

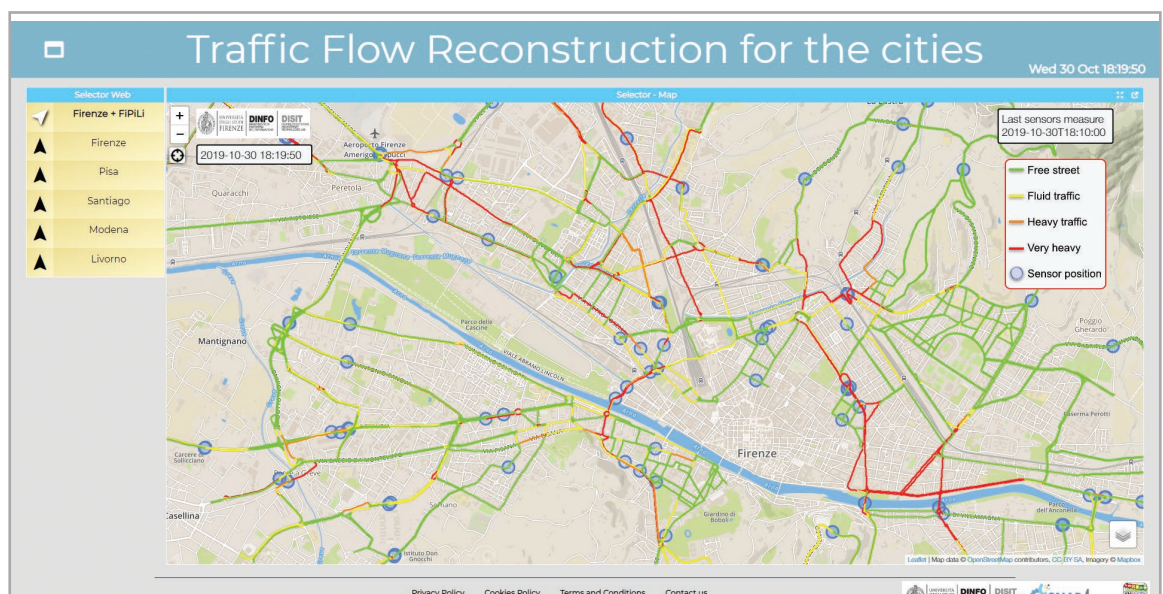


Mobility and Transport Analysis

The City Operators need to get a real time view of the city and regional status of traffic flow, mobility, parking, bike sharing, triage, event of traffic, public transportation, etc. According to what they observe and receive in terms of suggestions and alerts, they are stimulated as early warning to take decision and perform corrective actions for a more sustainable mobility.

In the context of mobility and transport, Snap4City in Tuscany is collecting data from the whole Tuscany Region, which is an area of more than 3.5 Million of inhabitants, and 45 million of tourists per year. It is an area with more than 1500 traffic flow sensors, 1.5 million of civic numbers, and about 16 different operators of public transportation, 250 parking areas, 12 major hospitals, etc. About 1.5 million of complex data per day reach the platform.

On the basis of the data collected, it has been possible to produce a number of data analytics tools in the context of Mobility and Transport. For example, algorithms for Traffic Flow reconstruction on the basis of the data of traffic sensors. The following figure and accessible Dashboard depicts location of traffic sensors and the traffic flow reconstructed in a number of cities in Tuscany (Firenze, Pisa, Livorno), in Modena (Reggio Emilia region of Italy) and in Santiago di Compostela (Spain).



<https://www.snap4city.org/dashboardSmartCity/view/index.php?iddashboard=MTc5NQ==>

The Traffic Flow reconstruction algorithm works in real time and has have been demonstrated to overcome in precision the solutions based on queue models as well as those based on that crowd sourcing obtaining data from mobile App. Our Traffic Flow reconstruction tools are based on machine learning and partial differential equations solution that regards the problem as traffic flow network.

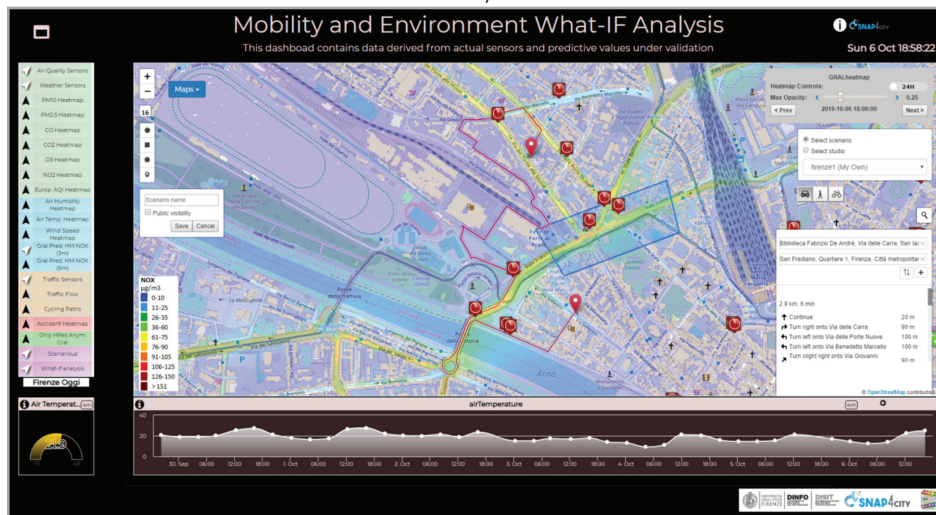
The data produced in real time by the traffic flow reconstruction algorithm or the derived historical data can be used for a large number of applications:

- dynamic routing to avoid crowded conditions, police, rescue teams, ...;
- estimating the production of NO, NO2 from the vehicles in the city;
- inform citizens and city operators in general;
- regulating the traffic lights;
- tuning the public transportation service, for example changing paths and time schedule;
- receiving and classifying traffic events to see them in real time and clustering them;
- real time assessment of the impact of the performed traffic regulation, configuration changes.

**Traffic Flow
Reconstruction**

**Firenze
Santiago de
Compostela
Modena
Pisa
Livorno
Fi-Pi-Li**

The following figure depicts an example of the usage of Traffic Flow exploited for the computing of the prediction on NOX and thus used in the What-If analysis.



<https://www.snap4city.org/dashboardSmartCity/view/index.php?iddashboard=MjE5MA==>

Please note that, in the context mobility and transport we have developed in different contexts:

- Smart Parking solution, with precision higher of 97%
- Computation of General city traffic flows entering/exiting of the city
- Computation of average delay on Public Bus transportation with respect to the official schedule
- Clustering of road accidents in the city/region
- mobility Demand vs transportation offer analysis
- Wi-Fi people flow predictions (high precision)
- Routing, multimodal and conditional routing, ...

The above solutions can be tested on Snap4City Dashboards which are publicly accessible from <https://www.snap4city.org>, and from the mobile Apps: Toscana What Where ... Km4City, Toscana in a Snap. In the Dashboards, you can zoom and see the traffic flow details.

Stimulations in this direction have been performed by using the Km4City Mobile App in collaboration with ATAF, BusItalia and CTTnord public transportation operator in Tuscany.

Other examples and connected scenarios:

- Traffic Flow reconstructions: <https://www.snap4city.org/dashboardSmartCity/view/index.php?iddashboard=MTc5NQ==>
- What If analysis dashboard online help: <https://www.snap4city.org/521>
- Data Analytics: the cases of Antwerp and Helsinki, and general views: <https://www.snap4city.org/524>
- Balancing of traffic in Florence, ingoing and outgoing flows: <https://www.snap4city.org/dashboardSmartCity/view/index.php?iddashboard=MTc2MQ==>
- Dashboard on Mobility on Florence: <https://www.snap4city.org/dashboardSmartCity/view/index.php?iddashboard=OTA5>
- Dashboard on mobility Pisa: <https://www.snap4city.org/dashboardSmartCity/view/index.php?iddashboard=MjUy>
- Dashboard Life in Toscana with Origin Destination matrices: <https://www.snap4city.org/dashboardSmartCity/view/index.php?iddashboard=MTc3NA==>
- P. Bellini, S. Bilotta, P. Nesi, M. Paolucci, M. Soderi, "Traffic Flow Reconstruction from Scattered Data", IEEE SMARTCOMP, IEEE international conference on smart computing, 18-20 June, Taormina, Sicily, Italy. 2018 <https://ieeexplore.ieee.org/abstract/document/8421365/>
- P. Bellini, S. Bilotta, P. Nesi, M. Paolucci, M. Soderi, "Real-Time Traffic Estimation of Unmonitored Roads", IEEE-DataCom'2018, Athen, 2018 <https://ieeexplore.ieee.org/abstract/document/8512000>
- C. Badii, P. Nesi, I. Paoli, "Predicting available parking slots on critical and regular services exploiting a range of open data", IEEE Access, 2018, <https://ieeexplore.ieee.org/abstract/document/8430514/>

What-IF Analysis

Dynamic Routing

Smart Parking

Offer vs Demand Analysis



Extended version accessible from: <https://www.snap4city.org/533>

Contact: <https://www.snap4city.org>

Partners: Regione Toscana, Firenze Città Metropolitana