Veronica Cipriani

HUMAN MOBILITY IN AN URBAN CONTEXT

Public transportation and Points-Of-Interest:
The case of the city of Trento

Computational Models of Human Behaviour

Human Mobility Science:

- **Human Mobility** quantitatively studies **individual and collective mobility patterns.**
- A significant proportion of our everyday lives has always been spent getting from one place to another.
- The aim of human mobility science is to generate models that can describe and predict regularities and patterns in human trajectories.
- There is an increasing number of sources of data (mobile devices with GPS, but also different data-source such as bank notes, CDRs, *ad hoc* surveys), that allows to track human trajectories.
- Mobility has big impact on many aspects of everyday-life: *health and epidemics, urban planning, traffic flows and public transportation.*

Transport behaviour is rooted in human behaviour

Points-of-Interest:

- *POI is a specific point location that someone may find useful or interesting* (https://en.wikipedia.org/wiki/Point_of_interest)
- Basically, point of interest are able to explain – at least partly- the patterns that shapes individual's movements

Aim of the analysis:

- There is a deep connection between human mobility and Points of Interest.

- Is it possible to recognize the same connection between public transportation and POI?
- Since – as already mentioned – human mobility influence public transportation, do POIs influence the routes of urban buses?

The study case of Trento.

Previous studies:

- Liu Y., Liu C., Lu X., Teng M., Zhu H., Xiong H., *Point-of-Interest Demand Modeling with Human Mobility Patterns,* 2017.
- Liu X., Gong L., Gong Y., Liu Y., *Revealing travel patterns and city structure with taxi trip data*, 2015.
- Huang L., Yang Y., Zhao X., Gao H., Yu H., *Mining the Relationship between Spatial Mobility Patterns and POIs,* 2018.
- Zeng W., Fu C., Arizona S. M., Schubiger S., Burkhard R. A., Ma K., *Visualizing the Relationship Between Human Mobility and Points of Interest*, 2017.

Previous studies:

- Liu Y., Liu C., Lu X., Teng M., Zhu H., Xiong H., *Point-of-Interest Demand Modeling with Human Mobility Patterns,* 2017.
- Liu X., Gong L., Gong Y., Liu Y., *Revealing travel patterns and city structure with taxi trip data*, 2015.
- Huang L., Yang Y., Zhao X., Gao H., Yu H., *Mining the Relationship between Spatial Mobility Patterns and POIs,* 2018.
- Zeng W., Fu C., Arizona S. M., Schubiger S., Burkhard R. A., Ma K., *Visualizing the Relationship Between Human Mobility and Points of Interest*, 2017.

Data and analysis:

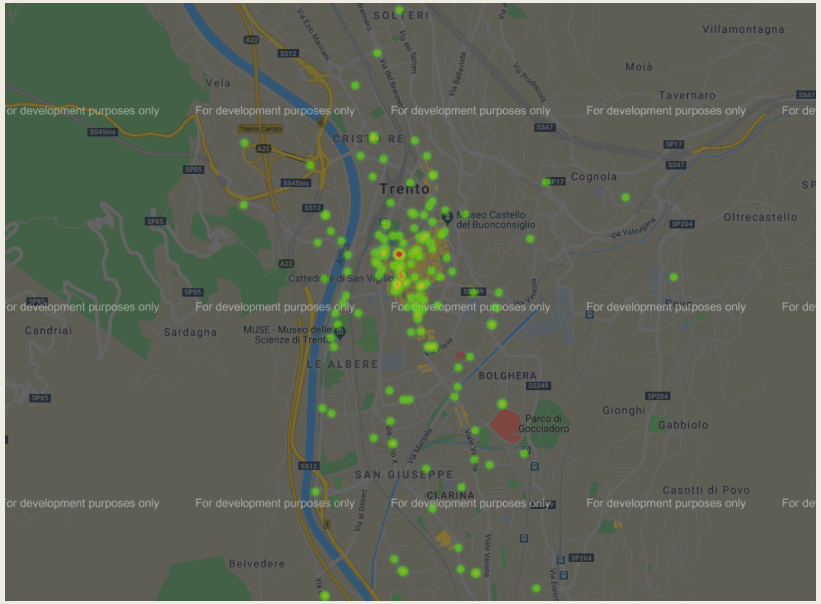
DATASET USED FOR THE ANALYSIS:

- *TRENTINO TRASPORTI GTFS (‘GENERAL TRANSIT FEED SPECIFICATION’)*
  https://www.dati.gov.it/dataset/trasporti-pubblici-trentino-formato-gtfs
  https://www.trentinotrasporti.it/open-data

- *POINT-OF-INTEREST*
  https://dati.trentino.it/dataset/e491b841-cc4a-47e3-9d6e-0c54436bb98f/resource/e572c92e-05dc-41b7-ba22-e9898bddc85c/download/apttrentocensimentoappwudefinitivopart2.csv

Metodology:

- Heat map of the POINT-OF-INTEREST



- Flux of public transport in the city
  - *Trips.txt, shapes.txt and stops.txt for a pseudo satellite image*

  (http://simplistic.me/playing-with-gtfs-iii-geo-graphs.html#Interactive-bokeh-maps)

Findings:

Having plotted the distribution of POI in the city and the fluxes – or at least the stops – of urban buses, the aim is to check for the connections/similarities between these two maps.

In particular, one would expect that bus stops are as close as possible to POI, given that these hotspots can be seen approximately as the most crowded/attractive places for individuals.

Literature Review:

- Cohen K., *Human Behavior and New Mobility Trends in the United States, Europe, and China*, Working Paper – Fondazione Enrico Fermi, 2019.
- Giglio S., Bertacchini F., Bilotta E., Pantano P., *Machine learning and points of interest: typical tourist Italian cities*, Current Issues in Tourism 2019.
- Huang L., Yang Y., Zhao X., Gao H., Yu H., *Mining the Relationship between Spatial Mobility Patterns and POIs*, Wireless Communications and Mobile Computing 2018.
- Karamouzas I., Skinner B., Guy S. J., *A universal power law governing pedestrian interactions*, Physical Review Letters, 2014.
- Liu X., Gong L., Gong Y., Liu Y., *Revealing travel patterns and city structure with taxi trip data*, Journal of Transport Geography, 2015.
- Liu Y., Liu C., Lu X., Teng M., Zhu H., Xiong H., *Point-of-Interest Demand Modeling with Human Mobility Patterns*, KDD 2017 Research Paper 2017.
- Pappalardo L., Barlacchi G., Pellungrini R., Simini F., *Human Mobility from theory to practice: Data, Models and Applications*, Conference Paper – The web conf 2019, 2019.
- Wang J., Kong X., Feng X., Sun L., *Urban Human Mobility: Data-Driven Modeling and Prediction*, ACM SIGKDD Exploration Newsletter, 2019.
- Xu Z., Cui G., Zong M., Wang X., *Anomalous Urban Mobility Pattern Detection Based on GPS Trajectories and POI Data*, International Journal of Geo-information, 2019.
- Zang F., Pfoser D., *Using OpenStreetMap point-of-interest data to model urban change—A feasibility study*, PLoS ONE 14, 2019.
- Zeng W., Fu C., Arizona S. M., Schubiger S., Burkhard R. A., Ma K., *Visualizing the Relationship Between Human Mobility and Points of Interest*, IEEE Transactions on Intelligent Transportation Systems, 2017.

Thanks for your attention!