

Come i Big Data stanno trasformando la pianificazione dei trasporti

Urban Geo Big Data @Milano Digital Week
28 Maggio 2020

□ Systematica

transform
transport

Urban Informatics

Multi-disciplinary Methodology

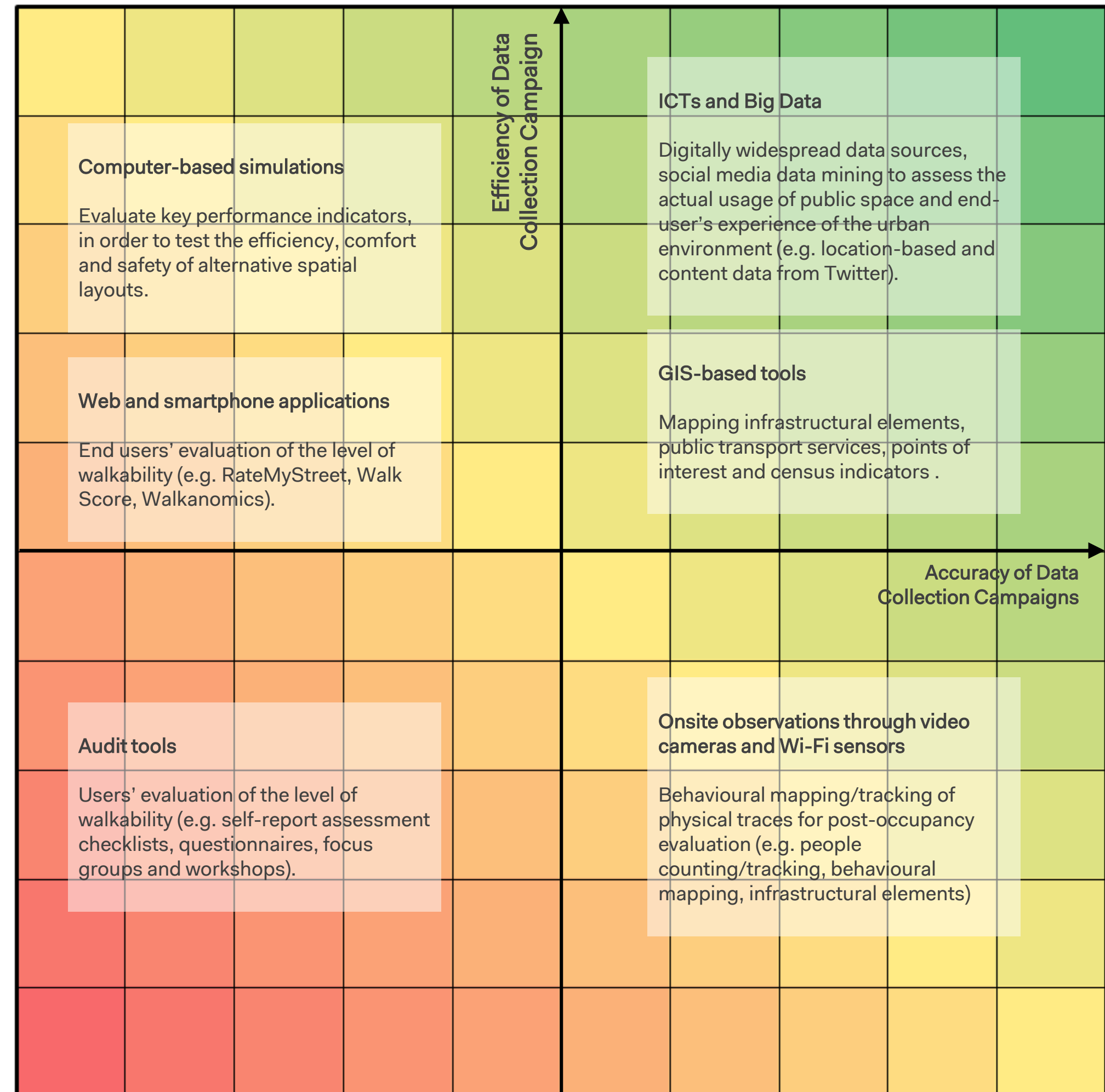
Urban Informatics (Foth et al., 2011) is becoming one of the most promising approaches for urban mobility and transport planning. This is based on the integration of relevant **multidisciplinary knowledge and skills** derived from traffic engineering, urban studies, social sciences and computer science.

Thanks to the recent development of advanced ICTs, the **Big Data** (combined with Thick Data) is becoming a valuable support to the activity of decision makers by **unveiling hidden movement patterns in the cities and specific target users' needs**.

"There are many definitions of 'big data' but one of the best I have heard, and I do not know who to attribute it to, is 'any data that cannot fit into an Excel spreadsheet'" (Batty, 2013).

Batty, M. (2013). Big data, smart cities and city planning. *Dialogues in human geography*, 3(3), 274-279.

Foth, M., Choi, J.H.j., Satchell, C. (2011). Urban informatics. In: *Proceedings of the ACM 2011 conference on Computer supported cooperative work*, pp. 1-8. ACM





DIAMOND

Revealing fair and actionable knowledge from data to support women's inclusion in transport systems

Addressing gender-specific needs in current and future transport systems

DIAMOND project analyses and converts data into knowledge with notions of impartiality to move towards a more inclusive and efficient transportation system from a gendered perspective.

The project makes use of data mining and analytics, together with the use of elicitation techniques, to identify and evaluate specific measures to achieve fair gender inclusiveness in different scenarios and promote female employment in the sector.

“ We envision **DIAMOND** becoming the platform of reference for transport planners, researchers and for the broader public, feeding the datasets and updating guidelines continuously, towards a universalization of the analysis outcomes. ”

www.diamond-project.eu
[@DIAMOND_H2020](https://twitter.com/DIAMOND_H2020)
info@diamond-project.eu



The project has received funding from the EU's Horizon 2020 programme. Grant N° 824326.

DIAMOND

Revealing fair and actionable knowledge from data to support women's inclusion in transport systems

A European reference tool for obtaining knowledge, recommendations and support to address gender-specific needs in Europe's current and future transport systems.



Railways and public multimodal transport

Research study on stations safety, accessibility and comfort from a gender perspective. Validation of the self-diagnose and DSS tool for infrastructure and transport service planning.

Automated vehicles

To guarantee women's inclusion generating guidelines for an empathic experience in autonomous passenger cars. Validate the DIAMOND model and toolkit for understanding emotional needs in autonomous vehicles with an inclusive approach.

Vehicle sharing

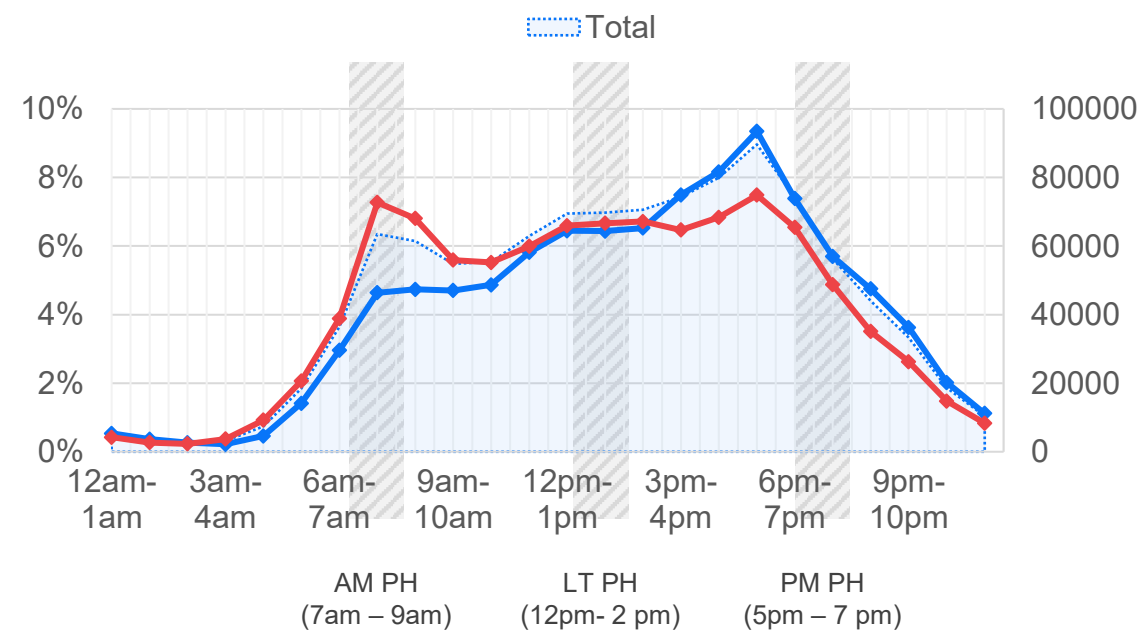
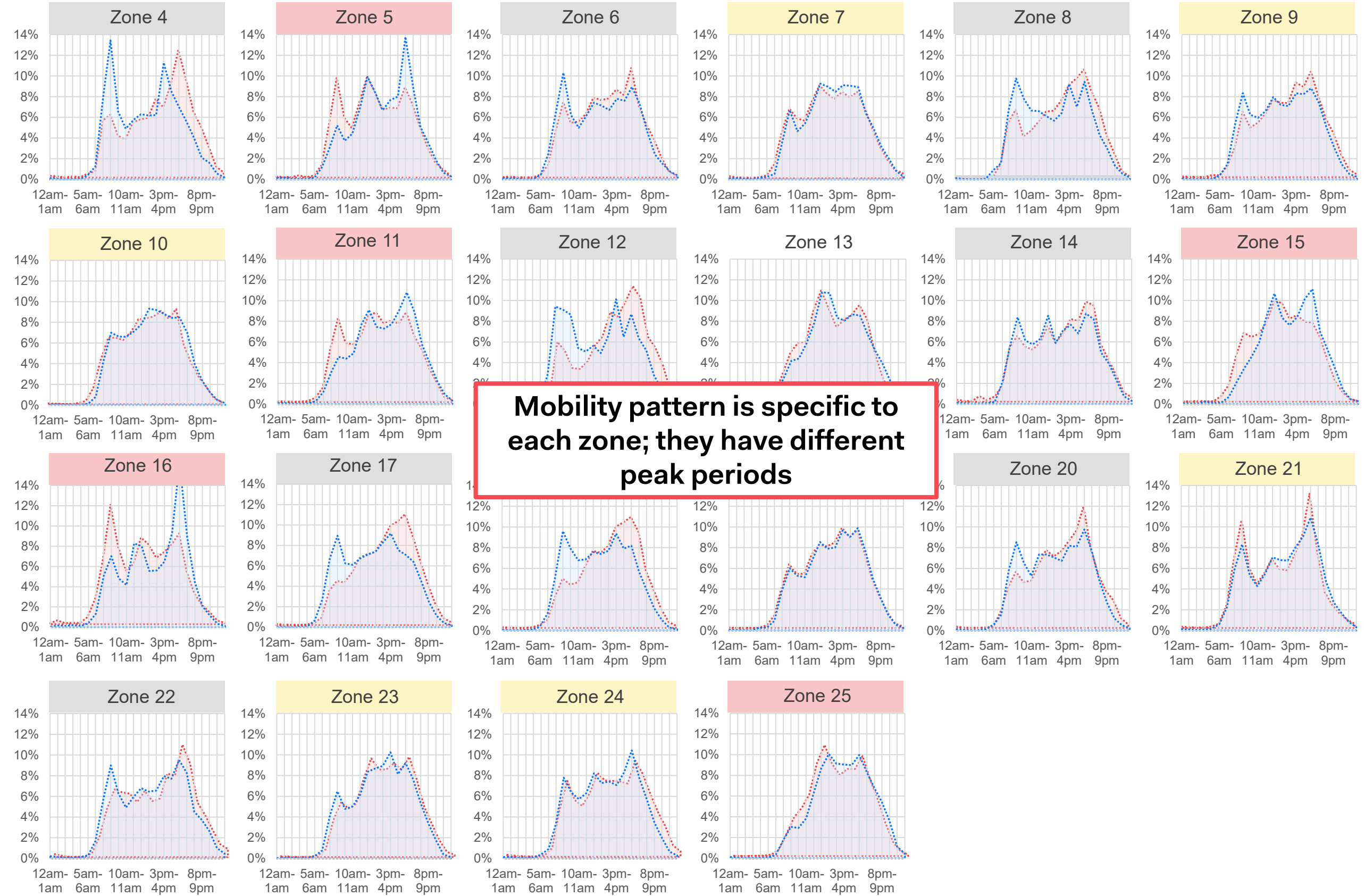
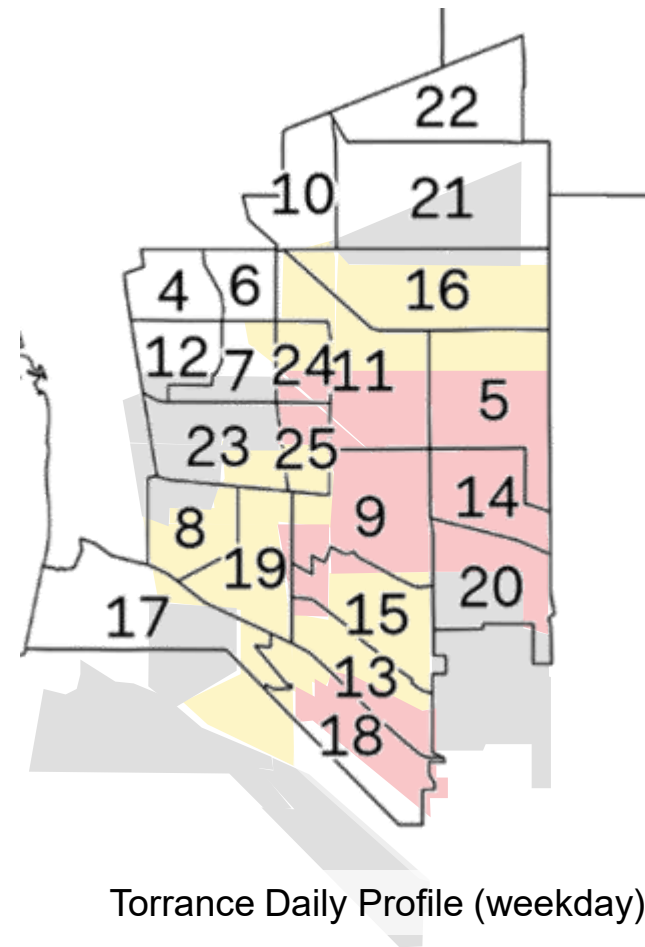
Evidence of needs and requirements in the planning of vehicle sharing services addressing gender. Validation and diagnosis of DIAMOND's Decision Support System for vehicles points and fleet distribution and location planning.

Corporate Social Responsibility (CSR) and employment

Research on women's participation in the transport and logistics sectors crossed with concrete job positions and new opportunities to translate this understanding into concrete better gender-oriented job descriptions and use of adapted candidate search processes.

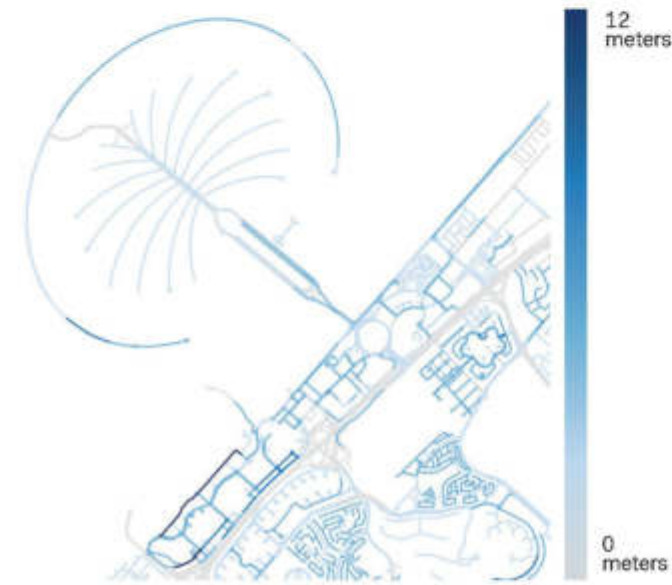
Big Data

Systematica's Experience and Key Relations | Torrance mobility study

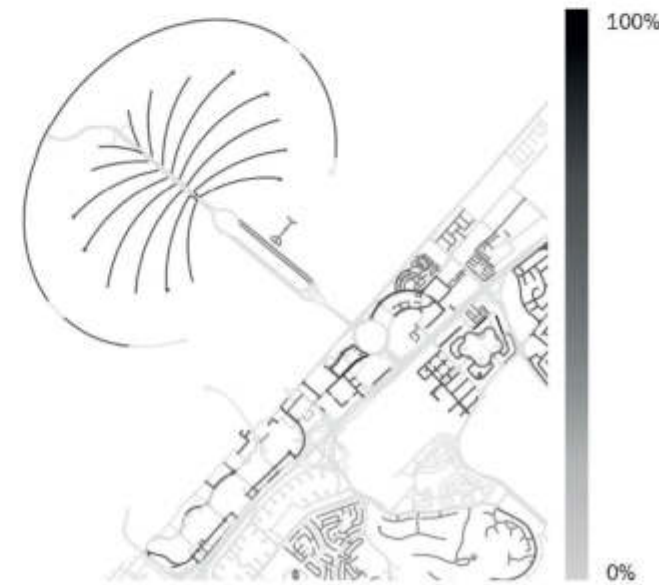


Elements increasing the Pedestrian Level of Service

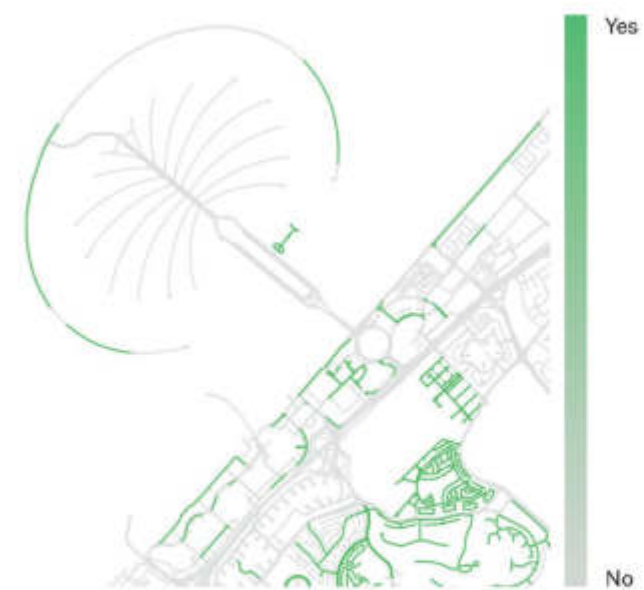
Among the quantitative and qualitative measures influencing the Pedestrian Level of Service, there are four elements, which increase the score: sidewalk width, on-street parking, greenery and buffer from vehicles.



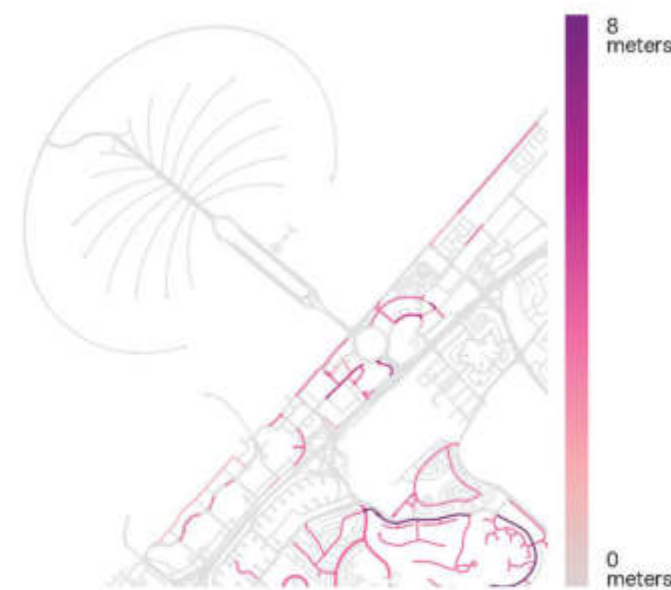
● SIDEWALK WIDTH
The width of the sidewalk is generally a measure of comfort and convenience for pedestrians to effectively use the sidewalk.



● ON-STREET PARKING
The presence of on-street parking tends to increase street quality as it gives pedestrians a sense of safety given the buffer created between walking people and cars.



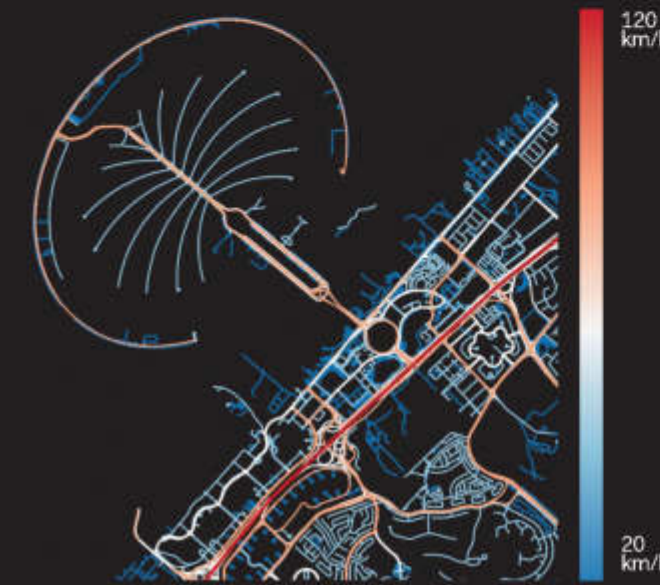
● GREENERY
The shadows shed by trees on sidewalks improve comfort conditions and improve its attractiveness, especially in places with extreme hot conditions like Dubai.



● BUFFER FROM VEHICLES
The buffer width is the distance between the roadway and the available sidewalk, which is important to provide an adequate sense of safety for pedestrians.

Elements decreasing the Pedestrian Level of Service

Among the quantitative and qualitative measures affecting the Pedestrian Level of Service, there are four elements, which decrease the score: vehicle speed, number of lanes, vehicular traffic and the presence of the median.



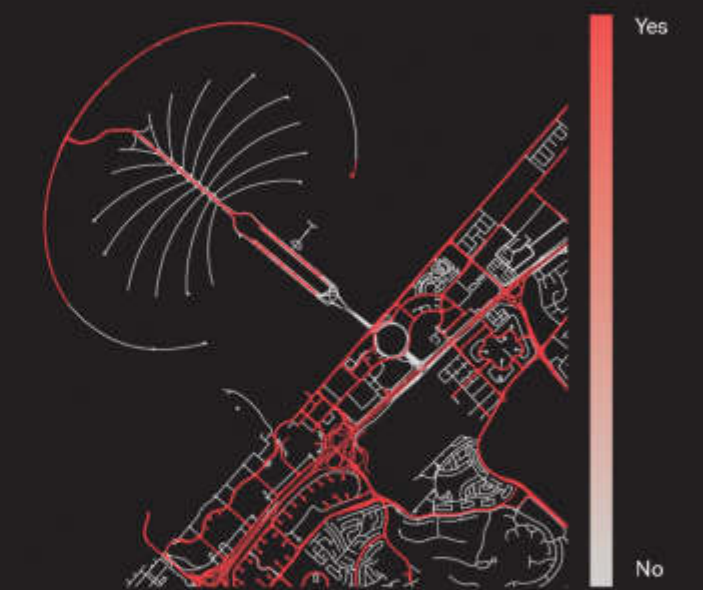
● VEHICLE SPEED
The motorized vehicles speed can decrease the PLOS since high vehicle speed greatly increases the risk of injury and death of pedestrians.



● NUMBER OF LANES
PLOS takes into consideration the number of through lanes on the segment in the subject direction of travel. The Higher number of lanes results in higher negative impact on the final score.



● TRAFFIC VOLUME
The vehicular traffic flow, measured as for direction nearest to the subject sidewalk, can have a strong negative impact on the PLOS, especially if the traffic volume is substantial.



● MEDIAN
The median of a street is a factor that can decrease the PLOS since its presence enlarges the total width of the roadway and consequently increases the distance from the opposite sidewalk.

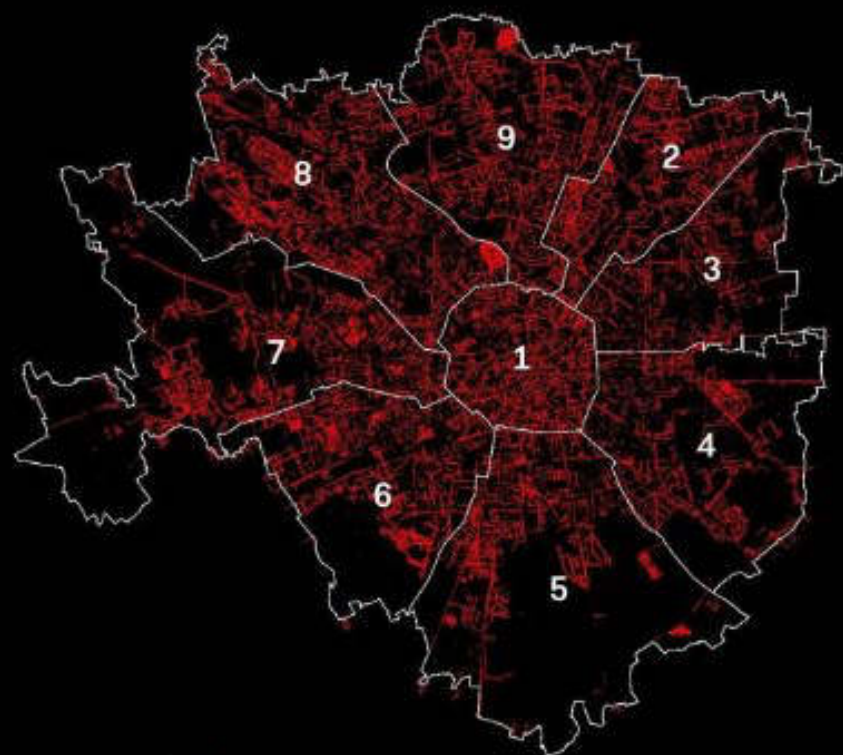


www.milansidewalks.com

Sidewalks in Milan

Marciapiedi a Milano

Unsafe sidewalk
Marciapiede non sicuro
 < 2,4 m



45%
1.374 km

- ZONA 1 - 44%
- ZONA 2 - 52%
- ZONA 3 - 32%
- ZONA 4 - 40%
- ZONA 5 - 47%
- ZONA 7 - 45%
- ZONA 7 - 46%
- ZONA 8 - 46%
- ZONA 9 - 49%

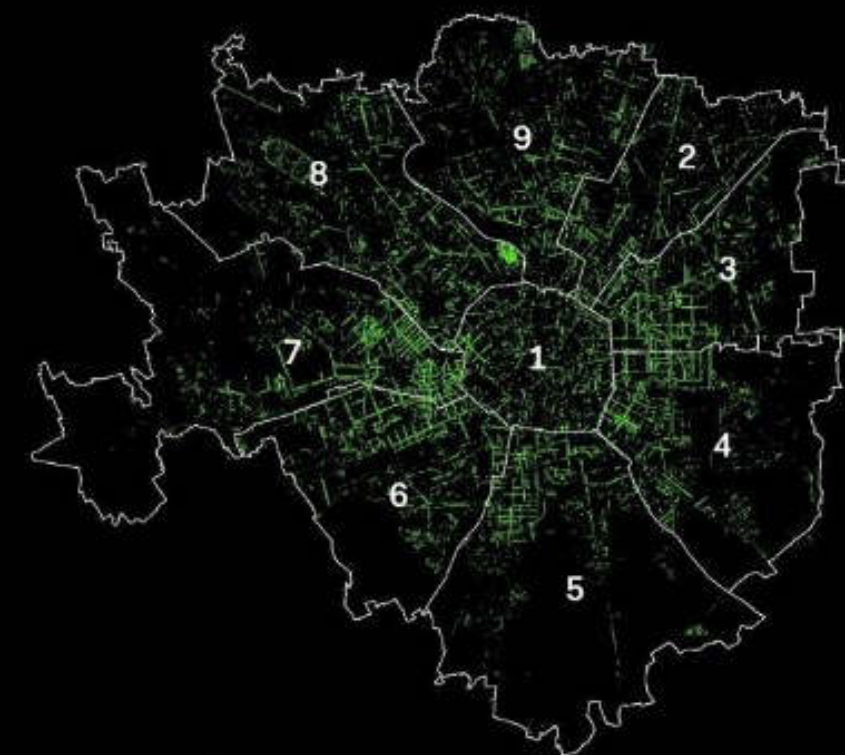
Acceptable sidewalks
Marciapiede accettabile
 >= 2,4 and < 3,3 m



24%
730 km

- ZONA 1 - 22%
- ZONA 2 - 25%
- ZONA 3 - 27%
- ZONA 4 - 26%
- ZONA 5 - 24%
- ZONA 7 - 22%
- ZONA 7 - 22%
- ZONA 8 - 22%
- ZONA 9 - 26%

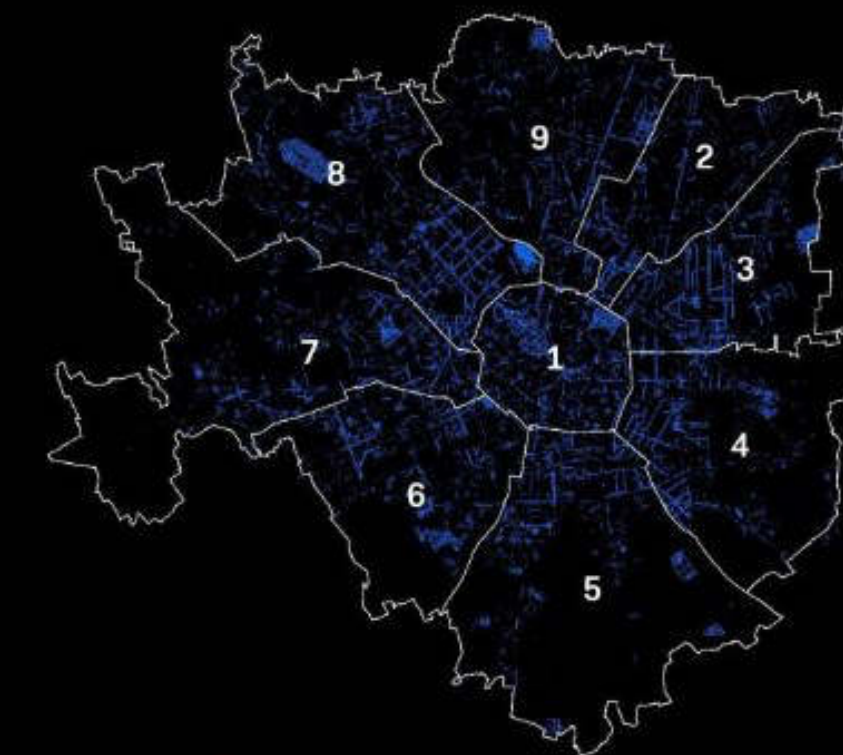
Safe sidewalk
Marciapiede sicuro
 >= 3,3 and < 4,2 m



14%
429 km

- ZONA 1 - 12%
- ZONA 2 - 11%
- ZONA 3 - 20%
- ZONA 4 - 17%
- ZONA 5 - 13%
- ZONA 7 - 17%
- ZONA 7 - 18%
- ZONA 8 - 11%
- ZONA 9 - 11%

Ideal sidewalk
Marciapiede ideale
 >= 4,2 m



17%
520 km

- ZONA 1 - 21%
- ZONA 2 - 12%
- ZONA 3 - 21%
- ZONA 4 - 17%
- ZONA 5 - 17%
- ZONA 7 - 16%
- ZONA 7 - 14%
- ZONA 8 - 21%
- ZONA 9 - 13%

Sidewalks intervals are based on social distancing of 1 meter, promoted in Italy to respond to Covid-19 pandemic
 Gli intervalli dei marciapiedi si basano sul distanziamento sociale di 1 metro, promosso in Italia durante la risposta al virus Covid-19

Thanks!

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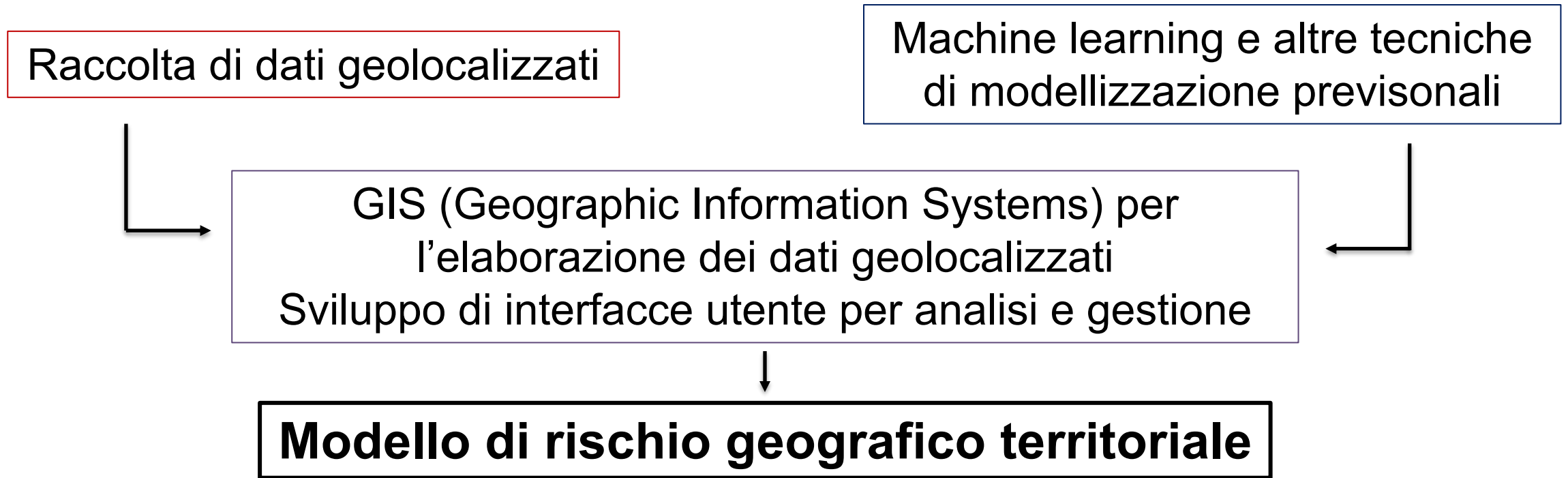


Una applicazione per i dati urbani: mappatura del rischio sanitario

Lorenzo Gianquintieri, Politecnico di Milano

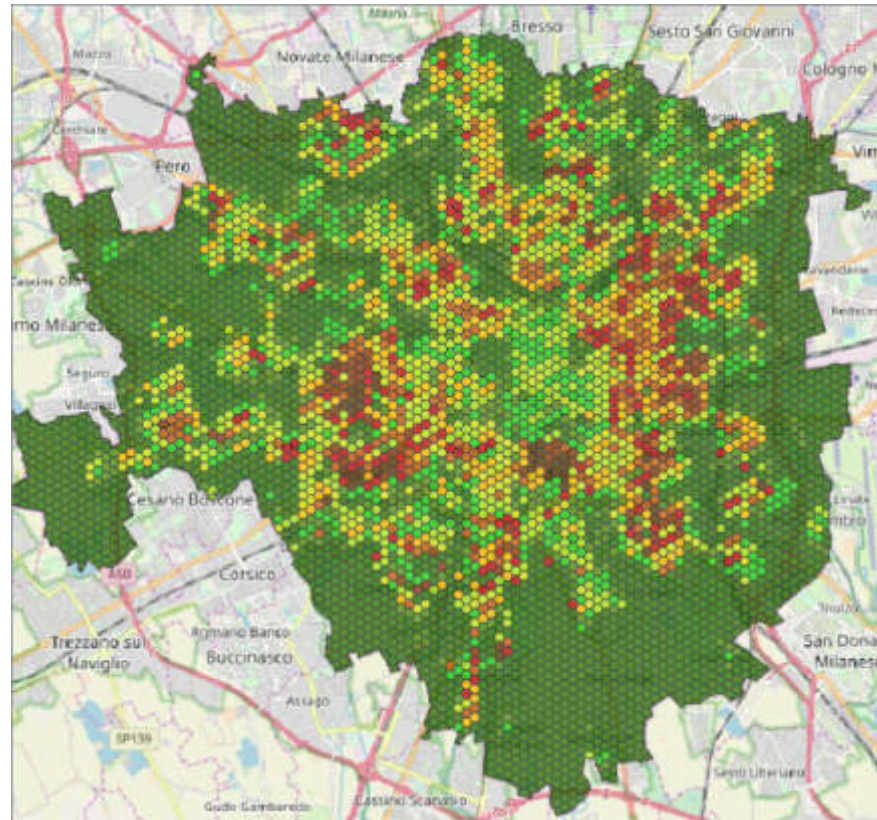
Health-geomatics

Applicazione di tecnologie e metodologie della geomatica all'ambito della salute e della sanità



Esempio: arresto circolatorio out-of-hospital

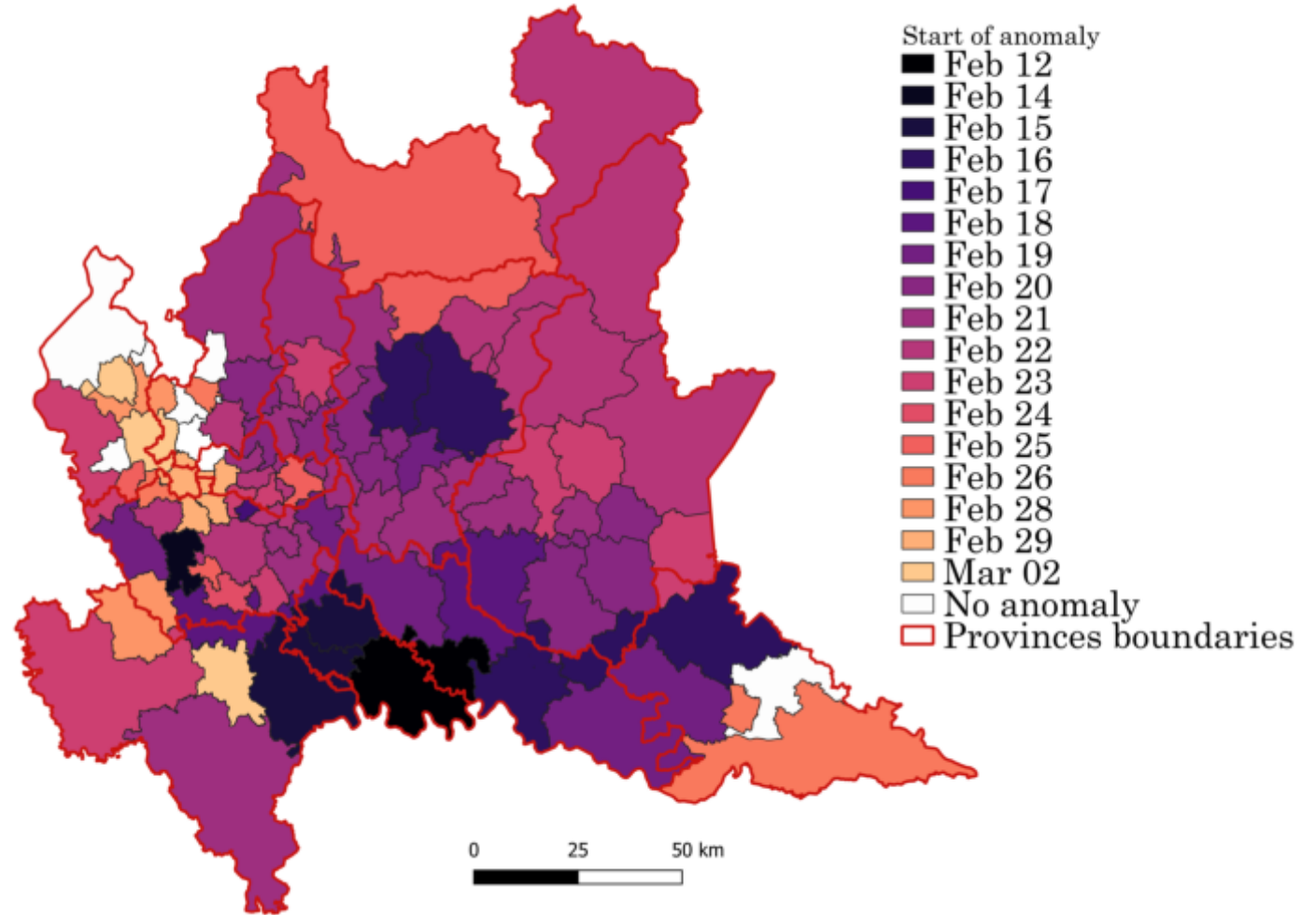
Mappatura del rischio di arresto circolatorio (al di fuori dell'ambiente ospedaliero) sul territorio della città di Milano → ottimizzazione della distribuzione dei DAE (defibrillatori ad accesso pubblico)



COVID-19: analisi evoluzione spazio-temporale

Analisi basata sugli interventi delle ambulanze (AREU)

Identificazione del punto di inizio di un trend anomalo (considerando numero, sesso ed età dei pazienti)



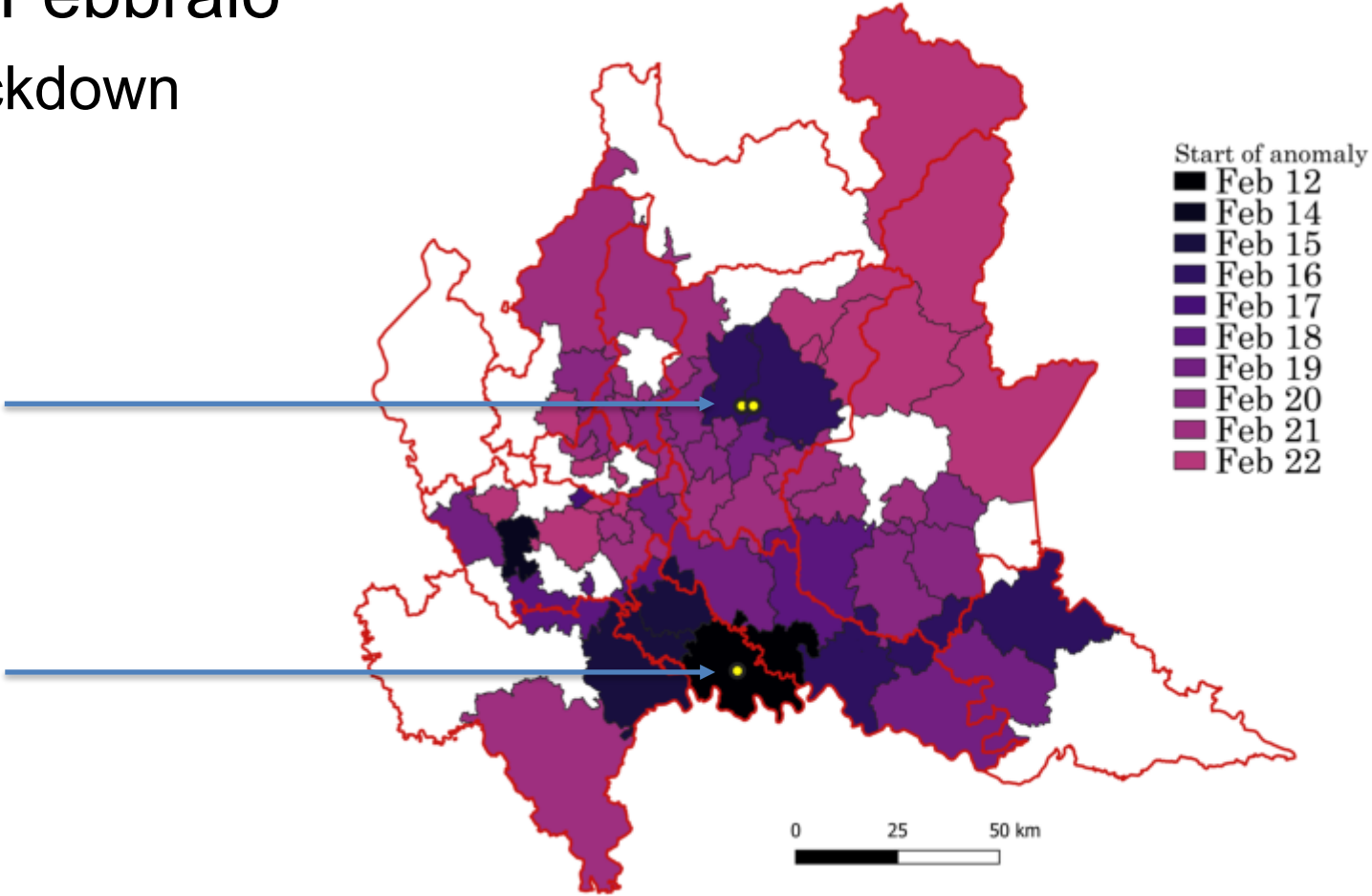
COVID-19: analisi evoluzione spazio-temporale

Aree già attive al 22 Febbraio

(istituzione del primo lockdown a Codogno e dintorni)

Nembro and Alzano Lombardo (aree più colpite)

Codogno (paziente 1)



COVID-19: sviluppi futuri

Identificazione di un modello di rischio territoriale 'addestrato' sulla base dell'evoluzione spazio-temporale identificata.

Dati → informazione

Maggiori dati → migliore informazione in termini di affidabilità e granularità.



POLITECNICO
MILANO 1863

Lorenzo Gianquintieri – lorenzo.gianquintieri@polimi.it
DEIB - Information, Electronics and Bioengineering dpt.

PRELIMINARY ON ARIDITY INDEX & GROWTH

GOAL OF THE STUDY

- ▶ Identify areas mostly affected by desertification
- ▶ Assess the socio-economic effects of desertification

How?

- ▶ Land degradation is not entirely exogenous: driven also by human activity
- ▶ Focus on *climate induced aridification of soil*
- ▶ Compare areas which had similar aridity index before starting the aridification process

DATA I: ARIDITY INDEX

- ▶ AI Defined as: yearly average of Total Precipitation over Potential evapotranspiration (PET)
- ▶ 5 subtypes of arid lands or drylands are classified:
 - ▶ Hyper-arid ($AI < 0.05$)
 - ▶ Arid ($0.05 < AI < 0.2$)
 - ▶ Semi-arid ($0.2 < AI < 0.5$)
 - ▶ Dry subhumid ($0.5 < AI < 0.65$)
 - ▶ Humid ($AI > 0.65$)

DATA I: ARIDITY INDEX

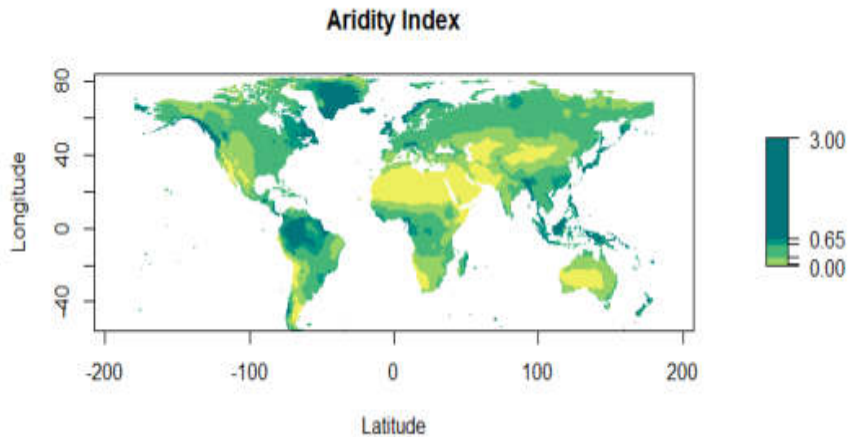


FIGURE:

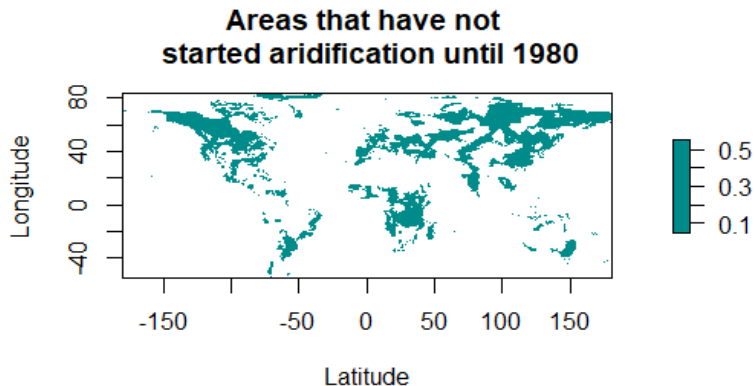
DATA II: SOCIO-ECONOMIC VARIABLES

- ▶ GDP per capita at grid level (0.5x0.5 deg) 1990, 2000, 2010
- ▶ Population, Urbanization and Ruralization per grid (0.083x0.083 deg) from 1900s until 2015
- ▶ Net Migration count (0.5x0.5 deg)
- ▶ Weather variables (Temp, Prec, 0.5x0.5 deg)

PROCEDURE

- ▶ Climate induced desertification has mostly started around 1980s and accelerated during the last 20 years
- ▶ To evaluate the effects of soil desertification we focus on similar areas (which are not already desert nor humid and have not started the desertification process until 1980)
- ▶ Controlled and Treated areas must also be similar in GDP, population and urbanization levels prior to the start of desertification (see Parallel Trend Assumption)

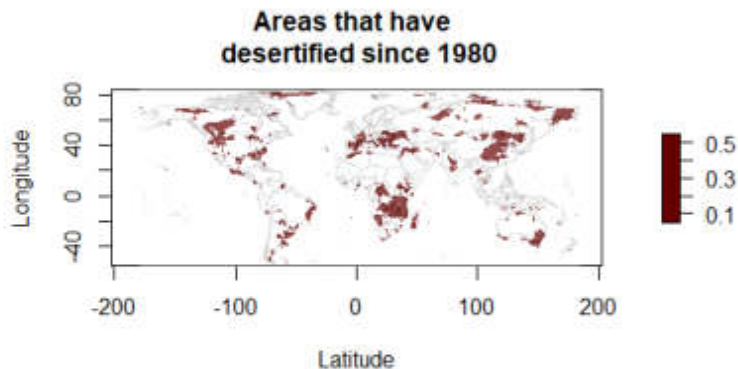
AREAS WHICH HAD NOT DESERTIFIED UNTIL 1980



PROCEDURE CONT'D

- ▶ First: among those areas we compare those which have started to desertify only after 1980s (and not before) against those which have not
- ▶ In other words we focus on areas which were both in terms of aridity of soil and in socio-economic development. We compare areas whose AI declined after 1980 with those whose AI did not

AREAS WHICH HAVE STARTED DESERTIFICATION SINCE 1980s



ECONOMETRIC SPECIFICATION

- ▶ Differences-in-Differences (DID) strategy.
- ▶ Treatment is continuous and represented by the decennial change in Aridity Index for each decade

$$\Delta Y_{i,c,t} = \alpha + \beta_1 \Delta AI_{i,t} + \delta_t + \sigma_i + \omega_{c,trend} + \epsilon_{i,c,t}$$

- ▶ $\Delta Y_{i,c,t}$: is the change of GDP per capita, population, share of people living in urban areas, share of people living in rural areas, net migration of grid i , in country c , at decade t
- ▶ $\Delta AI_{i,t}$ indicates the change in aridity index of grid i between two decades t and $t - 1$
- ▶ δ_t , σ_i and $\omega_{c,trend}$ indicate time FE, grid FE and country linear trends

PARALLEL TRENDS:

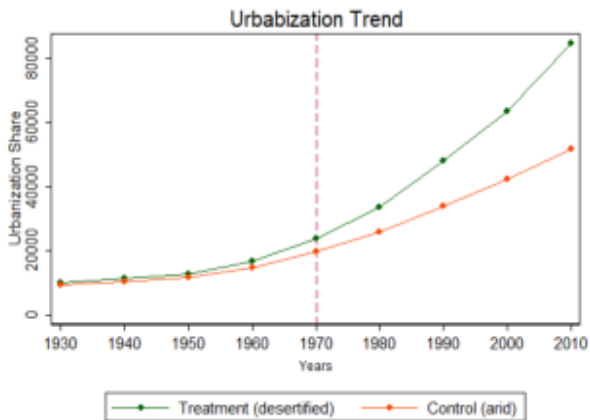


FIGURE:

PARALLEL TRENDS:

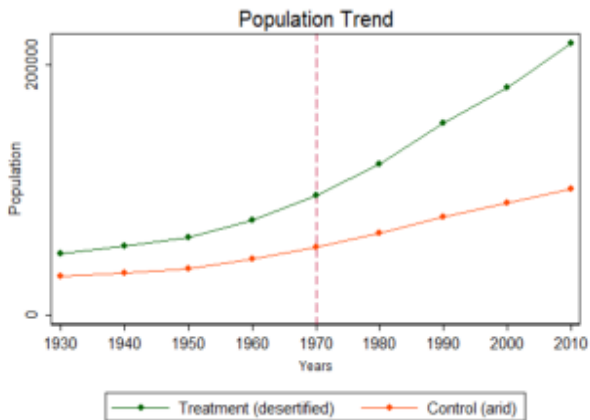


FIGURE:

PARALLEL TRENDS:

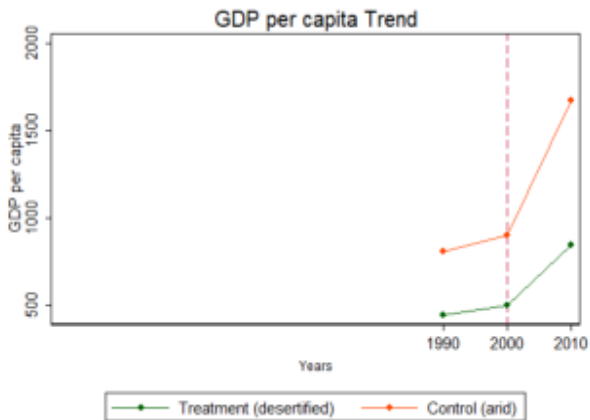


FIGURE:

TABLE: Preliminary on Desertification. No Controls. Year, Grid Fixed Effects and Country Trends

	Δ Pop Coef./SE	Δ Urb Coef./SE	Δ GDP Coef./SE	Net Migration Coef./SE
ΔAI	-0.033*** (0.003)	0.012 (0.060)	0.180*** (0.044)	
AI				37122.344* (23043.361)
AI^2				-25677.081 (29456.803)
Year, Grid FE, Country Trends	Yes	Yes	Yes	Yes
Observations	243328	99526	77744	116637

Notes: This table presents results of the effects of desertification on population, urbanization, gdp per capita and migration flows at grid level. Significant at *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

RISULTATI PER AFRICA:

TABLE: Preliminary on Desertification. Year, Grid Fixed Effects and Country Trends

	Δ Pop Coef./SE	Δ Urb Coef./SE	Δ GDP Coef./SE	Net Migr Coef./SE
ΔAI	0.023*** (0.008)	-0.210 (0.621)	0.224*** (0.042)	
AI				66079.941** (28887.719)
AI^2				-83618.148** (39846.539)
Year, Grid FE, Country Trends	Yes	Yes	Yes	Yes
Observations	47976	16744	12014	18021

Notes: This table presents results of the effects of desertification on population, urbanization, gdp per capita and net migration for Africa. Significant at *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

VALIDITY CHECK

1. The impact of desertification should be greater for poor economies. On the other hand advanced economies should experience a limited impact of desertification (e.g. Poverty Trap)
2. We also expect desertification to have a higher impact on areas highly suitable for agriculture compared to already arid areas of the world

POVERTY TRAP: IMPACT OF DESERTIFICATION ON CLASSES OF INCOME

TABLE: Preliminary on Desertification. Agricultural suitability Controls. Year, Grid Fixed Effects and Country Trends

	Low Income	Middle Income	High Income
	ΔGDP	ΔGDP	ΔGDP
ΔAI	0.026*** (0.007)	0.012 (0.015)	-0.130** (0.054)
Year, Grid FE, Country Trends	Yes	Yes	Yes
Observations	24122	26856	71048

Notes: This table presents results of the effects of desertification on gdp per capita for classes income per capita at grid level. Significant at *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

RESULTS FOR CLASSES OF AGRICULTURAL SUITABILITY:

TABLE: Preliminary on Desertification. Agricultural suitability Controls. Year, Grid Fixed Effects and Country Trends

	Not Suit ΔGDP	Mod Suit ΔGDP	Highly Suit ΔGDP
ΔAI	-0.042* (0.023)	-0.048 (0.046)	0.222*** (0.075)
Year, Grid FE, Country Trends	Yes	Yes	Yes
Observations	79102	32414	10510

Notes: This table presents results of the effects of desertification on gdp per capita for classes of agricultural suitability at grid level. Significant at *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

CHECK I: IMPACT OF DESERTIFICATION ON ALREADY DESERT AREAS

TABLE: Preliminary on Desertification. No Controls. Year, Grid Fixed Effects and Country Trends

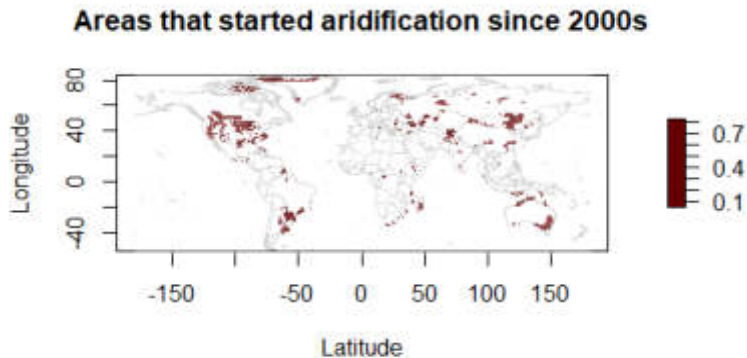
	Population Coef./SE	Urbanization Coef./SE	GDP per capita Coef./SE	Net Migration Coef./SE
change_ai	-0.081 (0.069)	0.081 (0.267)	0.041 (0.026)	
ai				-139400.857 (142321.103)
ai2				1718428.108 (1645399.947)
Year, Grid FE, Country Trends	Yes	Yes	Yes	Yes
Observations	52724	6094	16446	26424

Notes: This table presents results of the effects of desertification on population, urbanization, gdp per capita and migration flows on already desert areas. Significant at *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

ROBUSTNESS AND ADAPTATION TO DESERTIFICATION

- ▶ Here we evaluate the effects of the *speed of desertification* (i.e. some areas have started to desertify since 1980s, for other the AI started declining only recently, since 2000)
- ▶ Assumption: People living in areas whose AI started to decline since 1980s had enough time to migrate towards urbanized areas. As a result the economic impact could be significant.
- ▶ On the other hand people living in areas which have seen their AI falling only recently might not have had enough time to adapt.

AREAS WHICH HAVE STARTED DESERTIFICATION SINCE 2000s



RESULTS:

TABLE: Aridification started since 1980. No Controls. Year, Grid Fixed Effects and Country Trends

	Population Coef./SE	Urbanization Coef./SE	GDP per capita Coef./SE	Net Migration Coef./SE
Log AI	-0.105*** (0.021)		0.845*** (0.056)	
ln_ai2	-0.018*** (0.006)		0.197*** (0.014)	
ai		-0.209*** (0.045)		22891.725** (11034.370)
ai2		0.178*** (0.064)		-14124.625** (7096.171)
Year, Grid FE, Country Trends	Yes	Yes	Yes	Yes
Observations	363675	363675	109074	135753

Notes: This table presents results of the effects of desertification on population, urbanization, gdp per capita and migration flows at grid level. Significant at *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

RESULTS:

TABLE: Aridification started since 2000. No Controls. Year, Grid Fixed Effects and Country Trends

	Population Coef./SE	Urbanization Coef./SE	GDP per capita Coef./SE	Net Migration Coef./SE
Log AI	0.026 (0.095)		-0.644*** (0.200)	
ln_ai2	-0.001 (0.024)		-0.061 (0.052)	
ai		0.168 (0.131)		50089.652 (34323.112)
ai2		-0.218 (0.196)		-33318.560 (35685.341)
Year, Grid FE, Country Trends	Yes	Yes	Yes	Yes
Observations	17051	17051	5115	7974

Notes: This table presents results of the effects of desertification on population, urbanization, gdp per capita and migration flows at grid level. Significant at *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

WORK IN PROGRESS:

- ▶ Project the future trend of aridity index due to climate change
- ▶ Quali saranno le aree maggiormente colpite dalla desertificazione?
- ▶ Prevedere quale sarebbe l'impatto futuro
- ▶ "Switching" from agriculture labor to other sectors



POLITECNICO
MILANO 1863


bikeMi – analisi dei dati di bike sharing a Milano


Juan Fernando Toro Herrera, Daniela Carrion, Maria Antonia Brovelli
Politecnico di Milano – Dipartimento di Ingegneria Civile e Ambientale | GEOLab


Marco Percoco
Università Bocconi – Dipartimento di Scienze Sociali e Politiche

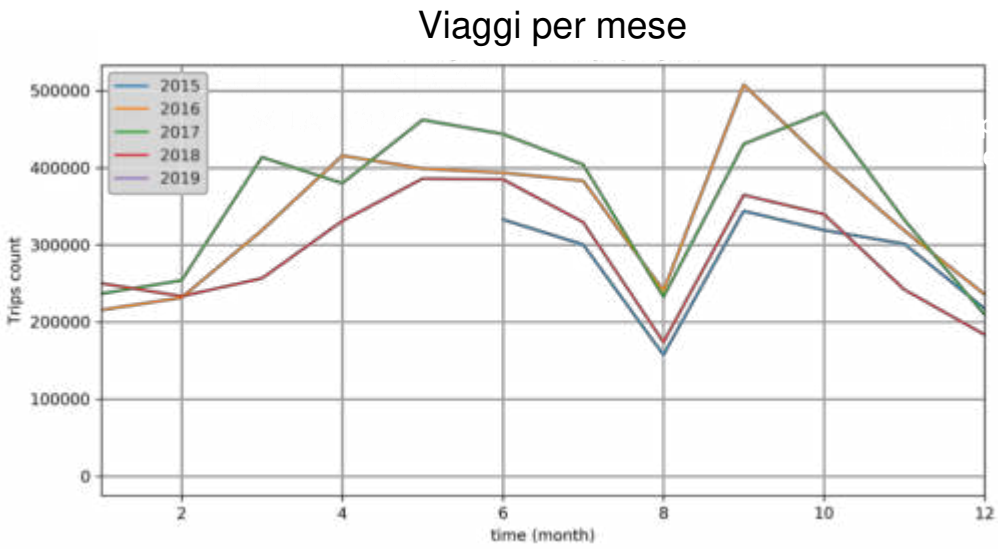


Dati disponibili

 43 tabelle con i dati del servizio di bike-sharing Bike-Mi

 I dati sono stati registrati tra Giugno 2015 e Gennaio 2019

 13'789'569 record di viaggi (Circa 1.8GB di dati)



293 stazioni

3650 biciclette tradizionali

1150 biciclette elettriche

213.602 utenti

Contenuto informativo

Caratteristiche delle biciclette

- ID della bicicletta [int]
- Tipo di bicicletta [string]

Dettagli utente

- ID utente [int]

Partenza

- Data [date]
- Data/Ora [date]
- ID stazione [int]
- Nome stazione [string]
- Posizione della bicicletta nella staz.[int]

Arrivo

- Data [date]
- Data/Ora [date]
- ID stazione [int]
- Nome stazione [string]
- Posizione della bicicletta nella staz[int]

Altre informazioni

- Lunghezza del viaggio [time]
- Distanza totale [double]
- CO2 risparmiata [double]
- Calorie consumate [double]



Pre-processamento dei dati

Criteri di filtraggio dei dati:



Il 3% dei record è stato eliminato

DATA RIFERIMENTO PRELIEV	DATA PRELIEV	NUMERO STAZIONE PRELIEV	NOME STAZIONE PRELIEVO
31/01/2016	01/02/2016 00:53	2	San Babila - RIMOSSA-

Eliminato ❌

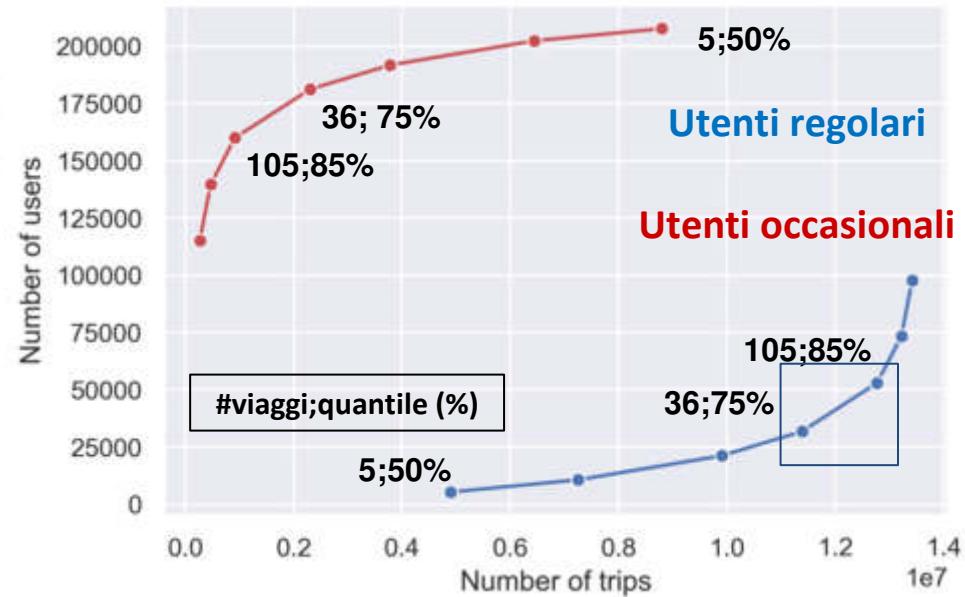
- 903 Castello Provvisoria
- 83 Rastrelli - Larga - RIMOSSA PROVVISORIAMENTE
- 90 Gioia - Sassetti - RIMOSSA PROVVISORIAMENTE
- 92 Cordusio - RIMOSSA PROVVISORIAMENTE-
- 189 Procaccini . Cimitero Monumentale - RIMOSSA PROVV.

Esistente ⚠️

- 83 Rastrelli - Pecorari
- 198 Garibaldi 2 - Sturzo
- 267 Sardegna - Sicilia
- 268 Lunigiana - Sammartini
- 340 Corvetto - Polesine
- 341 Cuoco - Monte Cimone
- 342 Bologna
- 343 Ortles - Ripamonti
- 384 Gabrio - Rosa
- 385 Ortles -

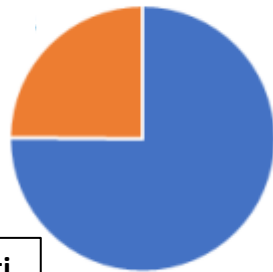
Tipologia di utenti

Gli utenti sono stati classificati sulla base della frequenza dell'uso del servizio.



Distinzione tra utenti occasionali e regolari
(N. di viaggi >36)

52,970; 25%



#utenti; %utenti

160009; 75%

Regolari Occasionali



Considerando il quantile tra il 75% e l'85% (tra 36 e 105 viaggi) si può notare un salto che permette di discriminare tra utenti occasionali e regolari. **Per questo motivo è stata considerata una soglia di 36 viaggi tra utenti occasionali e regolari.**



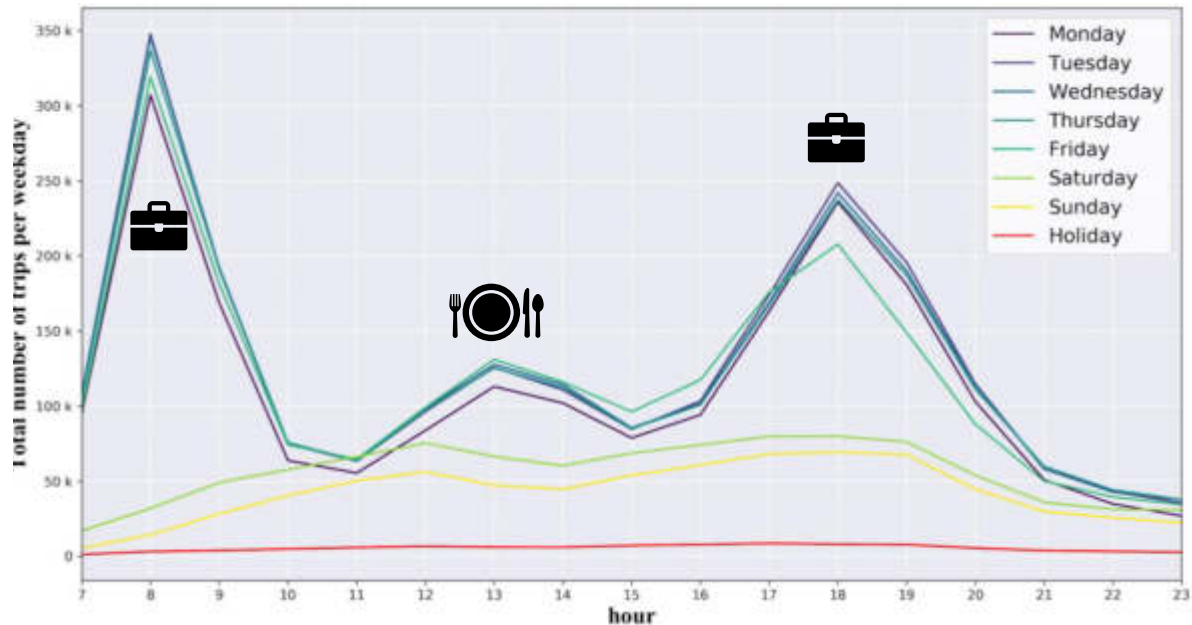
Tipologia di utenti

Analisi dell'andamento degli spostamenti rispetto a

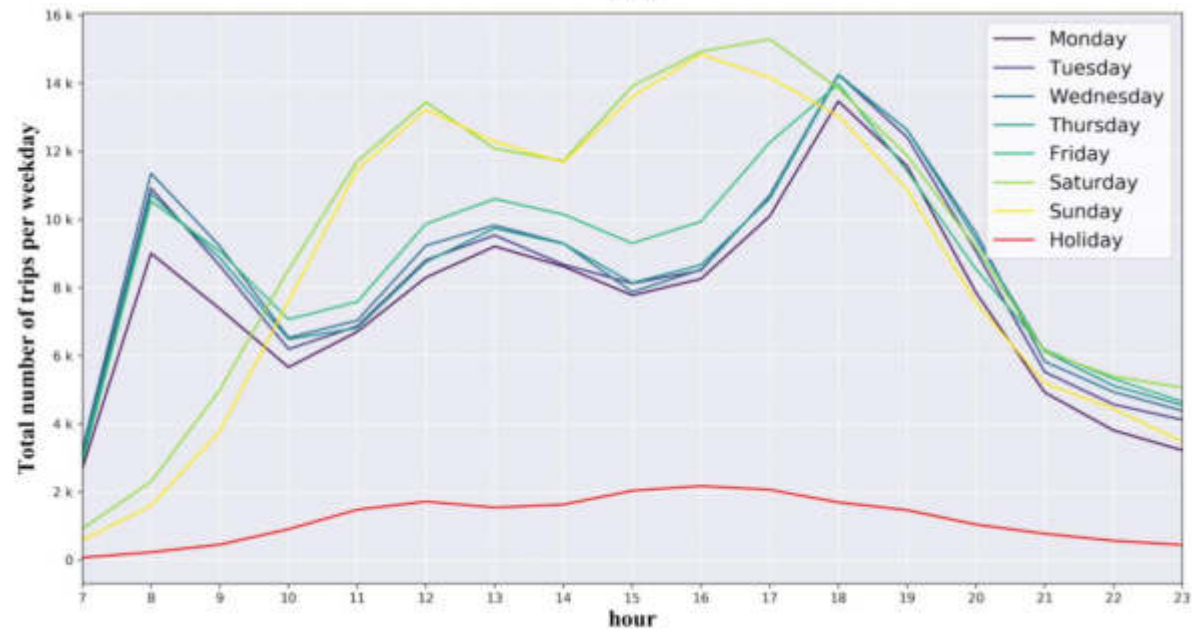
Giorno
feriale/festivo

Utente
regolare/occasionale

Utenti regolari




Utenti occasionali



Viaggi in arrivo e in partenza dalle stazioni bikeMI



08:00

Stazione di
Milano Garibaldi 

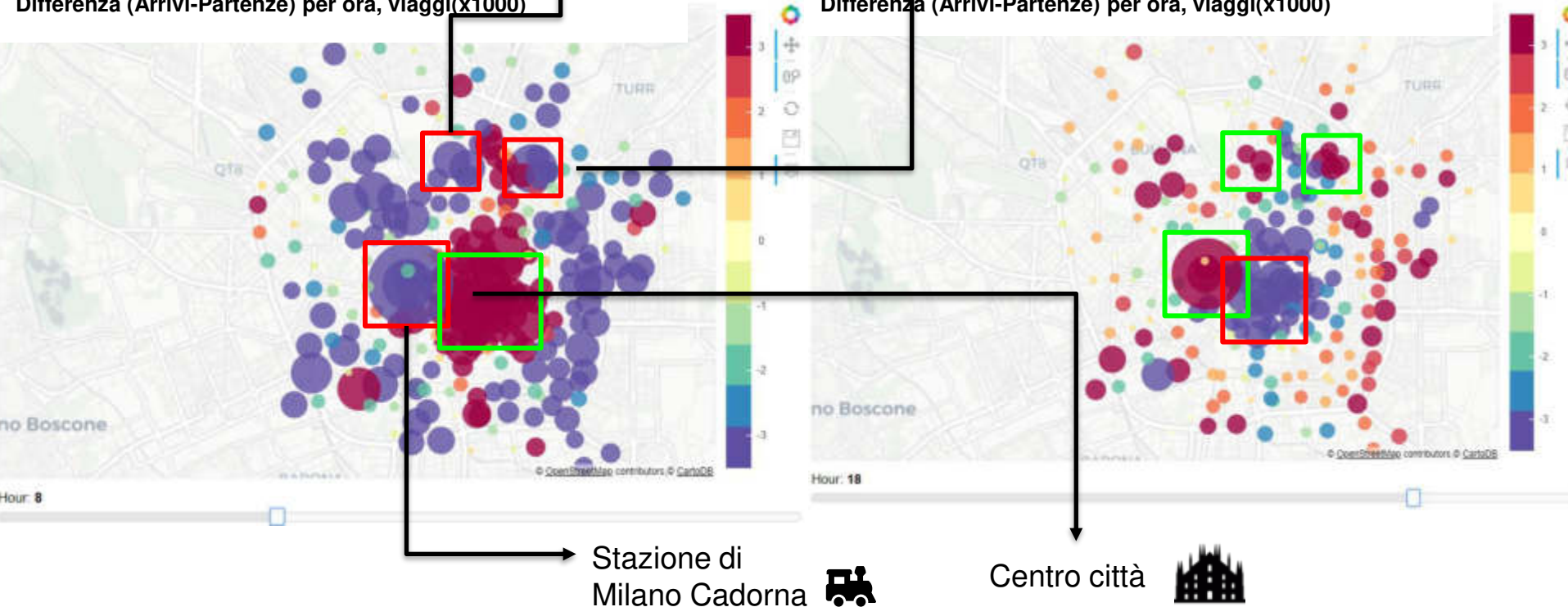
Stazione di
Milano Centrale 




18:00

Differenza (Arrivi-Partenze) per ora, viaggi(x1000)

Differenza (Arrivi-Partenze) per ora, viaggi(x1000)



Stazione di
Milano Cadorna 

Centro città 

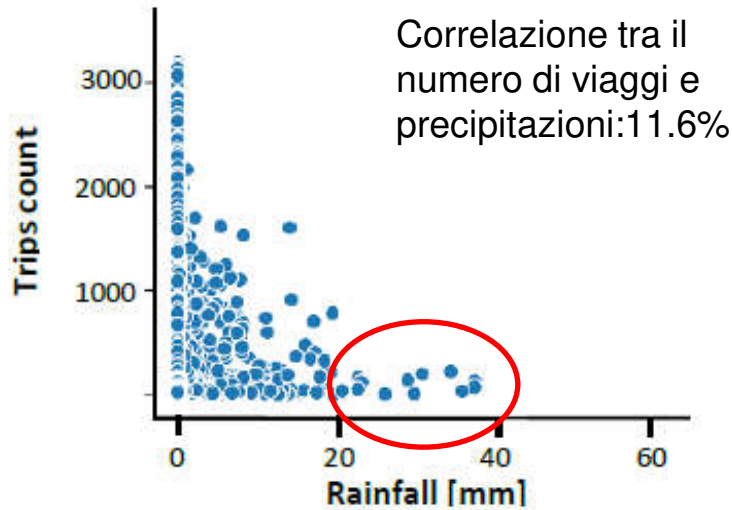
Stazioni BikeMI
vuote

Stazioni BikeMI
sovralimentate



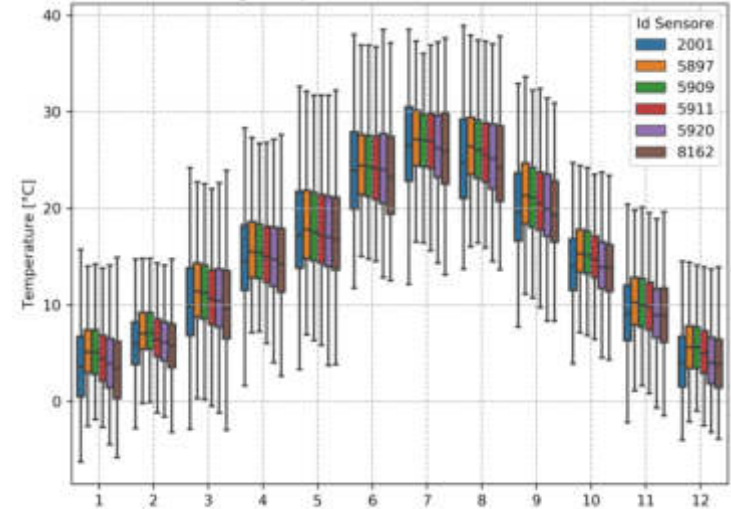
Impatto delle condizioni meteorologiche sugli spostamenti

Correlazione tra il numero di viaggi e temperatura: 17.8%

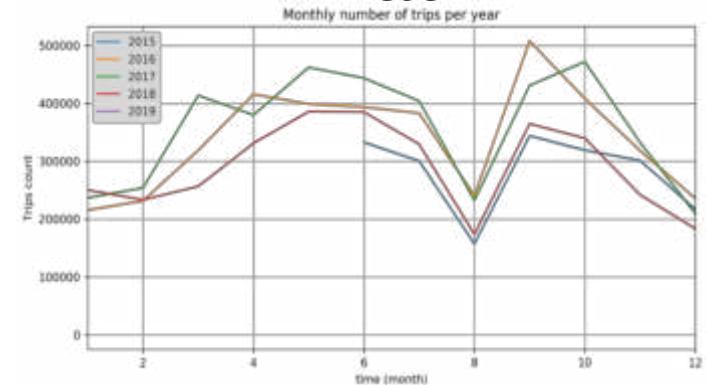


Rispetto alle precipitazioni, gli eventi più intensi inducono ad un minor utilizzo del servizio.

Temperatura media [°C]



Mese



Nei mesi invernali c'è un uso inferiore del servizio, a parte questo non c'è una significativa correlazione con la temperatura



Conclusioni e prossime analisi

- ❑ L'analisi dei dati di utilizzo del servizio bikeMI ha permesso di ricavare informazioni sulle abitudini degli utenti e sui flussi da e verso le stazioni
- ❑ Le analisi possono fornire indicazioni per una riallocazione efficiente delle biciclette in funzione della domanda
- ❑ Si intende aggiungere all'analisi dati di traffico veicolare
- ❑ Si cercherà di individuare i percorsi preferiti dagli utenti
- ❑ Si effettuerà un'analisi della correlazione con eventi che hanno impatto sull'uso dei trasporti, come gli scioperi.





POLITECNICO
MILANO 1863

Mappare l'accessibilità in OpenStreetMap: il progetto Via Libera

Ludovico Biagi, Maria Antonia Brovelli, Lorenzo Stucchi
Politecnico di Milano

Significato di accessibilità

L'accessibilità è definita come la possibilità di spostamento per persone con disabilità, nel nostro caso di tipo motorio.

La mancanza di accessibilità è uno dei principali motivi che scoraggiano la circolazione di persone con problemi motori (**Organizzazione Mondiale della Sanità [1]**).

Precedenti progetti per mappare l'accessibilità:

- autoritativi / crowdsourcing
- geodatabase proprietari / già esistenti e pubblici

[1] World Health Organization. World report on disability. World Health Organization, 2011. url: https://www.who.int/disabilities/world_report/2011/report/en/



ViaLibera?!

Identificare pratiche buone / ottimali per mappare l'accessibilità

- Mediante crowdsourcing, identificare
- percorsi accessibili per i cittadini,
- ostacoli per l'amministrazione

Finanziato da Fondazione Città di Milano. Altri partner del progetto: Spazio Vita Niguarda Onlus; LEDHA Milano; AUS Niguarda Onlus.

Kick-off: 1 ottobre 2019

Durata: 18 mesi?

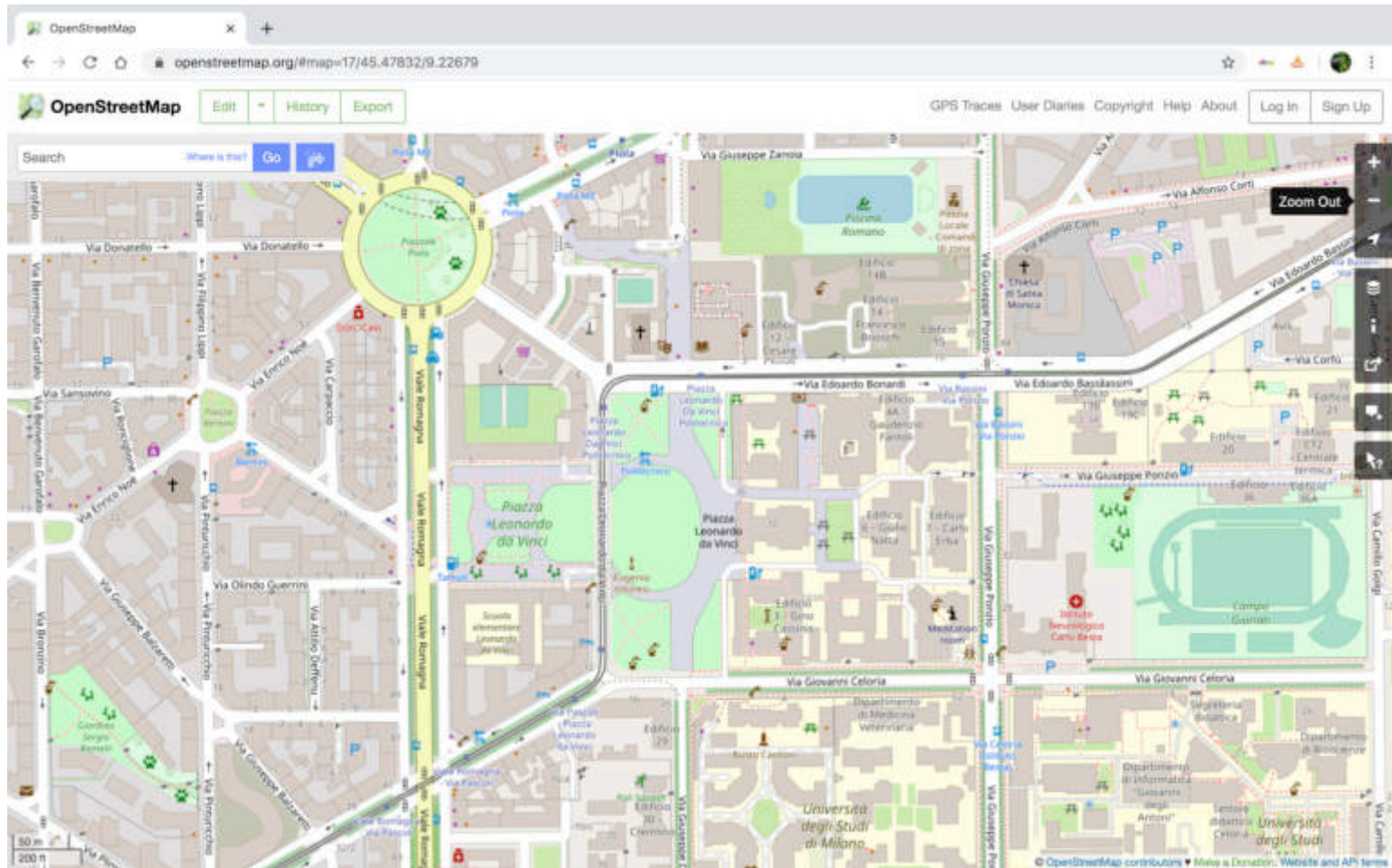
Caso di studio: **Municipalità 9** di Milano.

Volontari locali coinvolti nella mappatura.



OpenStreetMap (OSM)

Fondato nel 2004 all'UCL, un progetto completamente libero e basato su mappatura di volontari.



Valutazione di modelli di dati e metodologie

Problemi studiati:

modelli ottimali per memorizzare i dati di accessibilità,
metodi praticamente implementabili per l'attività dei
volontari.

Risultati pubblicati in:

Mapping the accessibility in OpenStreetMap: application in Via Libera project, Tesi di laurea magistrale di Lorenzo Stucchi, Politecnico di Milano, 2020

Mapping the accessibility in OpenStreetMap, a comparison of different techniques, Ludovico Biagi, Maria Antonia Brovelli, Lorenzo Stucchi, ISPRS 2020, IV, IV/4



Prossimi sviluppi

Prime sperimentazioni di attività di mappatura già discusse e concordate con associazioni di volontari e scuole

Inizialmente pianificate per la tarda primavera, ovviamente posticipate per l'Emergenza Covid

...sperabilmente il prossimo autunno





Navigazione veicolare e pedonale: nuove opportunità con gli smartphone Android di ultima generazione

Marco Fortunato, Augusto Mazzoni

Università di Roma "La Sapienza"

Dipartimento di Ingegneria Civile, Edile ed Ambientale

Area di Geodesia e Geomatica

PRIN PROJECT: *URBAN GEOmatics for Bulk Information Generation, Data Assessment and Technology Awareness*



MINISTERO DELL'ISTRUZIONE DELL'UNIVERSITÀ E DELLA RICERCA

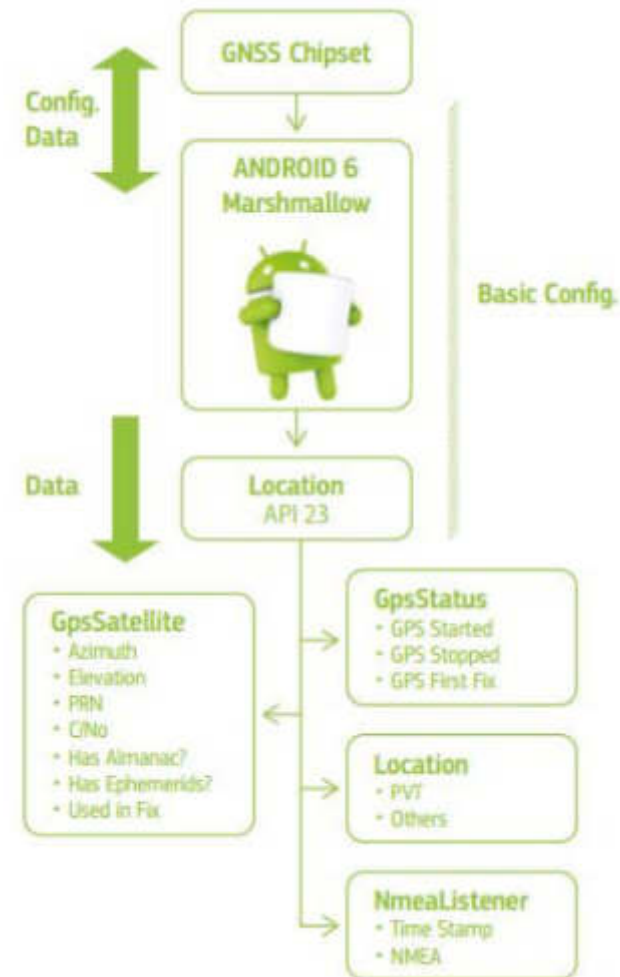


Evoluzione in Android OS in ambito GNSS

Location API 23

Aspetti principali:

- ▶ Compatibile con Android OS 6.0 e successive
- ▶ Possibilità di accedere solo ad una soluzione PVT (Positioning-Velocity-Timing) calcolata internamente dal chip GNSS
- ▶ Utente non ha controllo sulla soluzione PVT che viene fornita
- ▶ Soluzione PVT accessibile attraverso protocollo di comunicazione NMEA (National Marine Electronics Association)



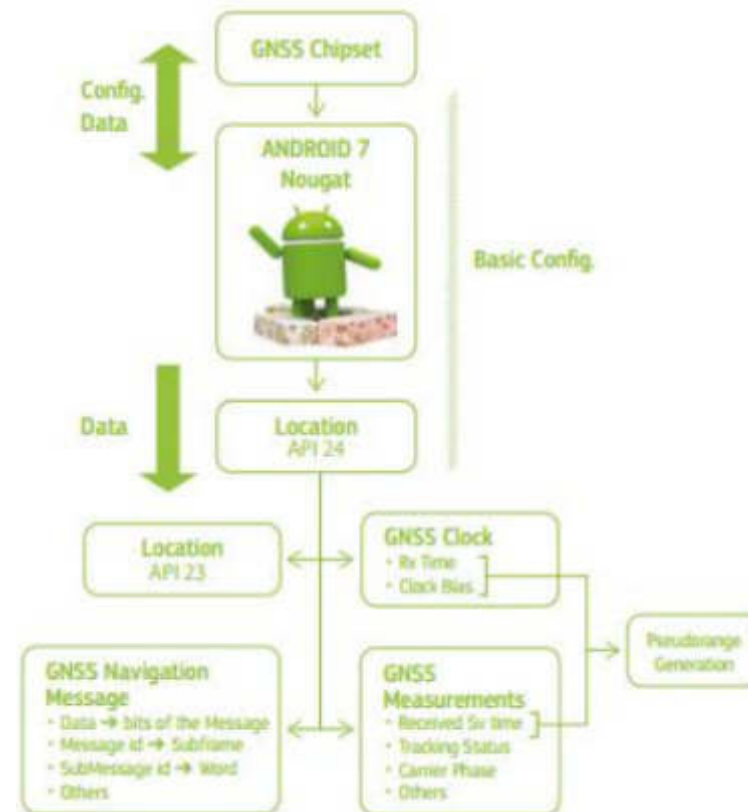
Navarro, M. et al. *Assessing Galileo Readiness in Android Devices Using Raw Measurements*. 30th International Technical meeting of the Satellite Division of ION, Portland, Oregon, September 2017. v, 18, 20

Evoluzione in Android OS in ambito GNSS

Location API 24

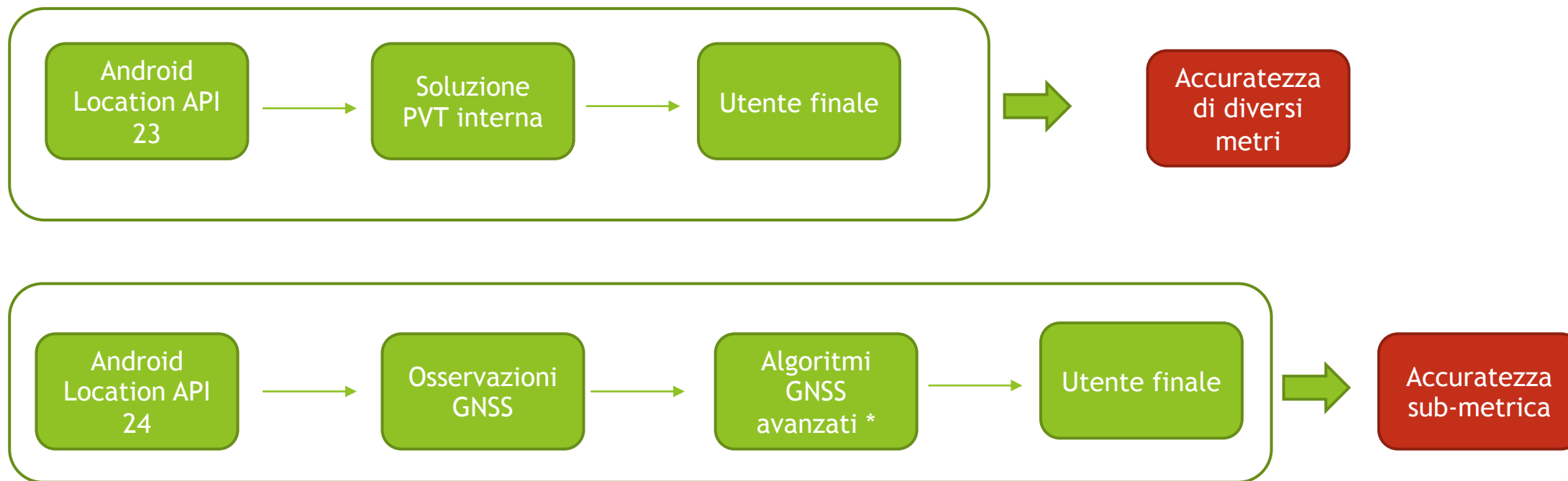
Aspetti principali:

- ▶ Annunciata a maggio 2016
- ▶ Compatibile con Android OS 7.0 e successive
- ▶ Possibilità di accedere alla soluzione PVT interna e a 3 nuove classi di dati:
 - ▶ GNSS Clock
 - ▶ GNSS Navigation Message
 - ▶ GNSS Measurements



Navarro, M. et al. *Assessing Galileo Readiness in Android Devices Using Raw Measurements*. 30th International Technical meeting of the Satellite Division of ION, Portland, Oregon, September 2017. v, 18, 20

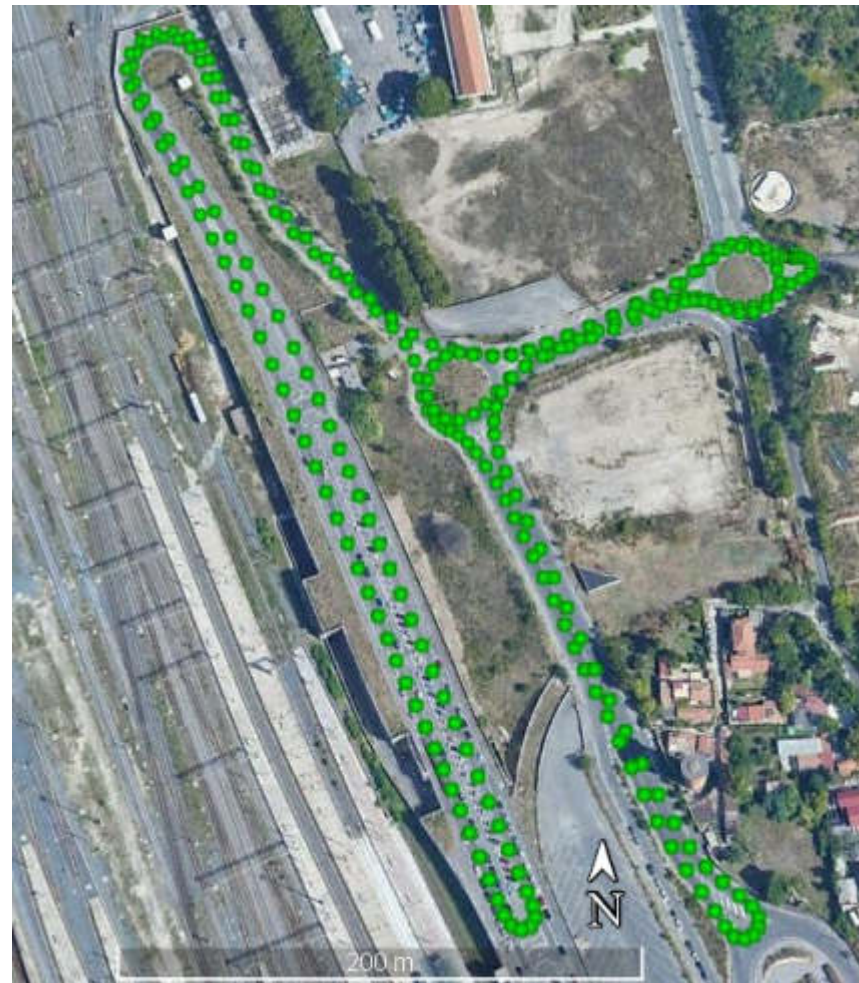
Cosa Cambia in Ambito di Navigazione?



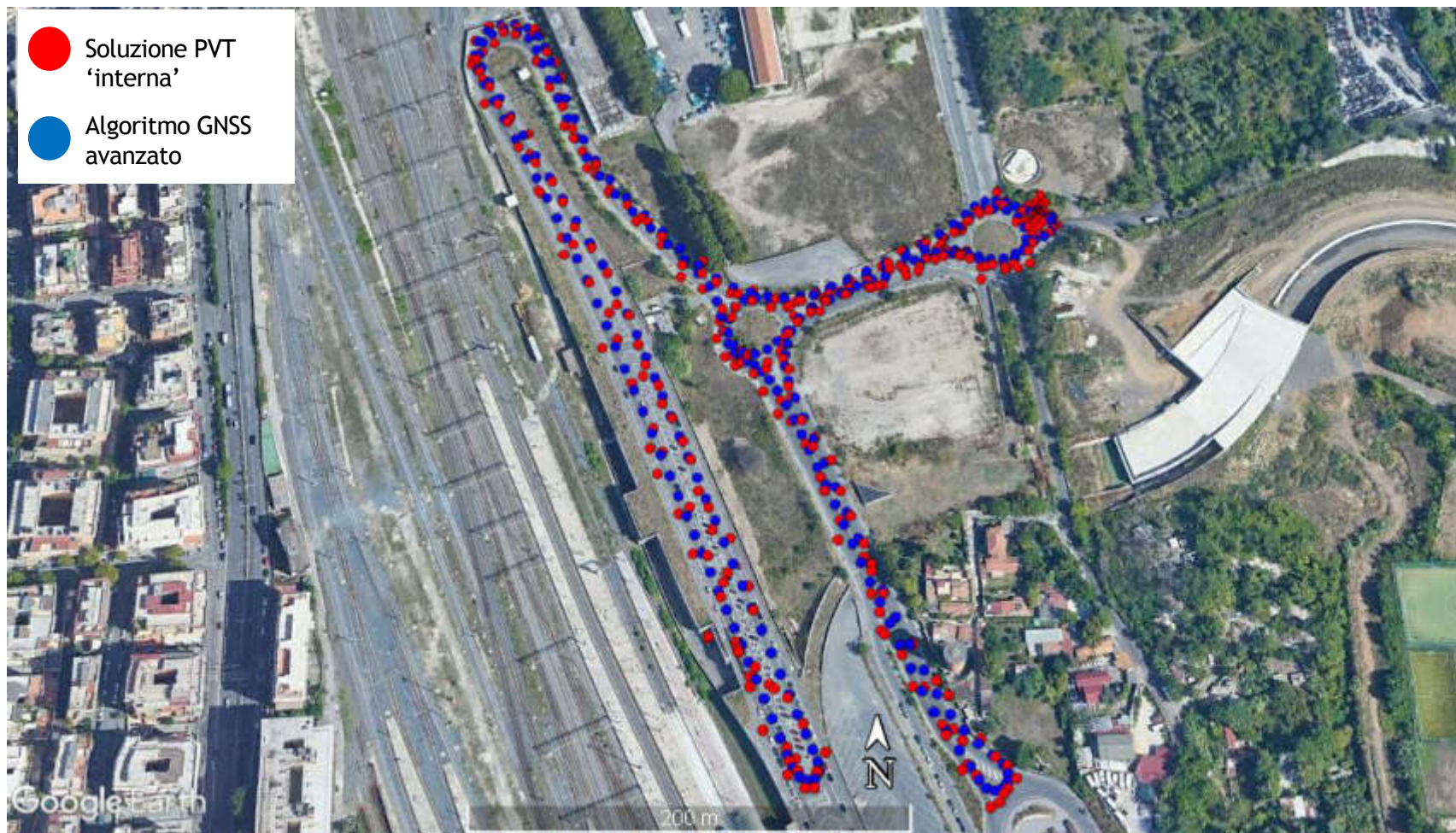
* Tra gli algoritmi avanzati rientrano RTK (Real Time Kinematic), PPP (Precise Point Positioning) e altri correntemente in fase di sviluppo in ambito di ricerca

Navigazione veicolare

Acquisizione cinematica utilizzando un ricevitore GNSS geodetico e un Huawei P10



Navigazione veicolare



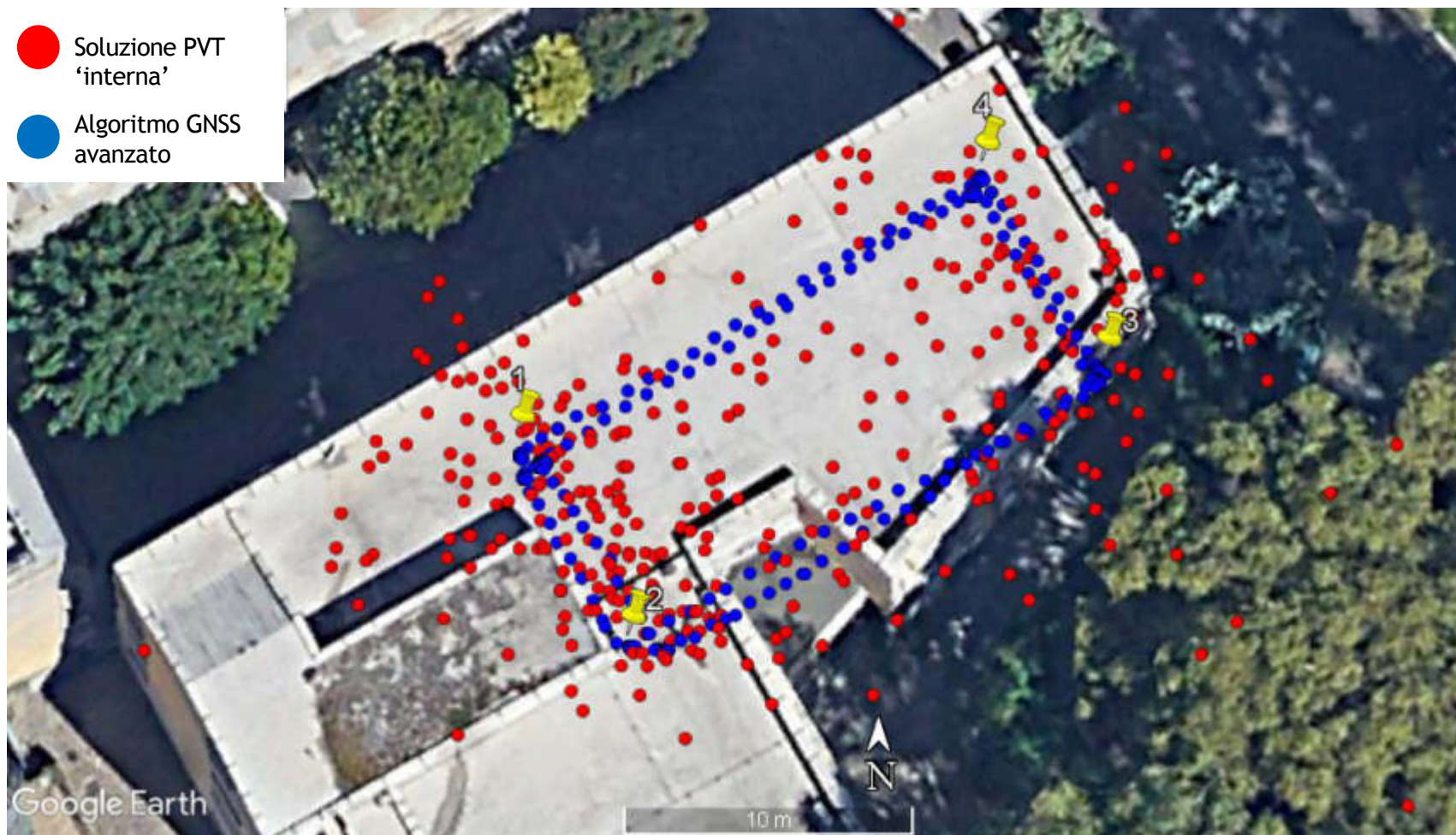
Navigazione pedonale

Acquisizione cinematica tra 4 punti noti utilizzando un ricevitore GNSS geodetico e uno Xiaomi Mi 8



Navigazione pedonale

- Soluzione PVT 'interna'
- Algoritmo GNSS avanzato



Conclusioni e sviluppi futuri

- ▶ La disponibilità di Android GNSS Raw Measurements API permette di ottenere direttamente **osservazioni GNSS dai nostri smartphone**
- ▶ L'**accuratezza** raggiungibile in **navigazione** veicolare e pedonale ne beneficia
- ▶ E' possibile stimare anche **parametri di moto** utilizzando osservazioni GNSS

Dove sta andando la ricerca?

- ▶ **Crowd Systems e Smartphone** possono supportare:
 - ▶ Applicazioni in ambito ITS (Intelligent Transport Systems)
 - ▶ Nuove **polizze assicurativa** in ambito veicolare
 - ▶ Interazioni tra veicoli a guida autonoma in **V2X communication**
 - ▶ Attività di **monitoraggio del manto stradale**
 - ▶ ...

Grazie per l'attenzione

m.fortunato@uniroma1.it