ThesisDay@SystemX 2018

Representation Learning for Mobility Digital Footprints Analysis in Transit Network

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1. CONTEXT & ISSUES

Context :

- Face the complexity of public transport management.
- Necessity of acquire deep knowledge on flows and mobility behaviors of passengers.
- Willingness to valorize amounts of digital mobility data.

Issues :

- Estimation of predictive indicators on transit network in operation.
- Apprehend passenger mobility behaviors both in nominal operations and with special events.
- Better understanding of the impact of traveler information on passenger mobility behaviors.

Credit: Scania

2. OBJECTIVES

This thesis uses data science to exploit mobility traces. We want to build, by learning on our data, a mathematical model informing us on flow behavior in public transportation network and more precisely:

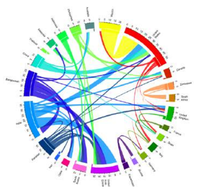
- **Short-term and Medium-term load prediction on multimodal transport network in nominal and disturbed operating situations.**
- **During disturbed operating situations, analysis of passenger mobility behaviors and the impact of traveler information.**

3. DATA

- **Mobility Traces of various sources.**
- **Study area : Paris area.**

Main data :

- Smart card Data.
- Origin-destination matrices.
- Anonymized ticketing data.



Other data

- Train loads
- Anomaly reports
- Counting sensors
- Wi-Fi detectors
- Route queries

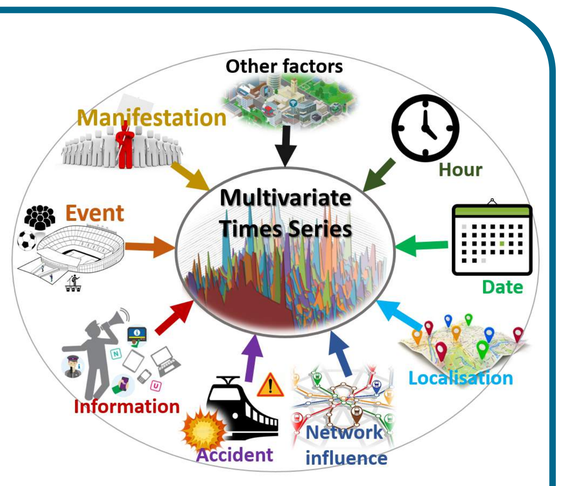
4. CHALLENGES

Nature of data :

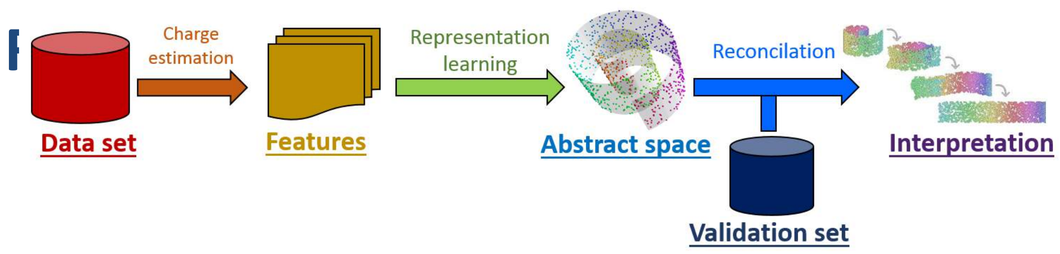
- multivariate time series,
- strongly structured in time and space,
- numerous unknown factors of influence,
- massive data.

Methodology :

- data driven and generic approaches,
- based on recent advances in deep learning.

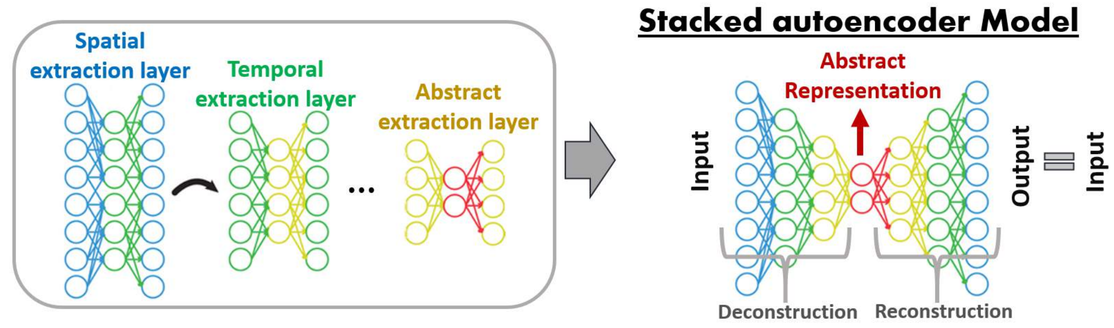


5. CURRENT WORK & EXPECTED



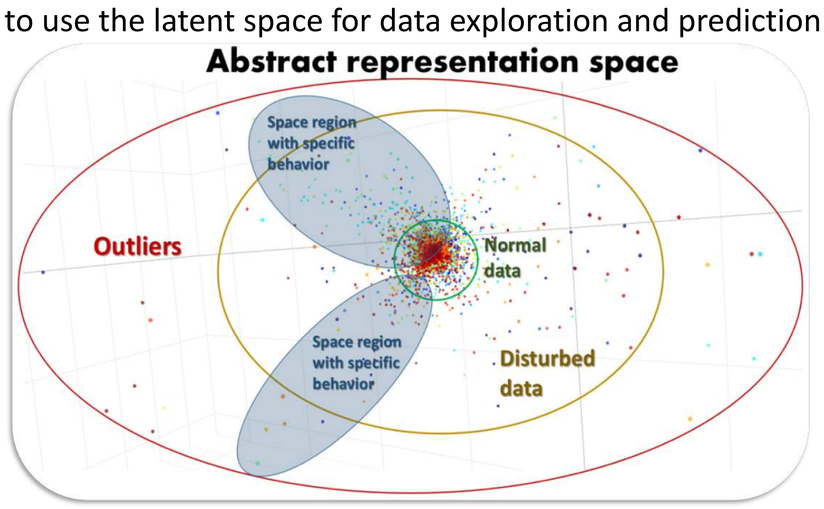
Aim: Create an abstract representation space capturing relevant latent structures in the data by building a deep neural network model able to capture and extract different information structures (temporal, spatial…).

Proposed Representation Learning approach:



Expectation:

- Be able to interpret the abstract space in order to guide the understanding of complex phenomena in transportation network.
- Be able to use the latent space for data exploration and prediction tasks.



REFERENCES

- BENGIO, Yoshua, COURVILLE, Aaron, et VINCENT, Pascal. **Representation learning: A review and new perspectives.** *IEEE transactions on pattern analysis and machine intelligence*, 2013.
- SOHN, Kihyuk, LEE, Honglak, et YAN, Xinchen. **Learning structured output representation using deep conditional generative models.** *Advances in Neural Information Processing Systems*, 2015.
- VINCENT, Pascal, LAROCHELLE, Hugo, LAJOIE, Isabelle, *et al.* **Stacked denoising autoencoders: Learning useful representations in a deep network with a local denoising criterion.** *Journal of Machine Learning Research*, 2010.
- ZIAT, Ali. **Apprentissage de représentation pour la prédiction et la classification de série temporelles.** *Thèse de doctorat à l'Université Pierre-et-Marie-Curie*, 2017.

Scientific domain: Data science and Interaction
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