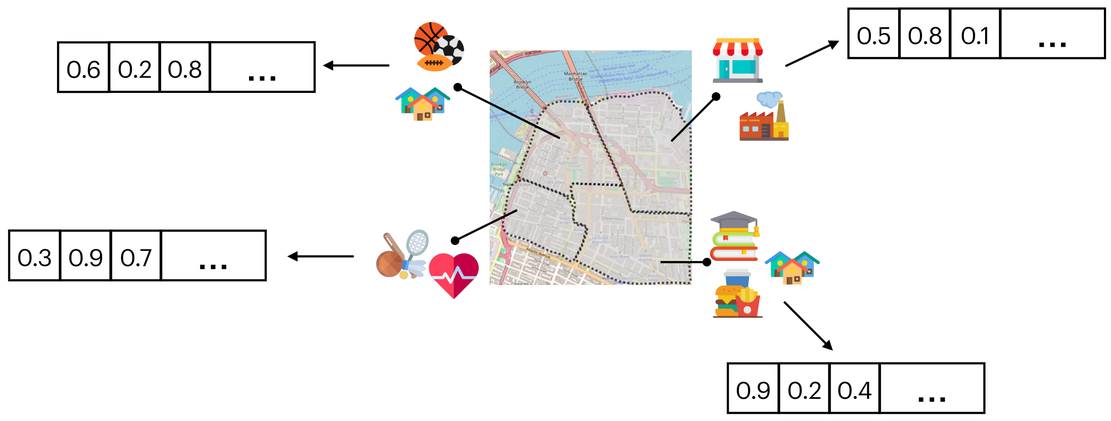
(3) *IMT Lucca, Lucca, Italy*
name.surname@imtlucca.it

MOTIVATIONS



We are witnessing a growing attention to **mobility data sharing**. The proper combination of mobility data shared by different collectors will considerably improve the understanding of **human mobility dynamics**.
At the same time, it calls for novel research approaches to create, represent, and analyze this **augmented mobility data**.
We are following three research directions.

Representation of semantic urban regions



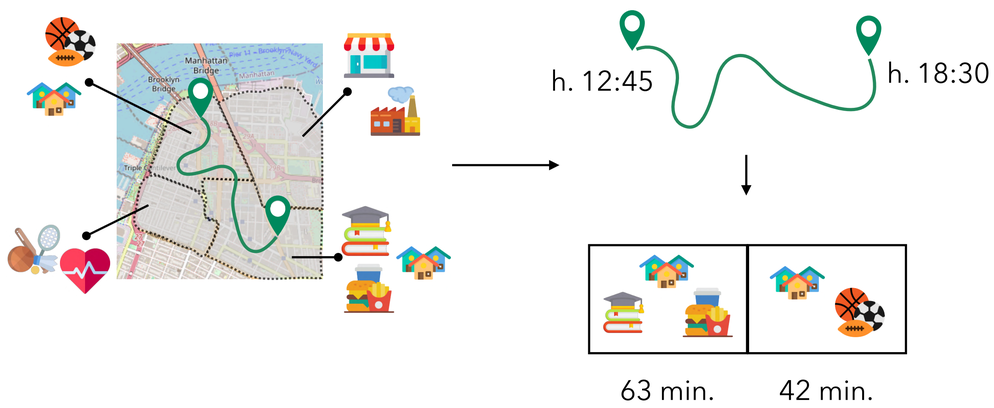
The use of **representation learning** to integrate diverse **location** and **semantic** data - such as Points of Interest, mobile traffic, user images, and public transportation - into **cohesive representations** of urban regions.
These representations, or embeddings, **capture relations** within regions and analogies between **similar** regions.

Semantic Trajectory Encoding for Urban Mobility Analysis

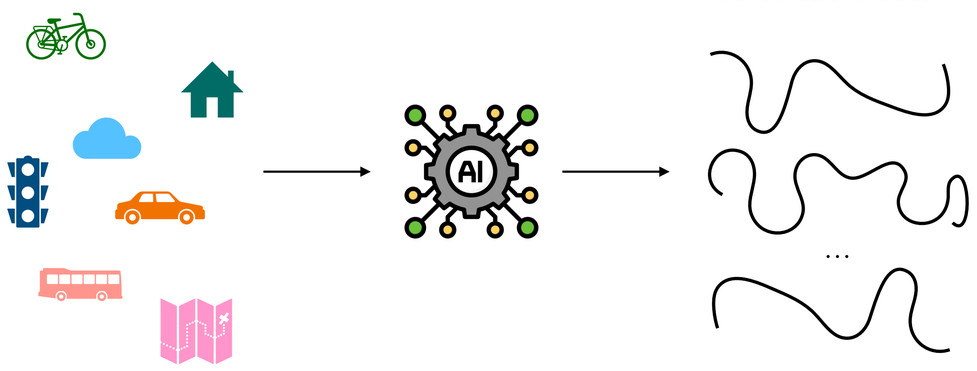
The **encoding** of users' trajectories traversing the semantically enriched urban regions:

(1) trajectories **inherit** the **semantic richness** of urban regions they traverse, improving their **contextual understanding**;

(2) this facilitates **trajectory summarization**, thus enabling the analysis in a compact version of enriched mobility data.



Generative AI for Synthetic Urban Data



Exploit semantic summarized trajectories with **generative AI** techniques to produce **synthetic urban-related data** (e.g., trajectories and mobile traffic consumption).
Researchers can leverage new synthetic datasets to test analysis techniques or develop simulators when real data is unavailable.

[1] Lettich, F., Pugliese, C., Renso, C., & Pinelli, F. (2023). Semantic Enrichment of Mobility Data: A Comprehensive Methodology and the MAT-BUILDER System. *IEEE Access*.
[2] Pugliese, C., Lettich, F., Pinelli, F., & Renso, C. (2023). Summarizing Trajectories Using Semantically Enriched Geographical Context. In *Proceedings of the 31st ACM International Conference on Advances in Geographic Information Systems*.