UNIVERSITÀ DEGLI STUDI FIRENZE | DINFO DIPARTIMENTO DI INGEGNERIA DELL'INFORMAZIONE | DISIT DISTRIBUTED SYSTEMS AND INTERNET TECHNOLOGIES LAB

SNAP4CITY

Powered by KM4CITY

DISIT Lab activities: predictions and What-if analysis

https://www.Snap4City.org

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https://www.Km4City.org
https://www.disit.org

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Some DISIT Projects

MobiMart: mobility in the mediterraneous

Herit-Data: Tourism and Mng. https://herit-data.interreg-med.eu/

Snap4City: IOT/IOE smart city www.snap4city.org

Trafair: CEF project with several Cities http://trafair.eu/

REPLICATE H2020, SCC1, EC flagship
http://replicate-project.eu/

Feedback: retail and GDO Big Data analytics

Sii-Mobility SCN MIUR: http://www.sii-mobility.org

5G with 3G-Wind, Open Fiber, Estra

ENELX, ISPRA JRC, SODA, WEEE Life, etc…

Mosaic: Mobility and transport model

Km4City: http://www.km4city.org

Coll@bora Social Innovation, MIUR:
http://www.disit.org/5479

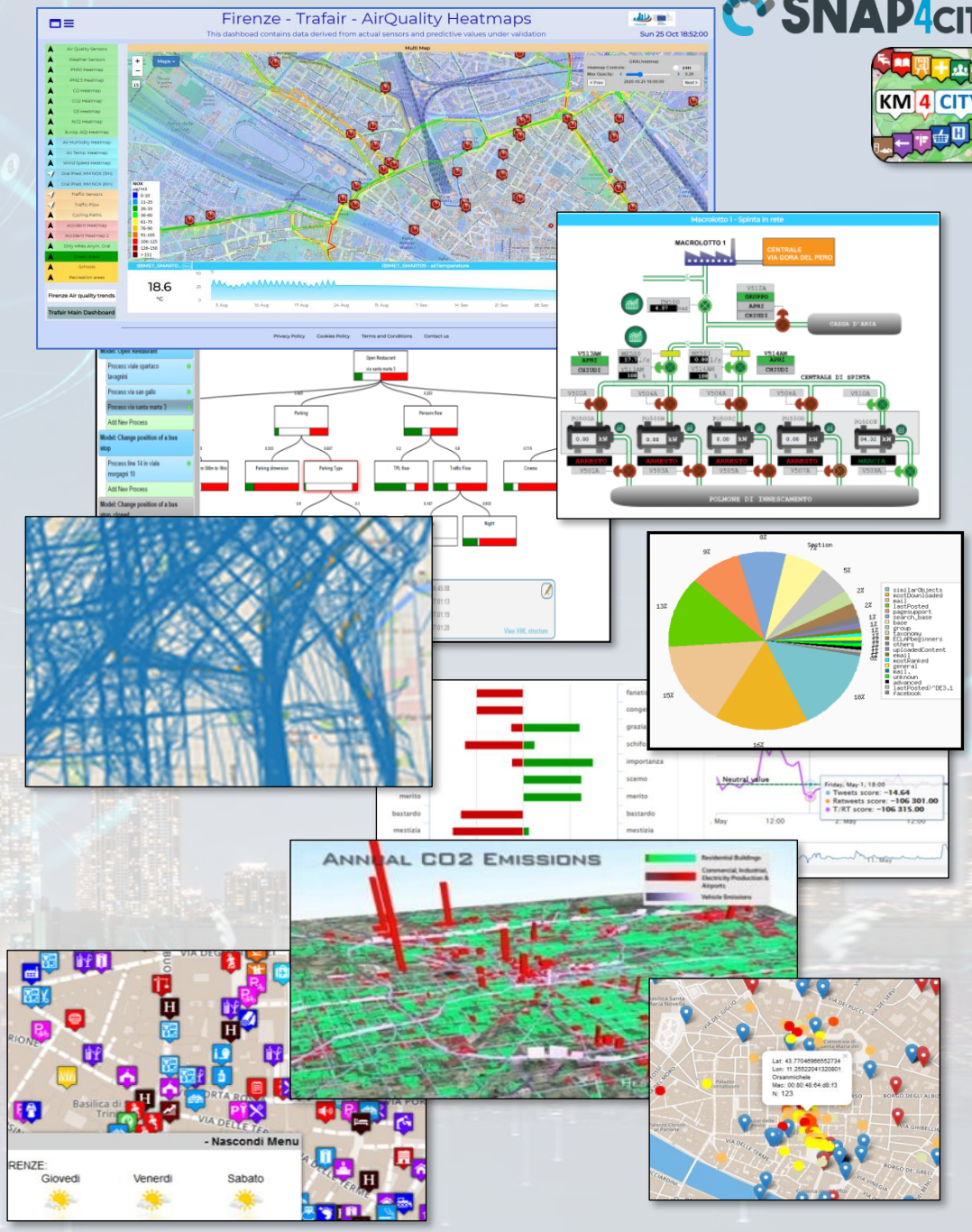
RESOLUTE H2020, EC:
http://www.resolute-eu.org

TRACE-IT, RAISSS, TESYSRAIL, …

Mobile Emergency:

Data Driven Decision Support

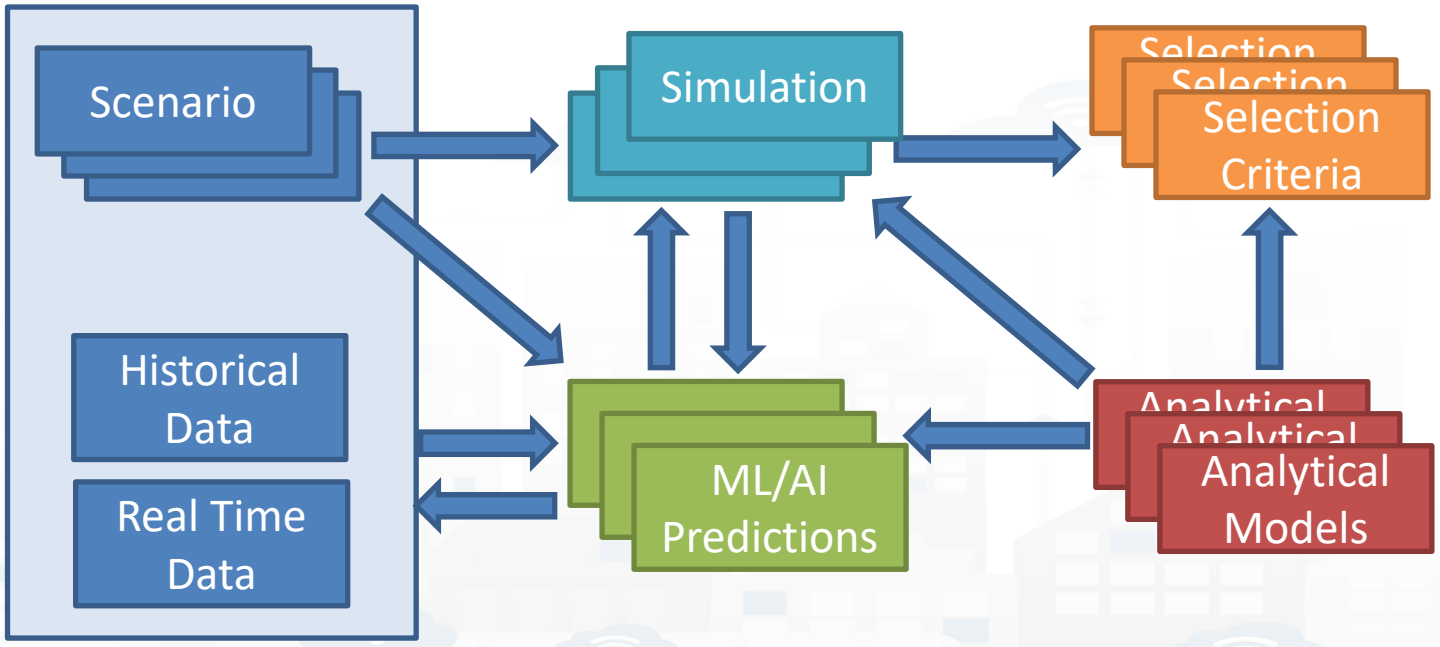
- Decision Support system
- Assessment / Strategies
- Data Rendering, visual analytics
- Data Analytics
- Data aggregation, Storage, indexing
- Data Ingestion



What-if: what is going to happen if …. this and that

- **What is going to happen at:**
  - People, Economy, Society, ..
  - Traffic, Pollutant, Parking, structures
  - Equipment, .. …
- **if certain unexpected events would occur**
  - Scenario definition
  - Guessing future data…
- **Taking into account**
  - Historical Data
  - Real Time Data
  - Contextual data

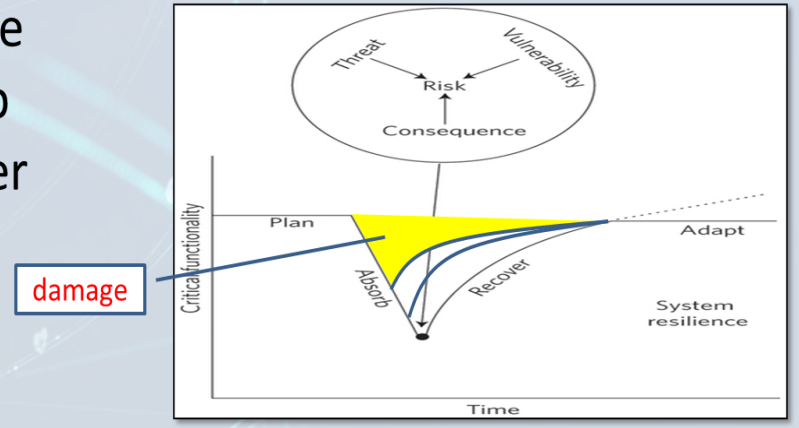
Decision Support System
KPI, Optimization
Visual Analytic: animations

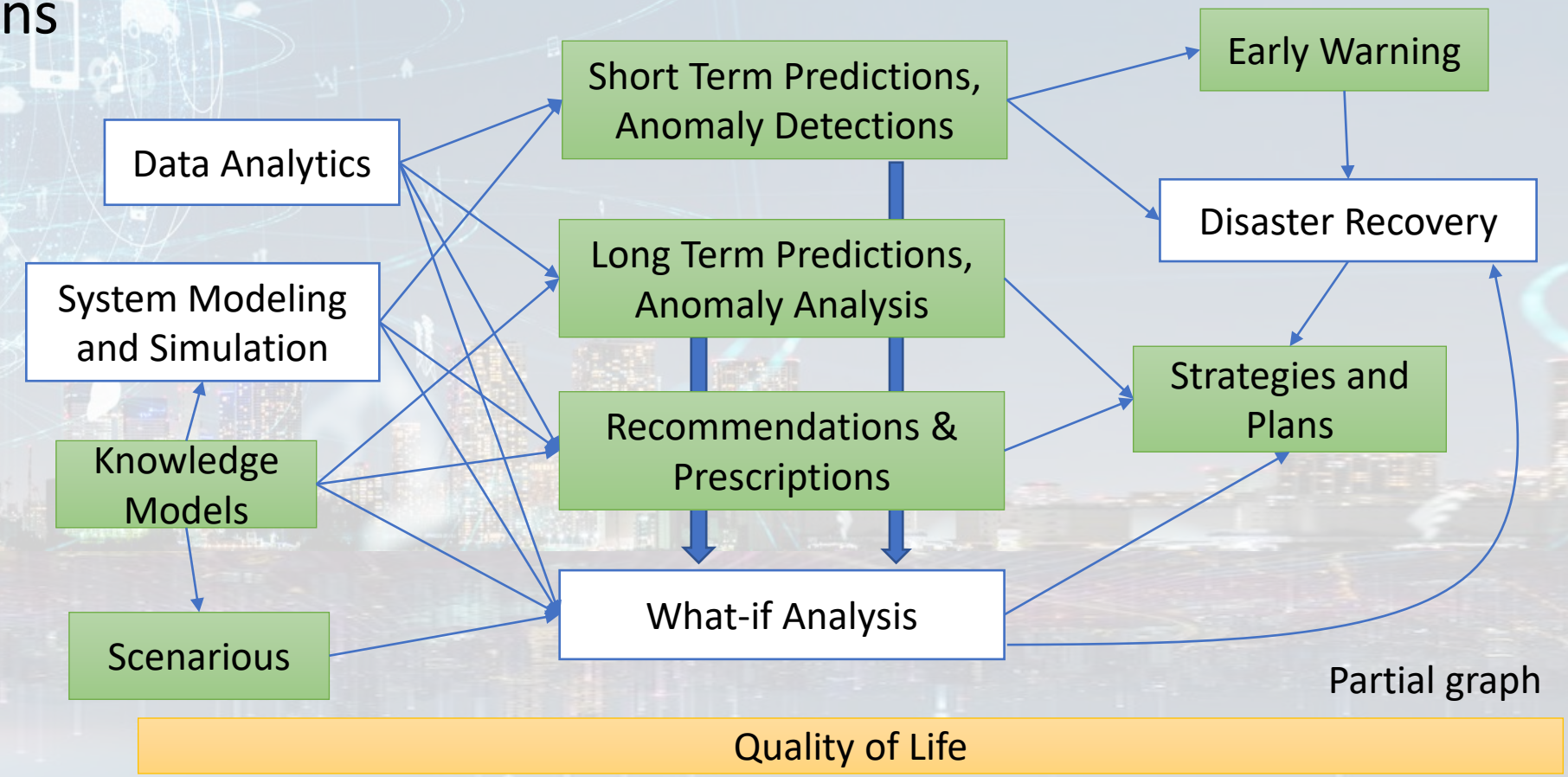


Objectives

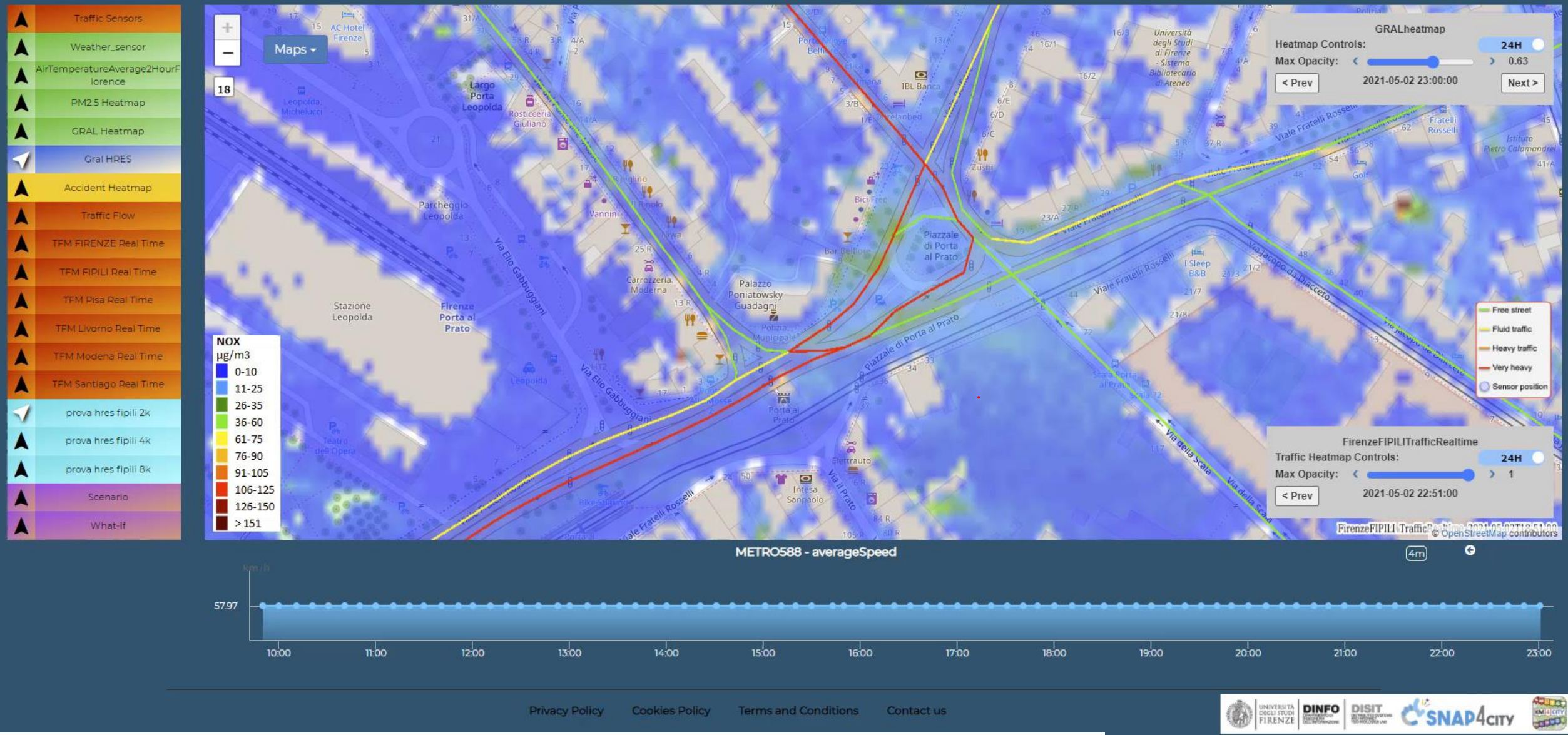
- Decision support systems
- Improvement of life quality
- Sustainable Solutions
- Reduction of costs
- Resilience

Prepare
Absorb
Recover
Adapt





Traffic Flow Manager on multiple cities



https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MzEyNg==

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Knowledge Base
Semantic Reasoners

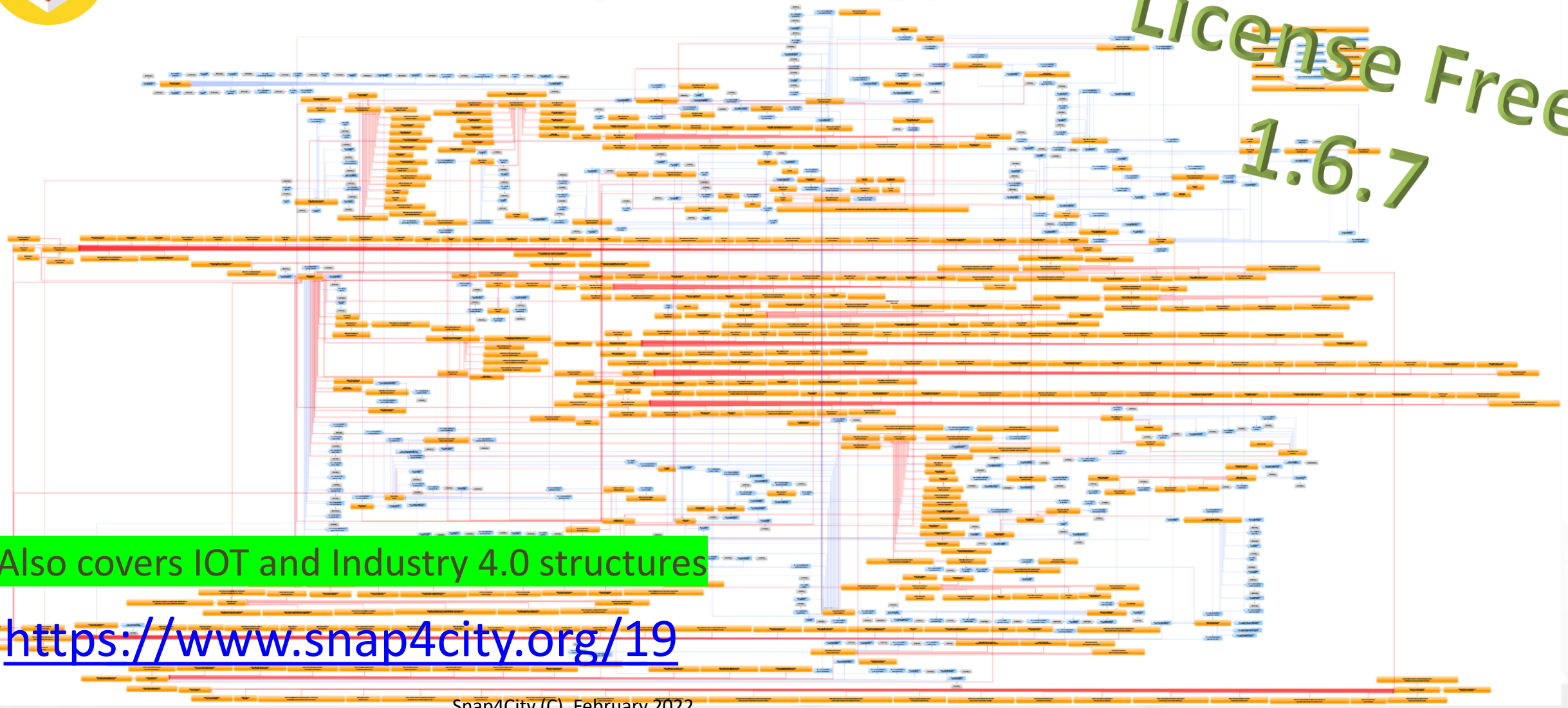
SNAP4CITY

100% OPEN SOURCE

Smart-city Ontology km4city

License Free

1.6.7



Also covers IOT and Industry 4.0 structures

https://www.snap4city.org/19

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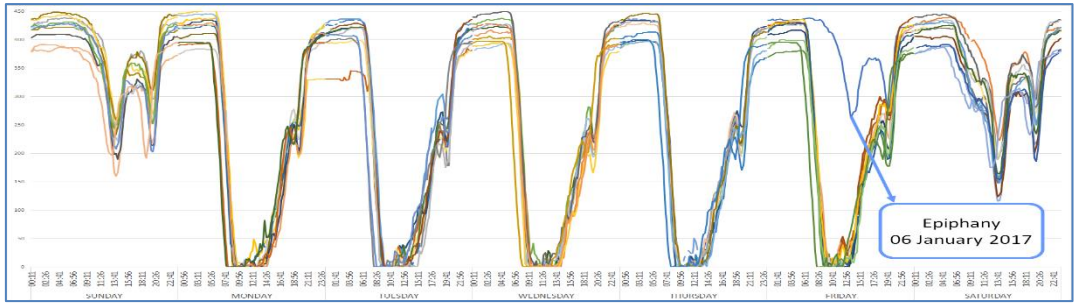
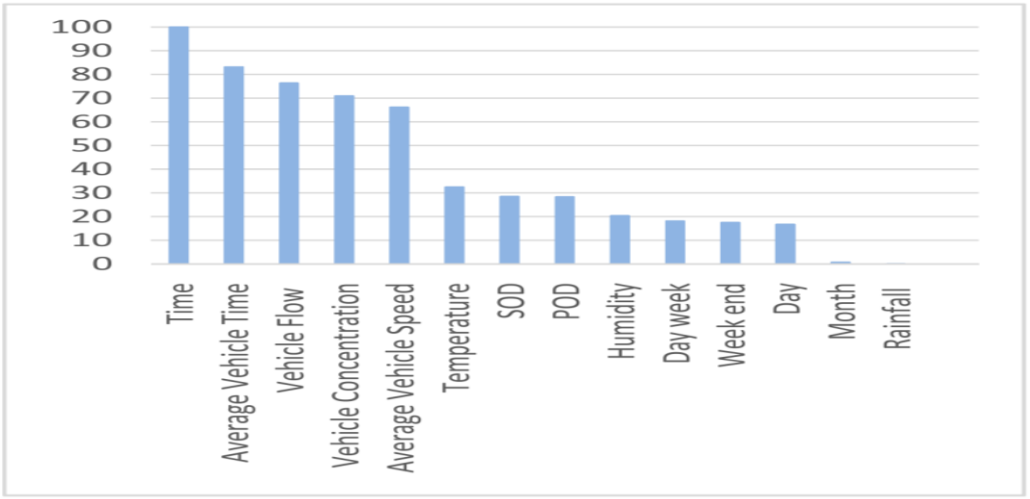
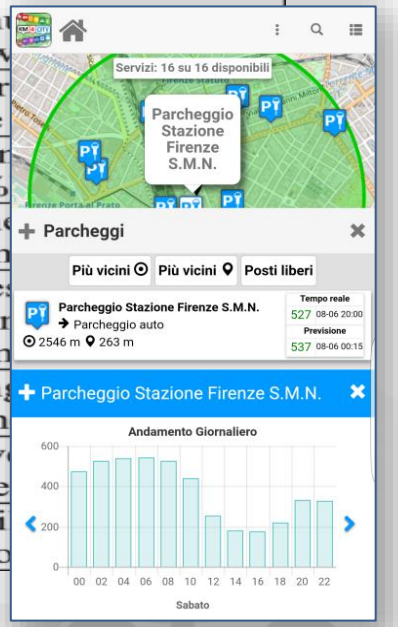
Free Parking PREDICTIONS



Category	Features	Description of features variable
Baseline features of free slot data	Free parking slots	Real number of available slots recorded every 15 minutes
	Time	Hours and minutes
	Month	Month of the year (1-12)
	Day	Day of the month (1-31)
	Day week	Day of the week (0-6)
	Weekend	0 for working days, 1 else
	Previous observation's difference (POD)	Difference between the number of free spaces at time i and number of free spaces at time (i − 15 minutes) recorded in the previous week
	Subsequent observation's difference (SOD)	Difference between the number of free spaces at time i, and the number of free spaces at time (i + 15 min in the previous w
Weather features	Temperature	City temperature measur earlier than Time
	Humidity	City humidity measured or than Time (%
	Rainfall	City rainfall measured on than Time (mn
Traffic Sensors features	Average Vehicle Speed	Average speed of vehicles being closest to the parkir hour period (km
	Vehicle Flow	Number of vehicles passing the parking, over one-h
	Average Vehicle Time	Average of distance betw over one-hour pe
	Vehicle Concentration	Number of vehicles per ki one-hour perio

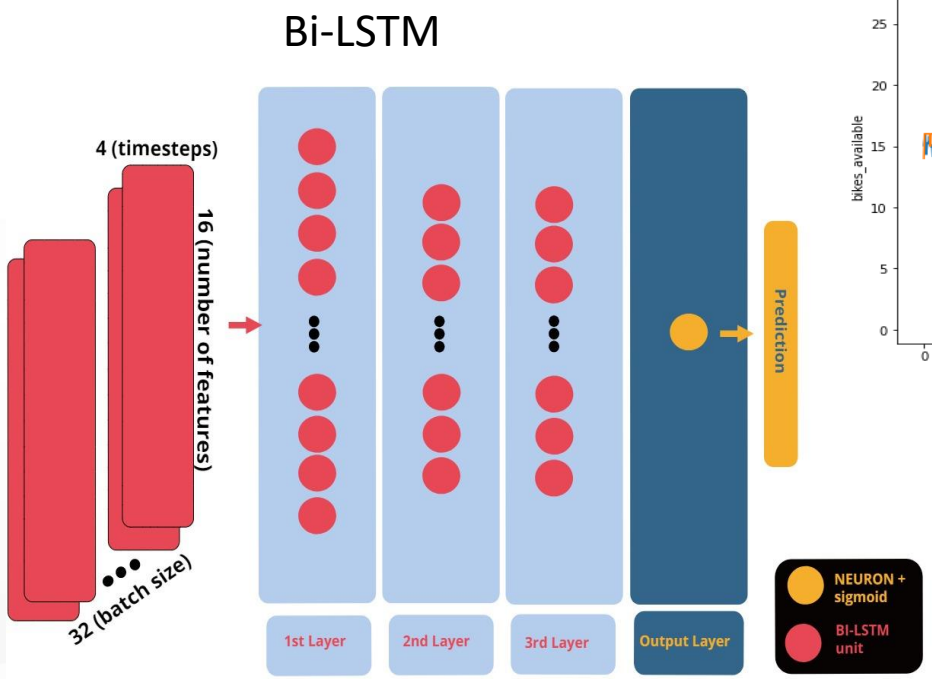
Relevance of Variables

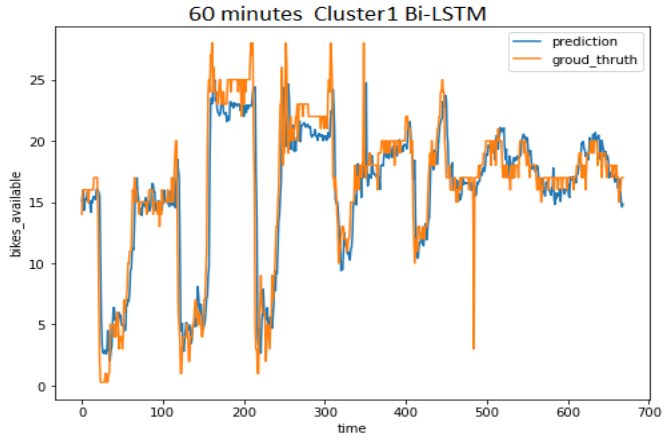




C. Badii, P. Nesi, I. Paoli, "Predicting available parking slots on critical and regular services exploiting a range of open data", IEEE Access, preprint, 2018
https://ieeexplore.ieee.org/abstract/document/8430514/

Deep Learning for Short-Term Prediction of Available Bikes on Bike-Sharing Stations



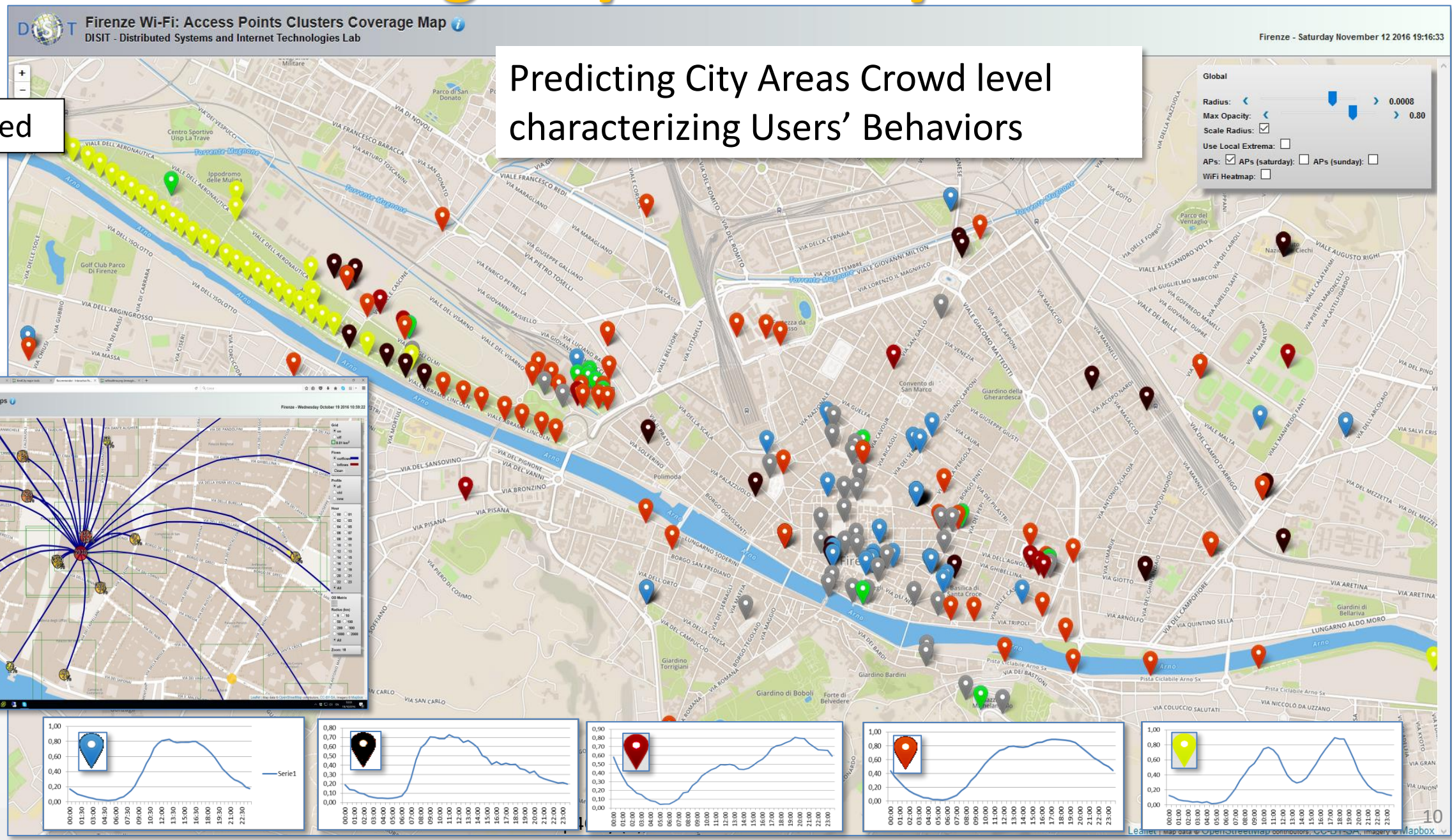


E. Collini, P. Nesi and G. Pantaleo, "Deep Learning for Short-Term Prediction of Available Bikes on Bike-Sharing Stations," in *IEEE Access*, vol. 9, pp. 124337-124347, 2021, doi: 10.1109/ACCESS.2021.3110794.
https://ieeexplore.ieee.org/abstract/document/9530580

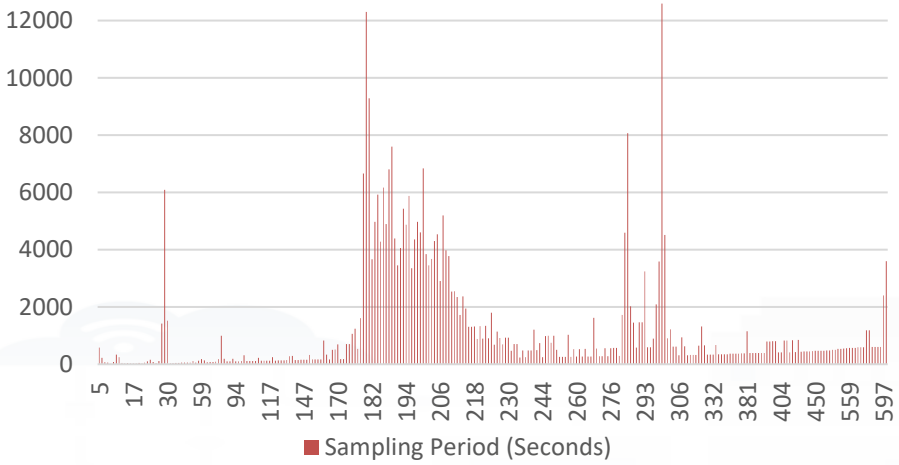
Characterizing City Areas by User Behavior

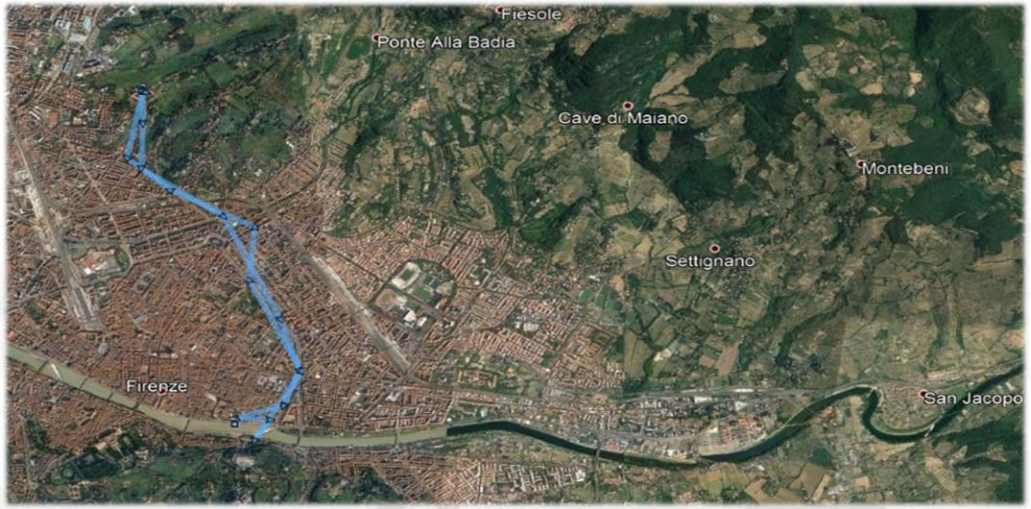
Wi-Fi based

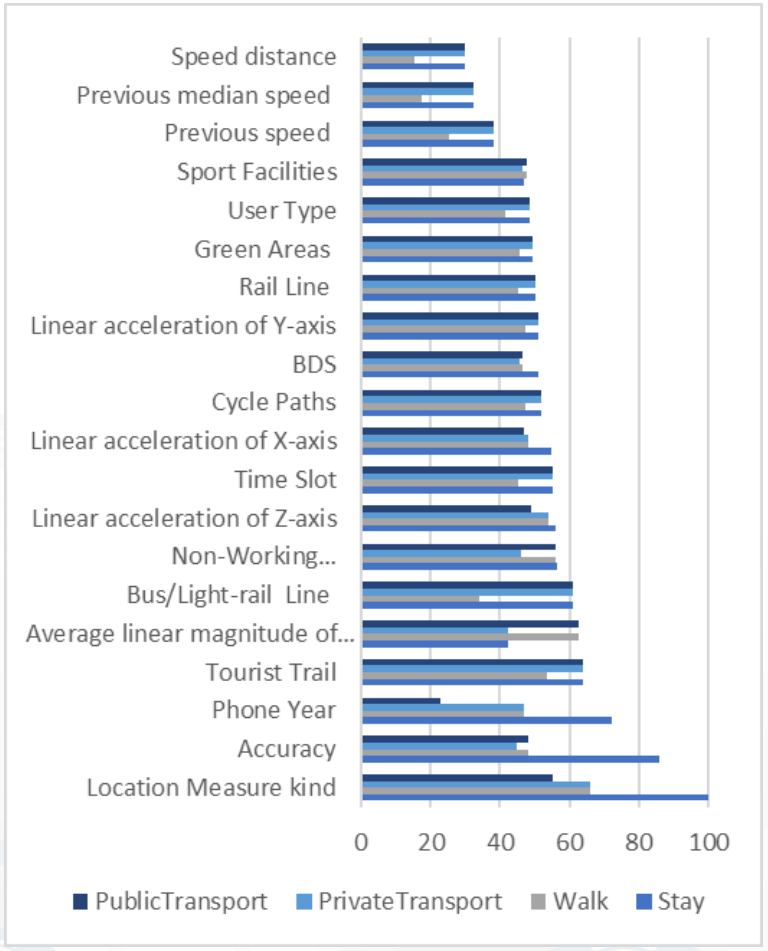
Predicting City Areas Crowd level characterizing Users' Behaviors



Automated Classification of Users' Transportation Modality in Real Conditions

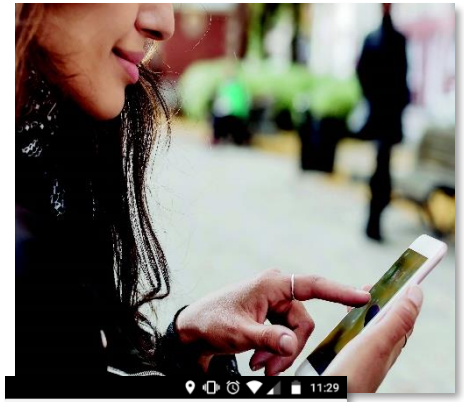


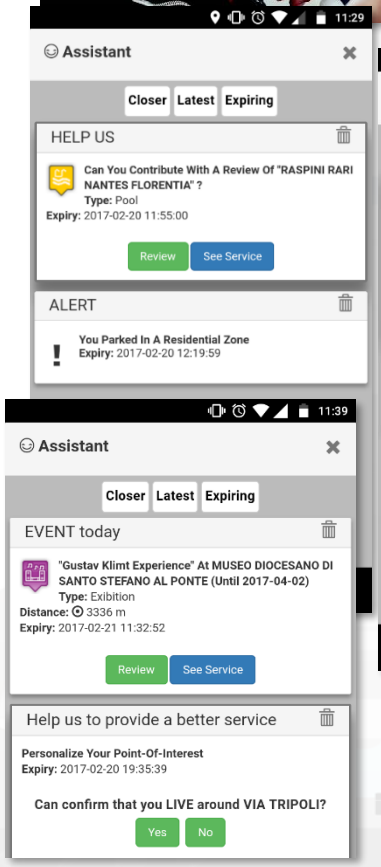


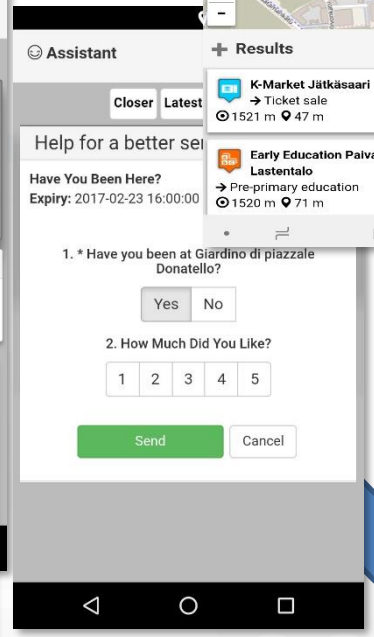


Badii, C., Difino, A., Nesi, P. *et al.* Classification of users' transportation modalities from mobiles in real operating conditions. *Multimedia Tools Appl* (2021). https://doi.org/10.1007/s11042-021-10993-y https://link.springer.com/article/10.1007/s11042-021-10993-y

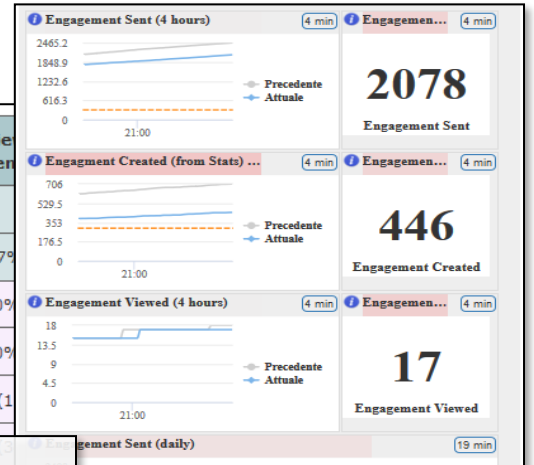
Users' Engagement







Rule name	Type	#sent	#viewed	#vie #sen
daily_event_de	ENGAGEMENT	1 (0%)	0 (0%)	0%
daily_event_en	ENGAGEMENT	1720 (2.12%)	70 (7.1%)	4.07%
	- commuter	5 (0.29%)	0 (0%)	0 (0%
	- student	14 (0.81%)	0 (0%)	0 (0%
	- tourist	1462 (85%)	25 (35.71%)	25 (1



Inform
- Air Quality forecast is not very nice
- You have parked out of your residential parking zone
- The Road cleaning is this night
- The waste in S.Andreas Road is full

Engage
- Provide a comment, a score, etc.

Stimulate / recommend
- Events in the city, services you may be interested, etc..

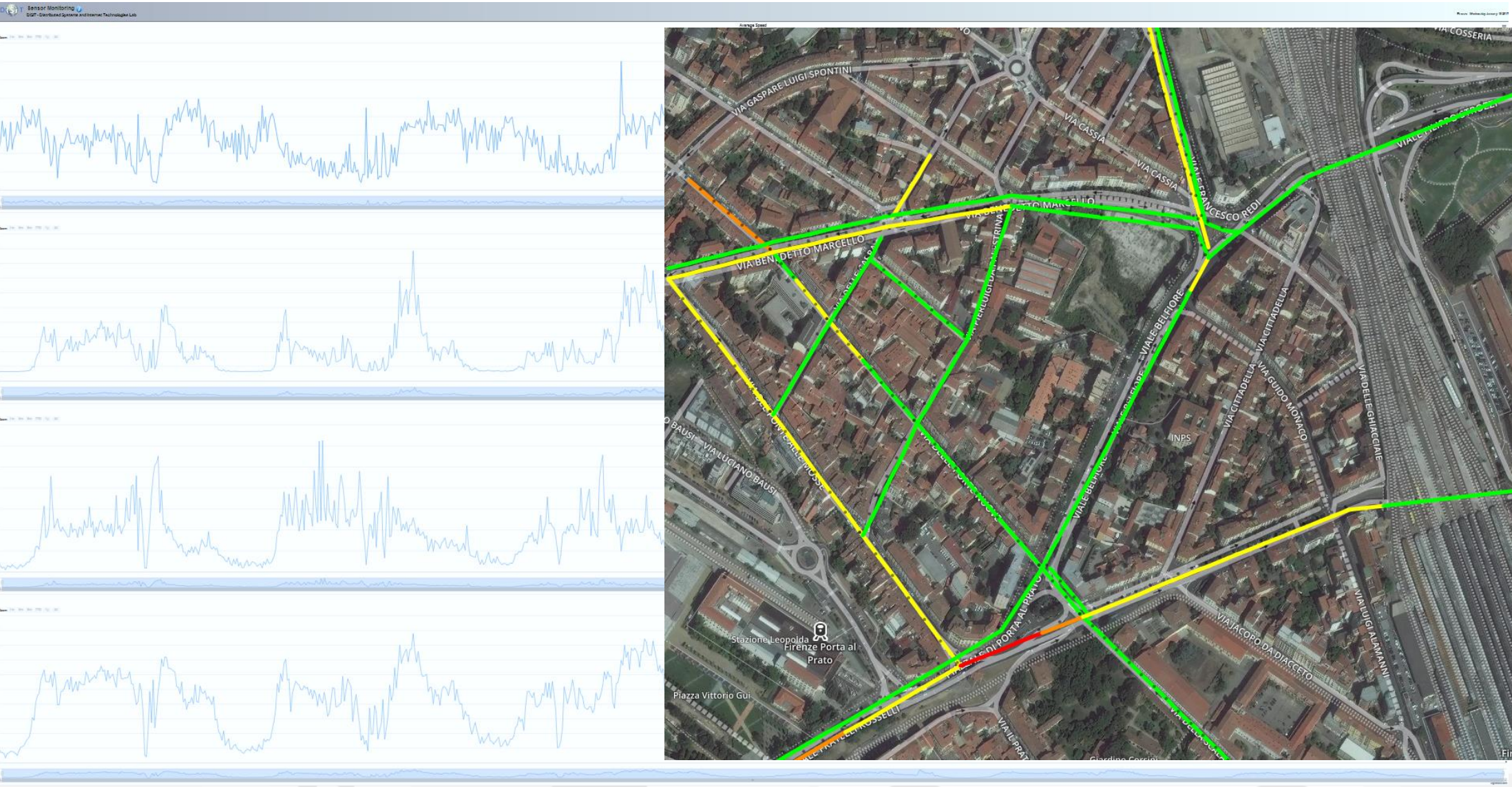
Provide Bonus, rewards if needed
- you get a bonus since you parked here
- We suggest: leave the car out of the city, this bonus can be used to by a bus ticket

User context

Rules

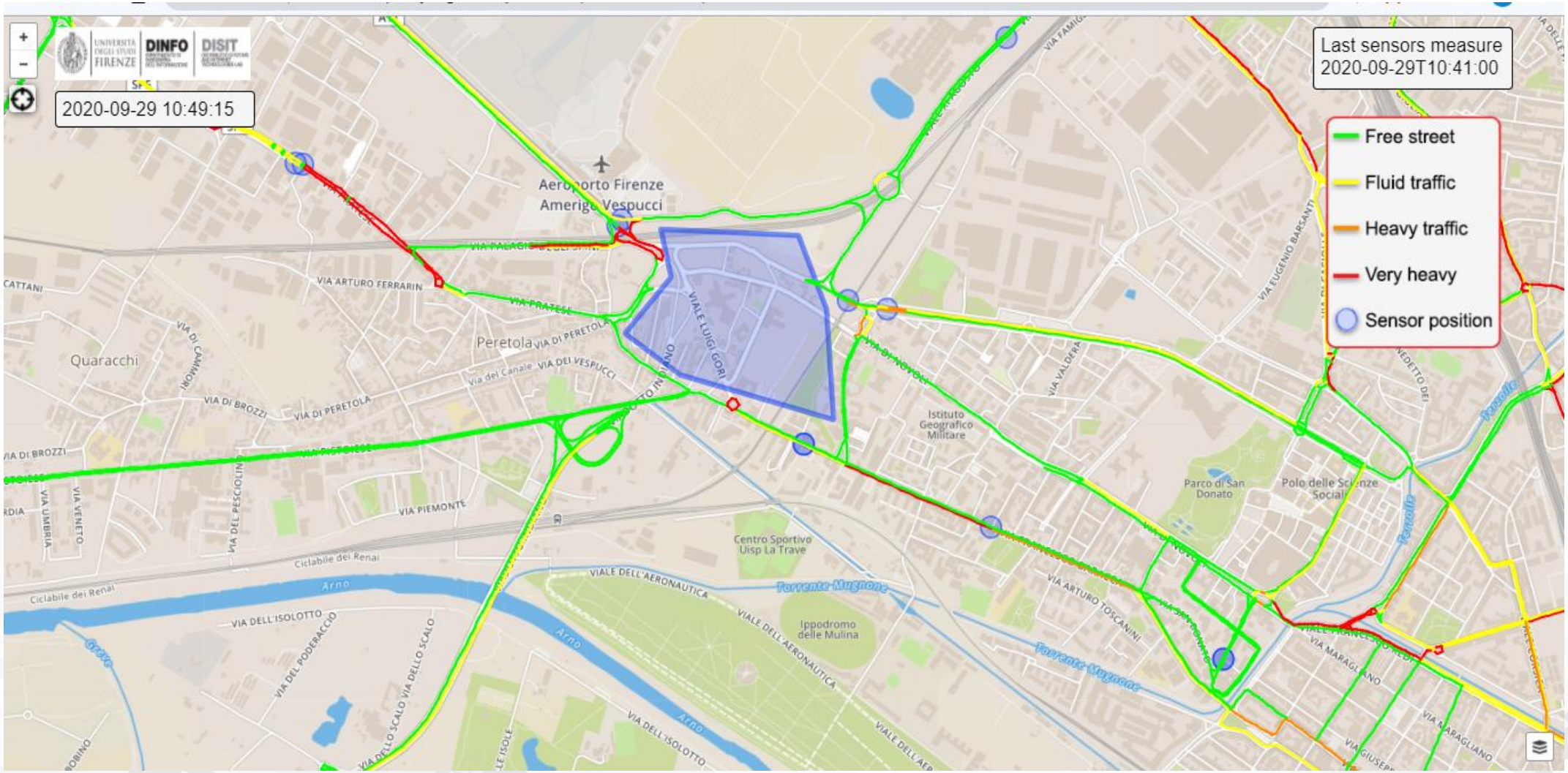
City context

Traffic Flow data

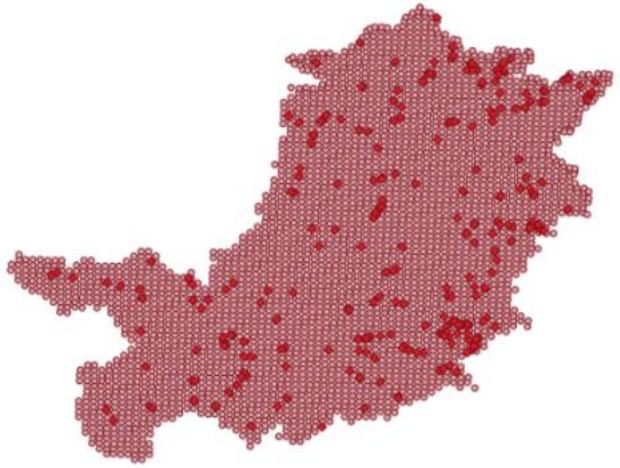


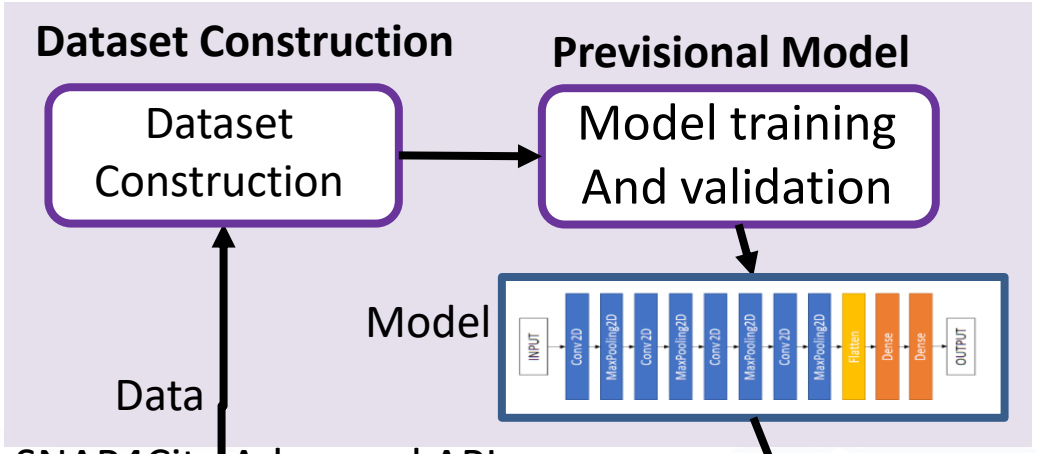
Stefano Bilotta, Paolo Nesi, **Traffic flow reconstruction by solving indeterminacy on traffic distribution at junctions**, Future Generation Computer Systems, Volume 114, 2021, Pages 649-660, ISSN 0167-739X, https://doi.org/10.1016/j.future.2020.08.017 .

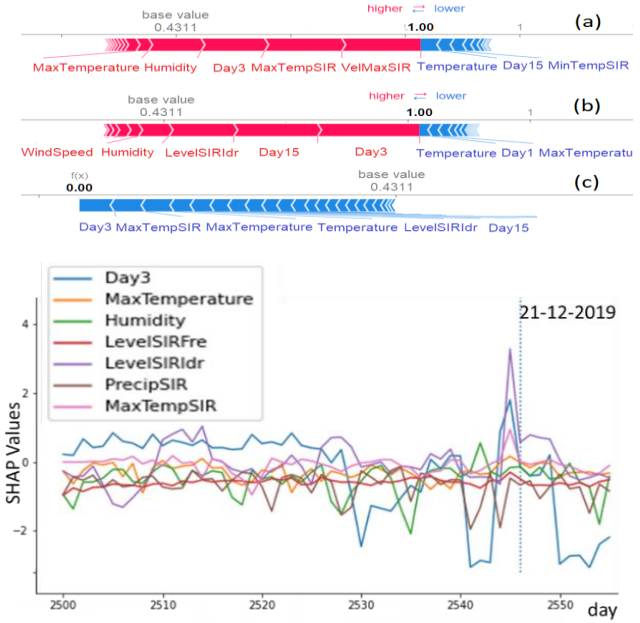
What it going to happen at traffic flow IF ….

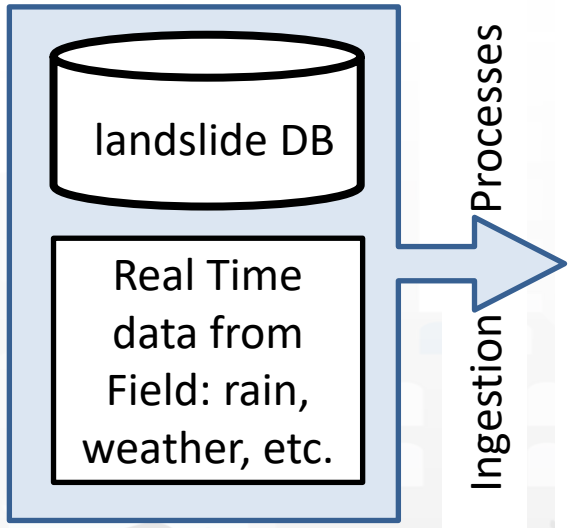


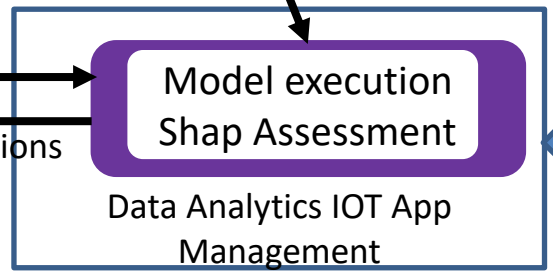
Predicting Land slides

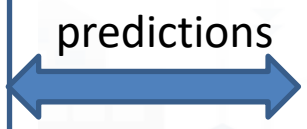










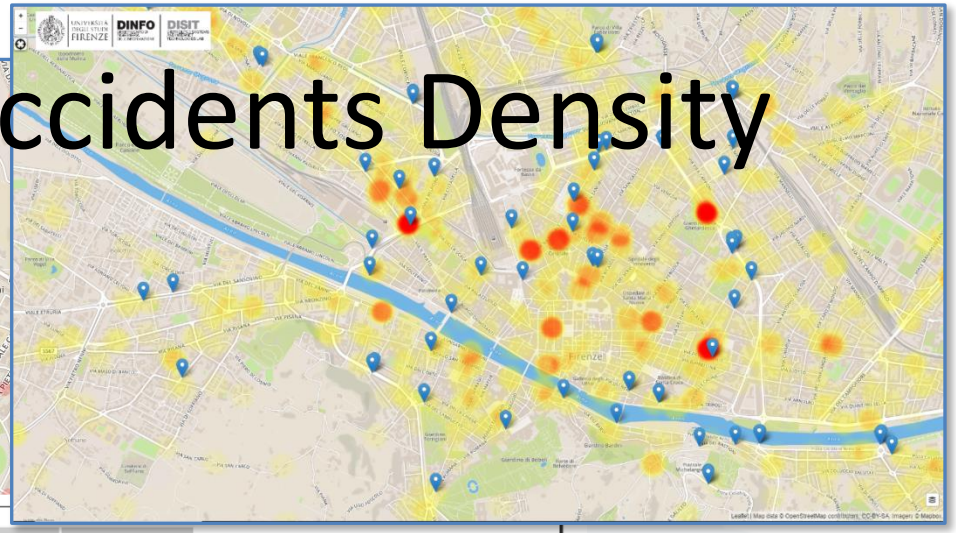


Snap4City Servers and Tools: Dashboard manager, Heatmap manager, GeoServer, Smart City API.

E. Collini, L. A. I. Palesi, P. Nesi, G. Pantaleo, N. Nocentini and A. Rosi, "Predicting and Understanding Landslide Events with Explainable AI," in *IEEE Access*, doi: 10.1109/ACCESS.2022.3158328.
https://ieeexplore.ieee.org/abstract/document/9732490

Anomaly Detection

Accidents Density

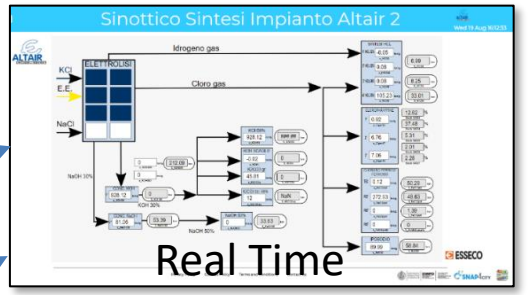


Accidents vs Traffic

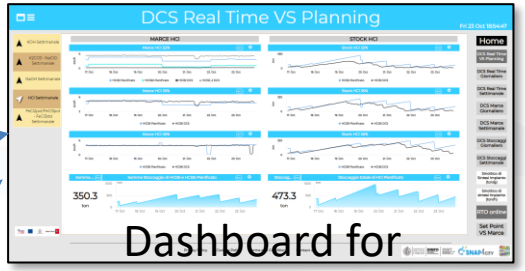
Date and Time	Anomaly
2018-07-01 02:00:00	12
2018-07-01 04:00:00	0
2018-07-01 19:40:00	480
2018-07-01 19:50:00	408

Predictive Maintenance

Plant Status



Real Time Production Synoptic



Dashboard for Production Control

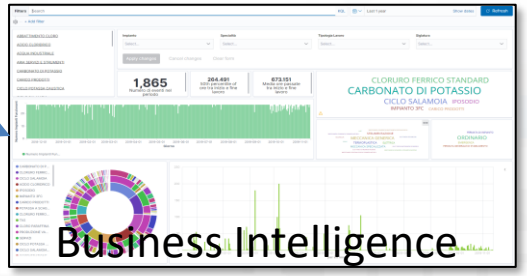
Control Supervisor

Business Logic

IoT App

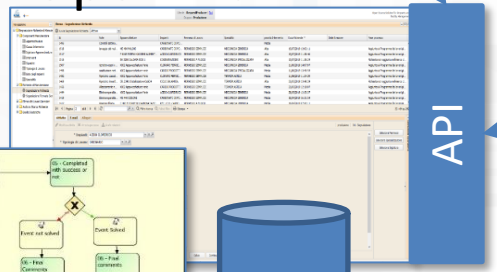
Data Storage

Elastic Search

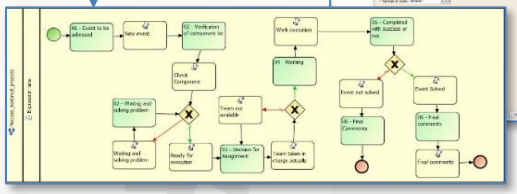


Business Intelligence Maintenance

OpenMaint



API



IoT App

IoT App

Business Logic 2

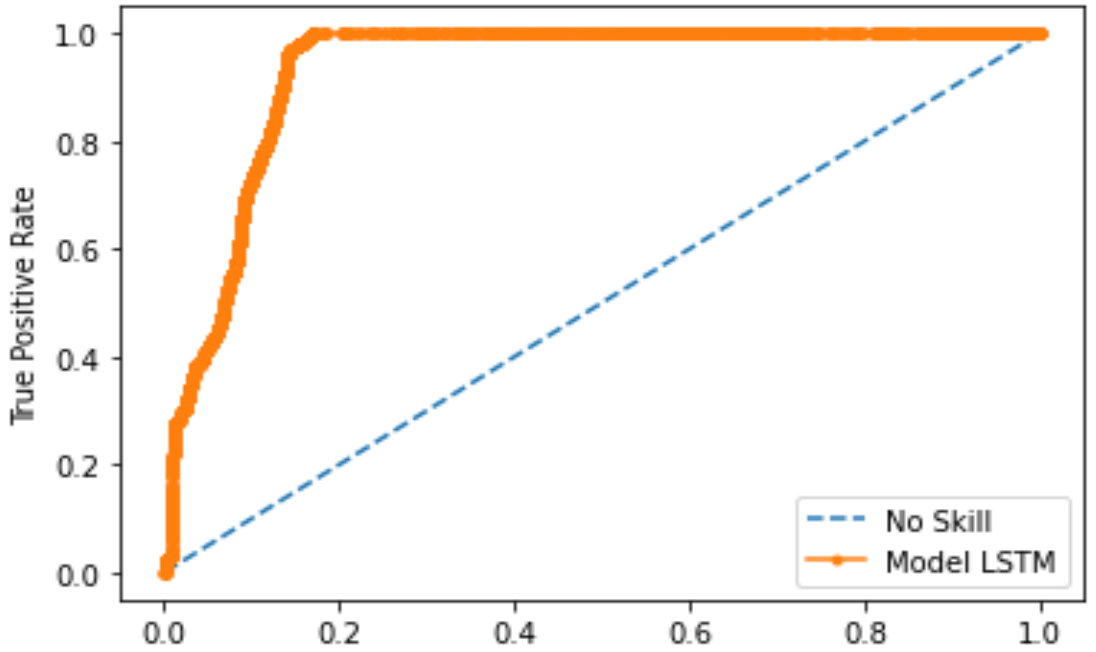
Predictive Maintenance

Predictive Training

Preditive capabilities

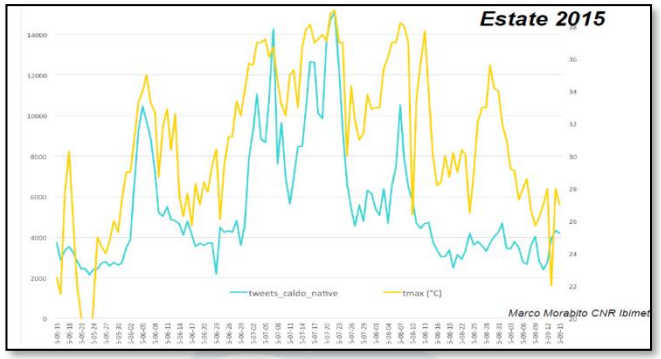
- Deep Learning: LSTM, CNN-LSTM approached
- Explainable AI: Identification of possible causes of fault

	Precision %	Recall %	F_1 score %
weighted avg	0.90	0.92	0.90



Prediction/Assessment

- Football game results as related to the volume of Tweets
- Number of votes on political elections, via sentiment analysis, SA
- Size and inception of contagious diseases
- marketability of consumer goods
- public health seasonal flu
- box-office revenues for movies
- places to be visited, most visited
- number of people in locations like airports
- audience of TV programmes, political TV shows
- weather forecast information
- Appreciation of services



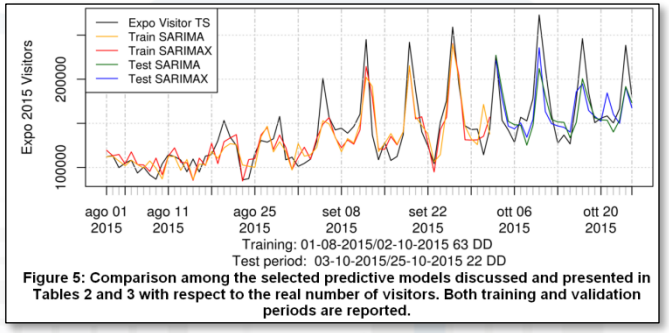
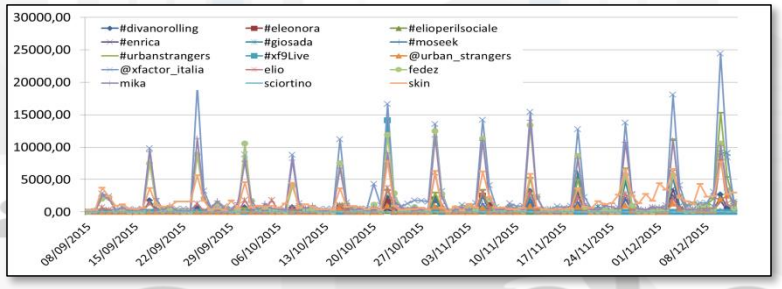
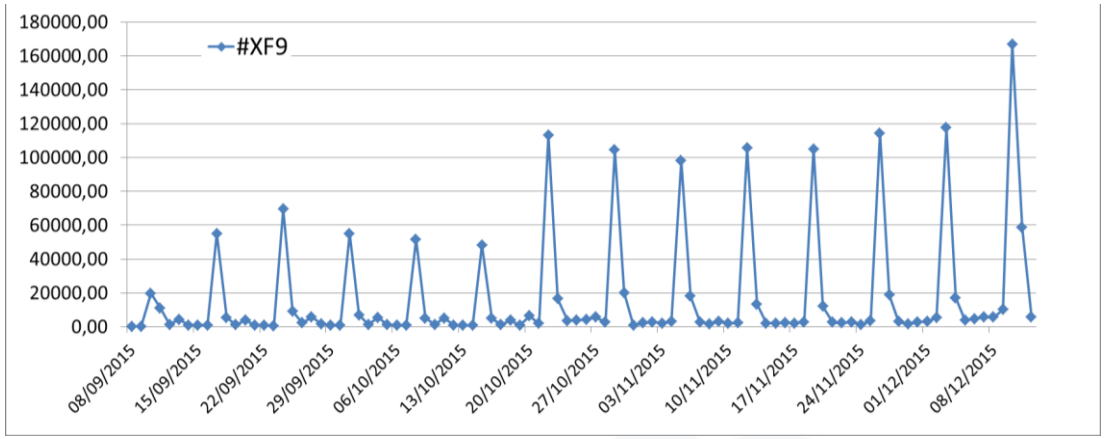


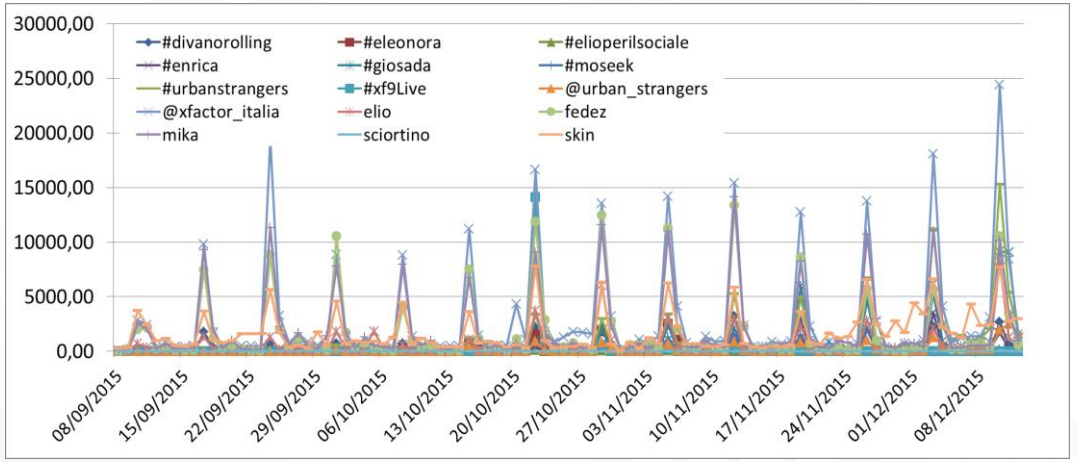
Figure 5: Comparison among the selected predictive models discussed and presented in Tables 2 and 3 with respect to the real number of visitors. Both training and validation periods are reported.

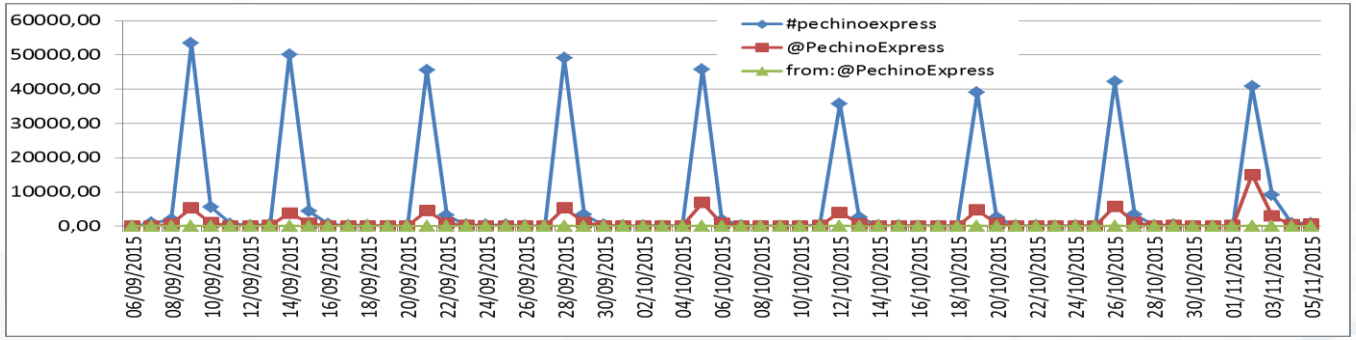


Predicting Audience: X-Factor, PechinoExpress, …

- Trend of TW and RTW for X-Factor 9
  - Several searches
- Similar model for other Social Intensive TV shows







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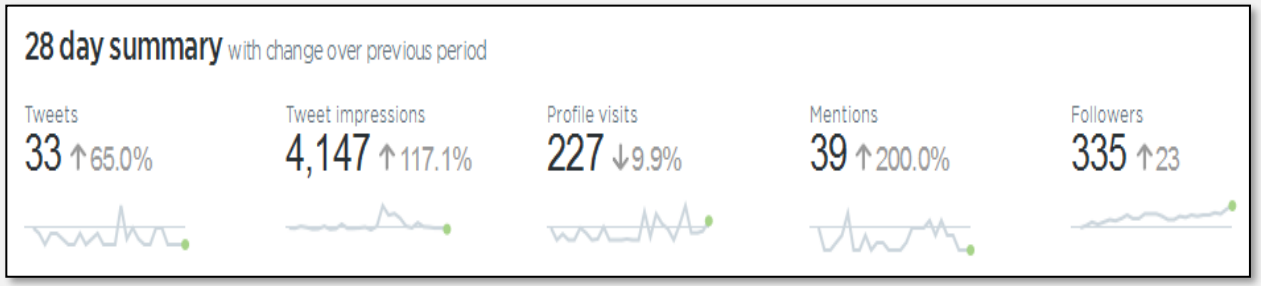
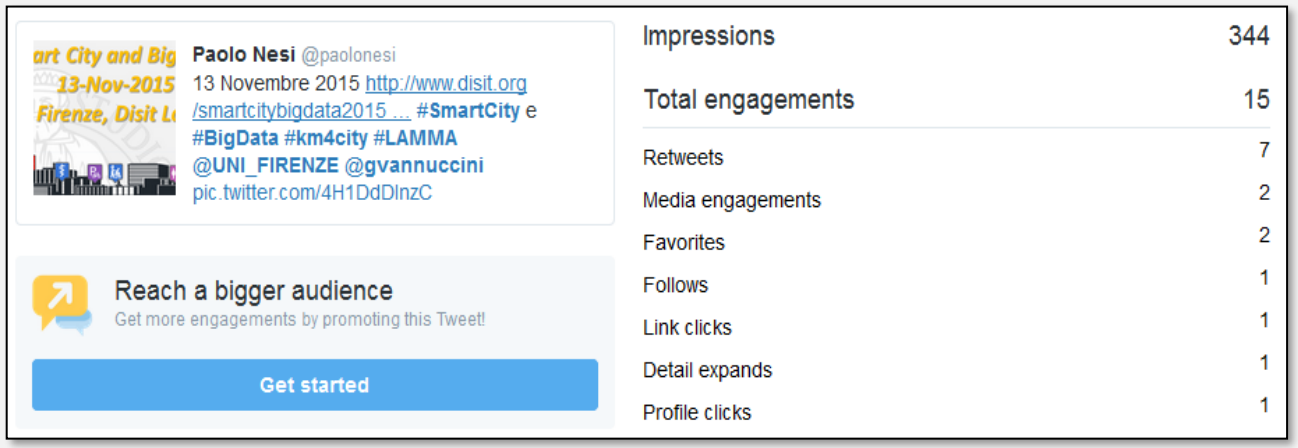
Twitter Vigilance

Assessing reTweet Proneness

- **Issue:**
  - How to understand if a tweet has a good probability of being retweeted?
- **Impact:**
  - Advertising, promotion, training
- **Several metrics related to**
  - Structure of the tweet
  - Features of the tweeting author
  - Relationships ….

Twitter Analytics





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Powered by FIWARE

FREE TRIAL

PEN Test Passed

EU GDPR COMPLIANT

SNAP4 Appliances and Dockers Installations

EUROPEAN OPEN SCIENCE CLOUD

Node-RED

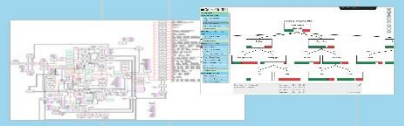
JS Foundation

E015 digital ecosystem

NVIDIA

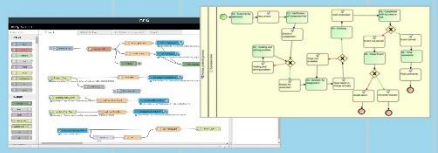
DASHBOARDS AND APPS - CONTROL ROOMS - DECISION SUPPORT SYSTEMS - WHAT-IF ANALYSIS - VISUAL ANALYTICS

PREDICTION - ANOMALY DETECTION - ENVIRONMENTAL MODEL - 3D MODEL
KPI - SIMULATION - EARLY WARNING - SYNOPTIC - DIGITAL TWIN - VIRTUAL REALITY



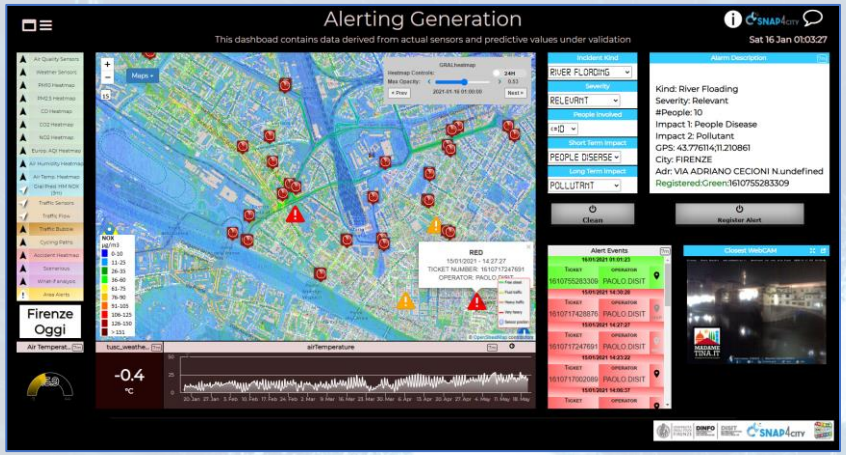
EXPERT SYSTEM
KNOWLEDGE BASE
STORAGE

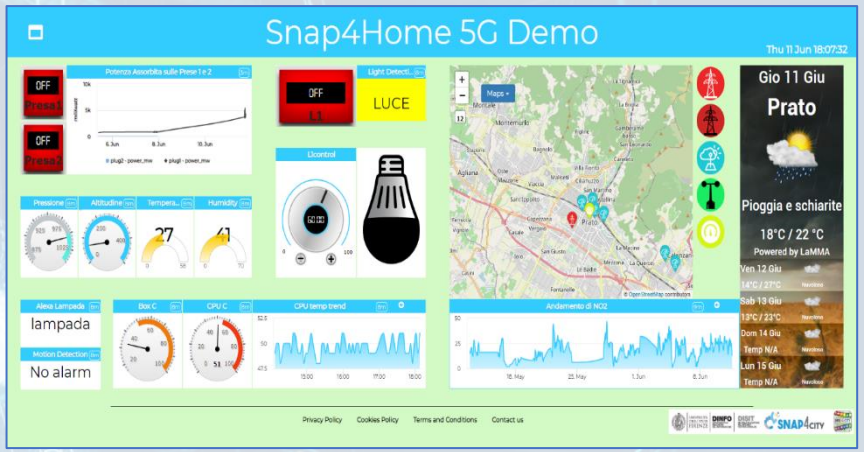
BIG DATA ANALYTICS
EXPLAINABLE ARTIFICIAL INTELLIGENCE
BUSINESS INTELLIGENCE
MACHINE LEARNING

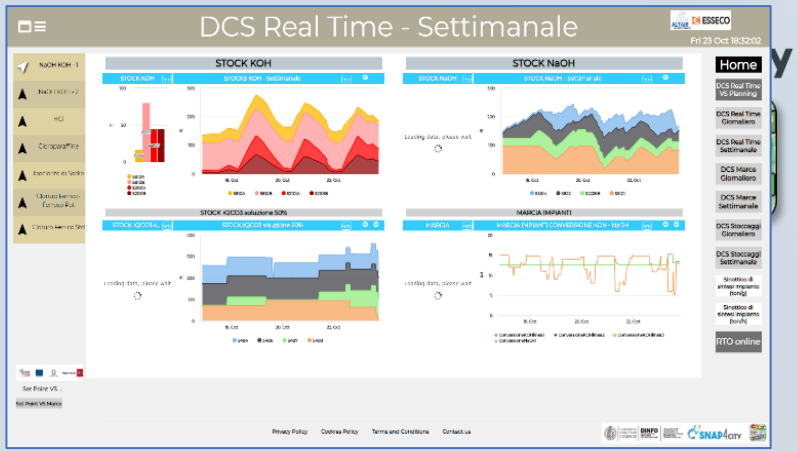


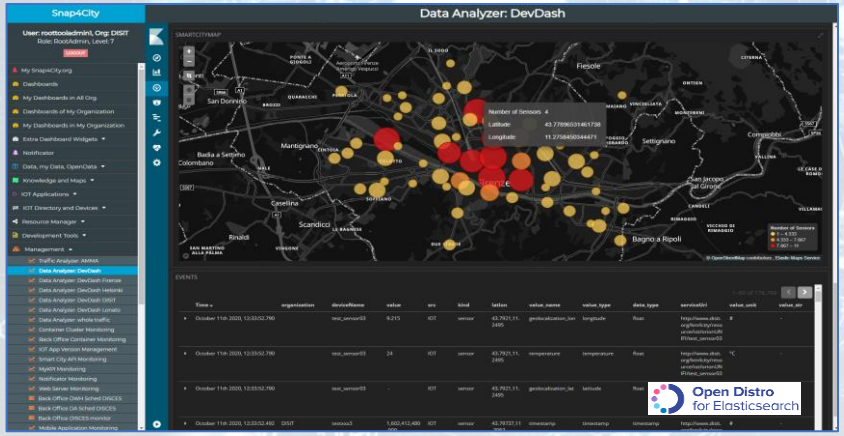
DATA FLOWS, DATA DRIVEN
WORKFLOWS, MICROSERVICES
PARALLEL DISTRIBUTED PROCESSING

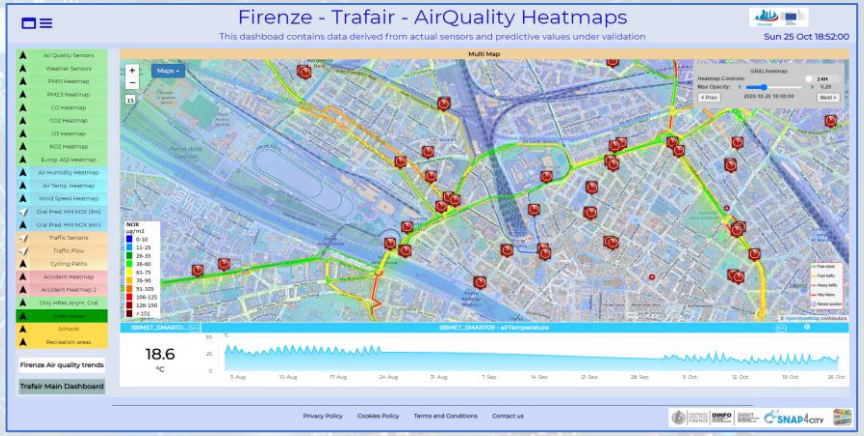
METHODOLOGIES
COURSES AND COMMUNITY
LIVING LABS
DEVELOPMENT TOOLS

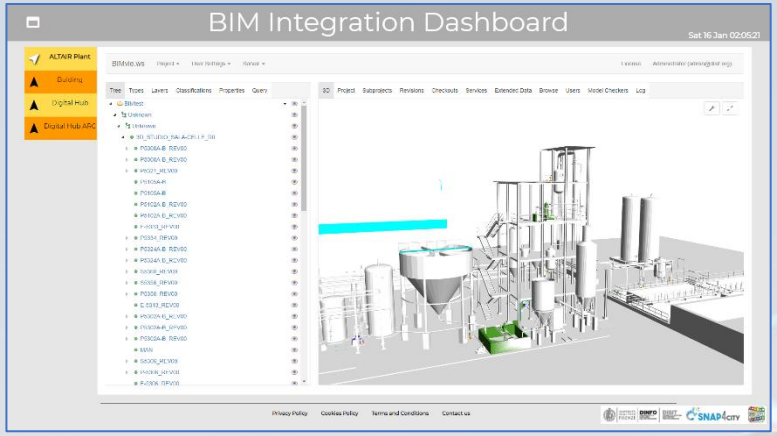

Alerting Generation
This dashboad contains data derived from actual sensors and predictive values under validation
Sat 16 Jan 01:03:27
Firenze Oggi
-0.4


Snap4Home 5G Demo
Thu 11 Jun 18:07:32
LUCE
lampada
No alarm
Gio 11 Giu
Prato
Pioggia e schiarite
18°C / 22 °C
Powered by LaMMA

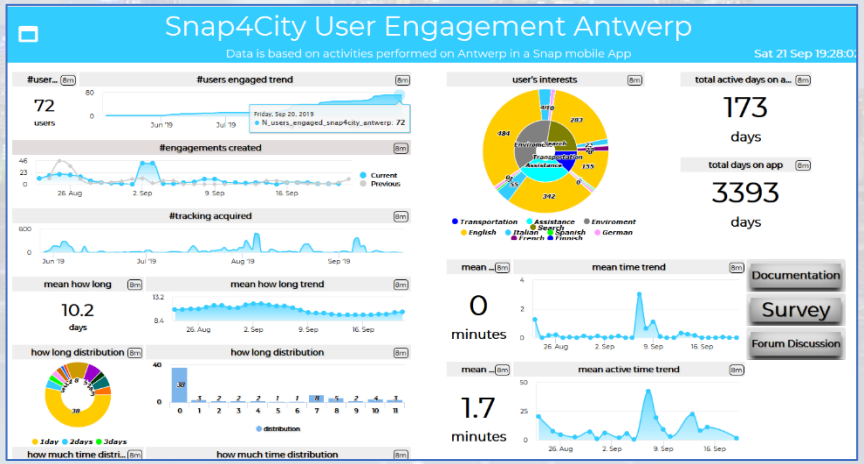

DCS Real Time - Settimanale
Fri 23 Oct 18:32:02
STOCK KOH
STOCK NaOH
Home

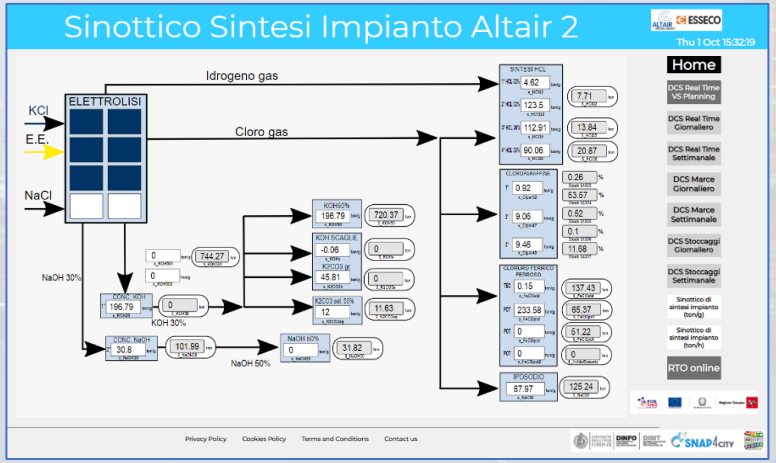

Snap4City
Data Analyzer: DevDash
Open Distro for Elasticsearch


Firenze - Trafair - AirQuality Heatmaps
This dashboad contains data derived from actual sensors and predictive values under validation
Sun 25 Oct 18:52:00
18.6


BIM Integration Dashboard
Sat 16 Jan 02:05:21


3D Multi Data Map - Digital Twin Global - Firenze
demonstrator
Wed 3 Nov 19:05:27
120


Snap4City User Engagement Antwerp
Data is based on activities performed on Antwerp in a Snap mobile App
Sat 21 Sep 19:28:0
72
users
173
days
3393
days
10.2
days
0
minutes
1.7
minutes
Documentation
Survey
Forum Discussion


Sinottico Sintesi Impianto Altair 2
Thu 1 Oct 15:32:19
Home
Idrogeno gas
Cloro gas
ELETTROLISI
KCl
E.E.
NaCl
NaOH 30%
KOH 30%
NaOH 50%

https://www.snap4city.org/577

On Line Training Material (free of charge)

	1st part (*)	2nd part (*)	3rd part (*)	4th part (*)	5th part (*)	6th part (*)	7th part (*)
what	General	Dashboards	IOT App, IOT Network	Data Analytics	Data Ingestion processes	System and Deploy Install	Smart City API: Web & Mob. App
PDF							
Inter active							
Video1							
Video2							
Video3							
Video4				none		none	none
duration	2:55	3:16	3:41	2:00	2:48	2:35	1:47