

Data Science and Philanthropy: a case study on Gender Gaps in Urban Mobility

Ciro Cattuto
ISI Foundation
@ciro

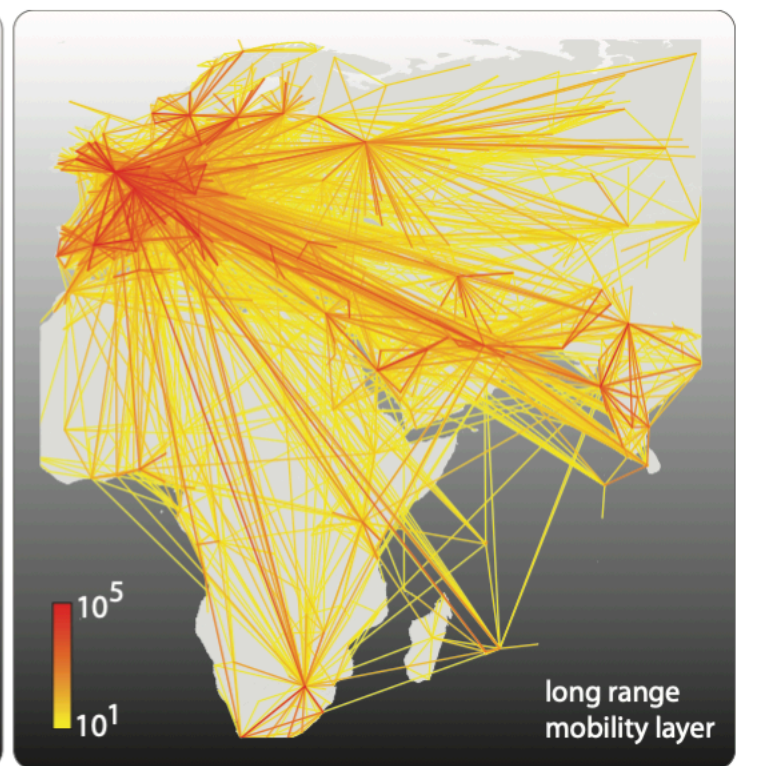
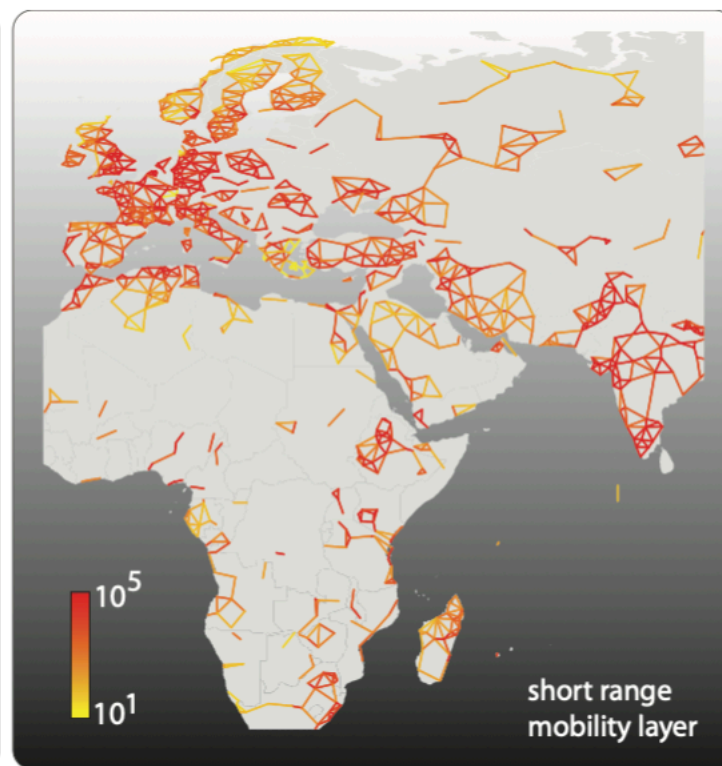
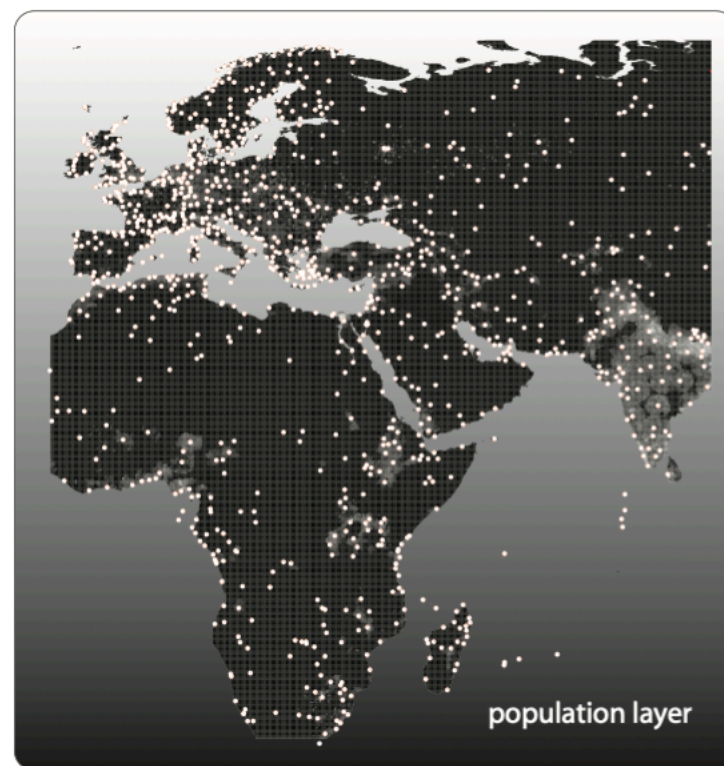
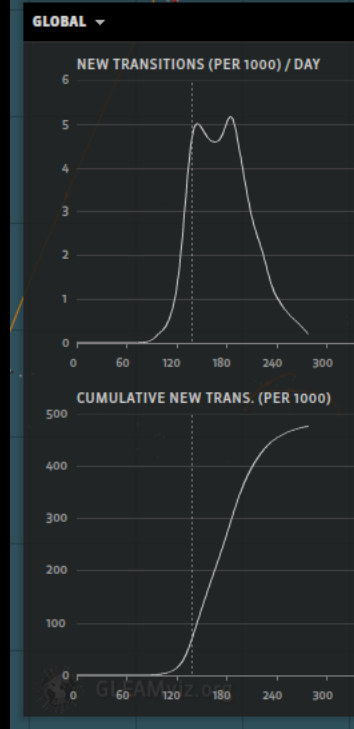
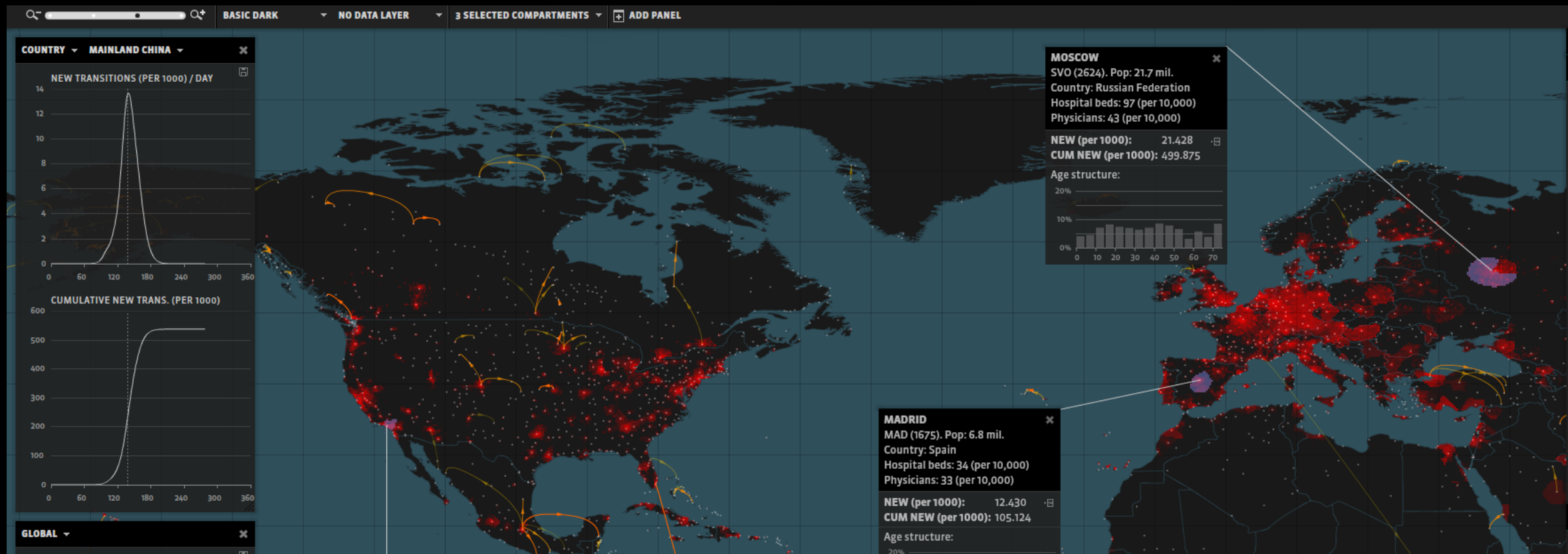
AI for Social Good Workshop
Qatar Computing Research Institute
Doha, 17 February 2019

ISI Foundation



www.isi.it

epidemic forecast



participatory disease surveillance

Welcome to InfluenzaNet Analytics

Explore the data collected by the InfluenzaNet platform
on Influenza-like illnesses throughout Europe

Browse data

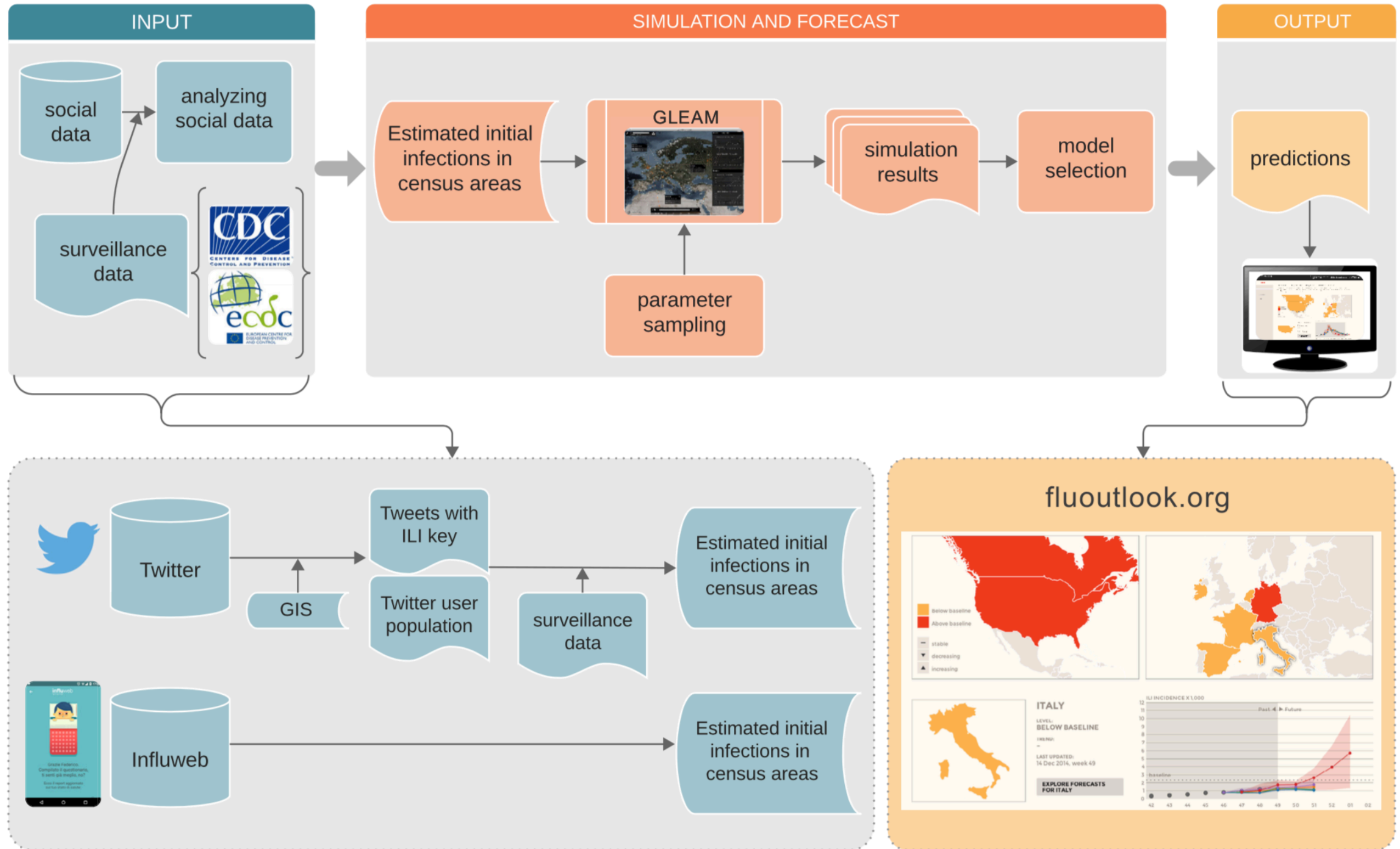
[Flu Report](#)[Vaccination Report](#)[Behaviour Report](#)[Risk factors Report](#)[User Report](#)

Learn more

[Project Information](#)[The Team](#)[The Data](#)

influenzanet.info

seasonal flu forecast



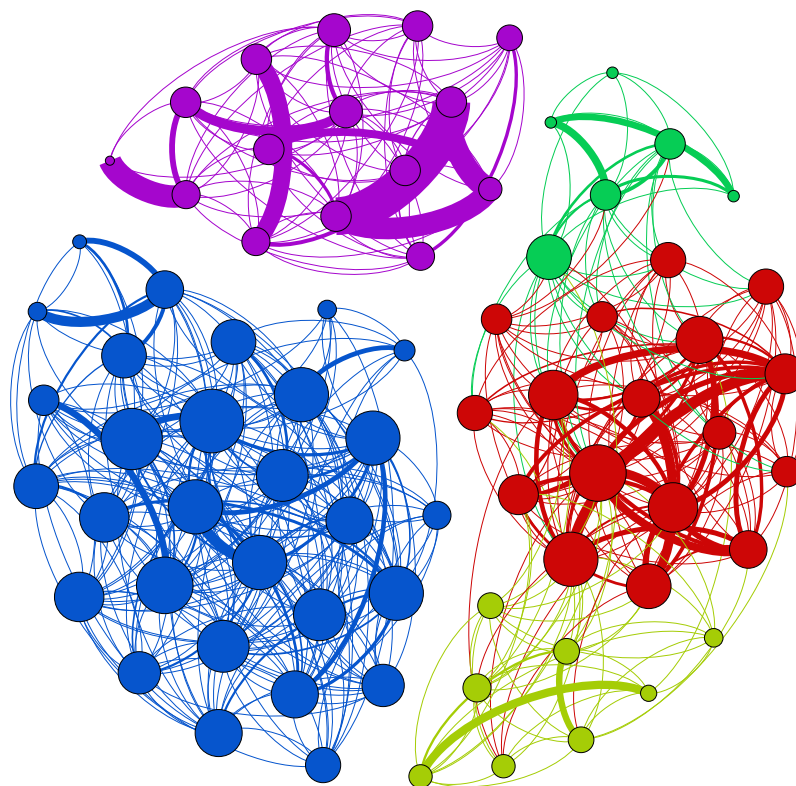
www.fluoutlook.org

high-resolution contact networks



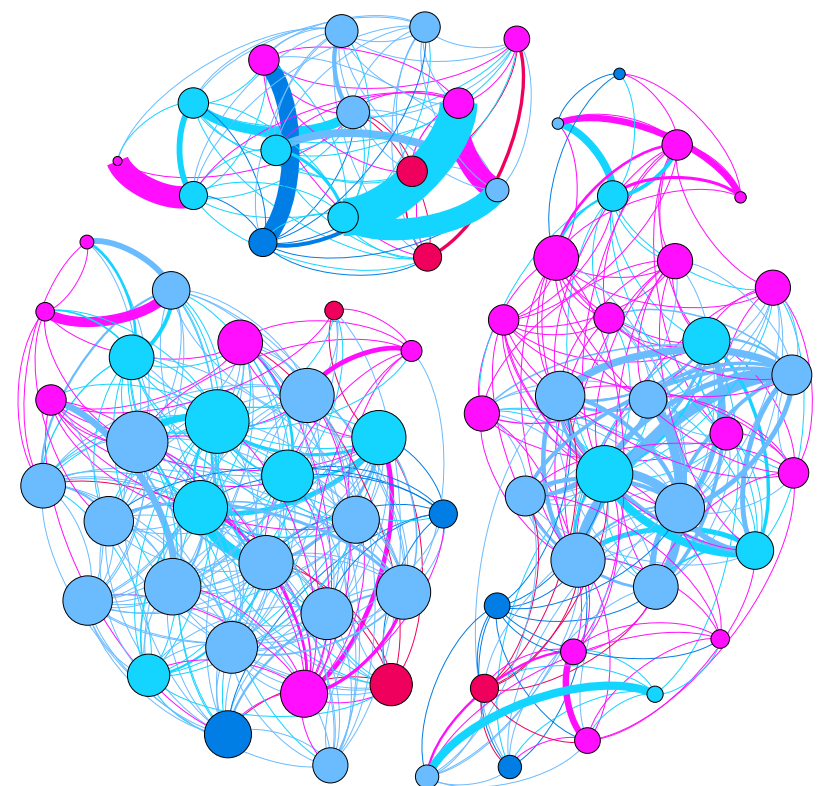
Household

■ B ■ E ■ F ■ H ■ L



Age

■ 0-5 ■ 6-14 ■ 15-19 ■ 20-49 ■ >50





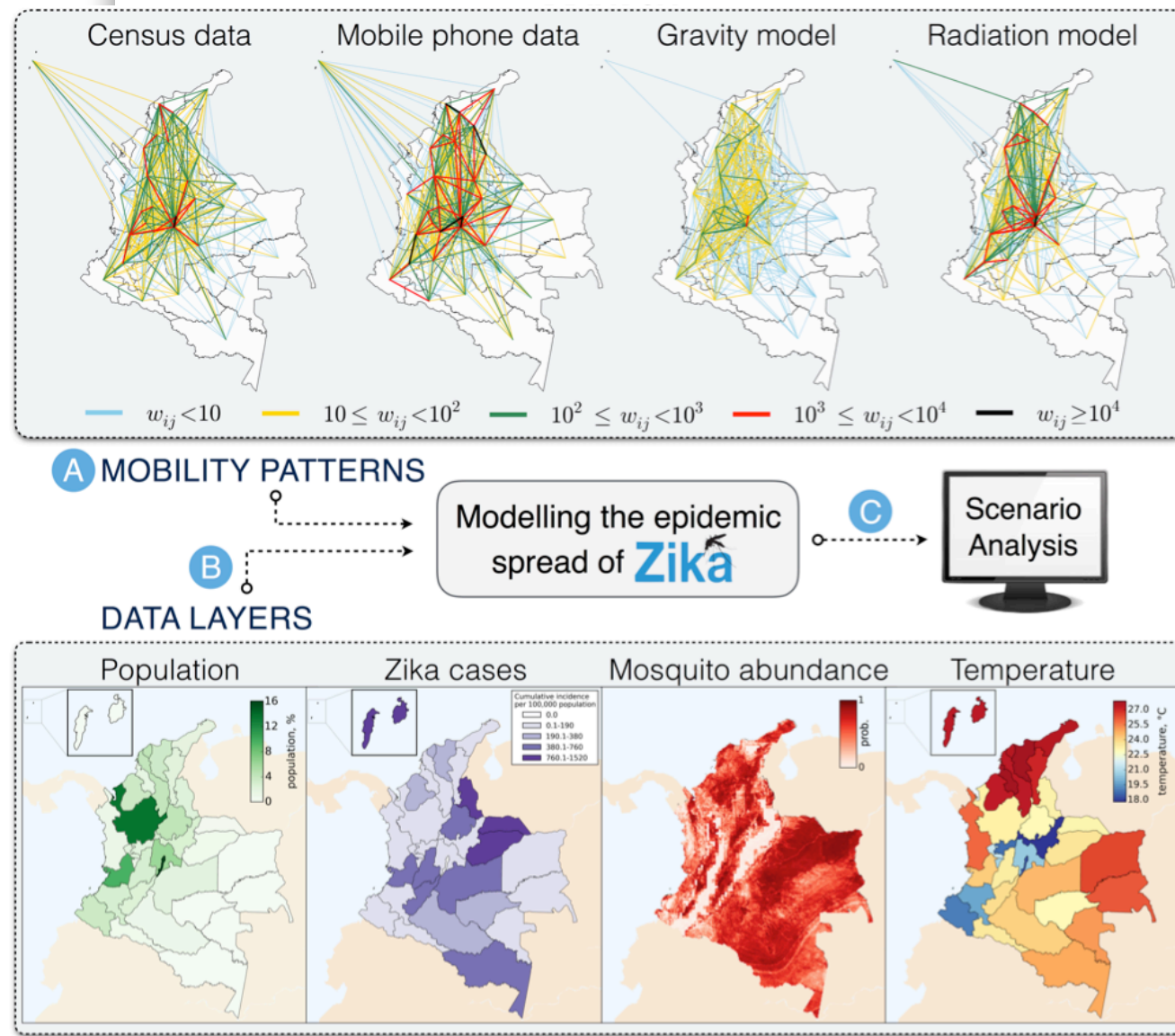
ABOUT
PROJECTS
LABS
NEWS
CHALLENGES

BLOG

CAN MOBILE PHONE TRACES HELP SHED LIGHT ON THE SPREAD OF ZIKA IN COLOMBIA?

Daniela Perrotta, ISI Foundation researcher and UN Global Pulse fellow

Apr 24, 2018



Telefonica



www.unglobalpulse.org/news/using_mobile_traces_curve_Zika_spread_Colombia_data-speaks.luca-d3.com/2018/04/mobile-data-mapping-Zika.html

Sections

Abstract

Introduction

Methods

Results

Discussion



Abbreviations

References

Copyright

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How Search Engine Data Enhance the Understanding of Determinants of Suicide in India and Inform Prevention: Observational Study

Natalia Adler¹, MA ;  ; [Ciro Cattuto², PhD](#)  ; [Kyriaki Kalimeri², PhD](#)  ; [Daniela Paolotti², PhD](#)  ;
[Michele Tizzoni², PhD](#)  ; [Stefaan Verhulst³, MA](#)  ; [Elad Yom-Tov⁴, PhD](#)  ; [Andrew Young³, MA](#) 

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²ISI Foundation, Torino, Italy
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⁴Microsoft Research, Herzeliya, Israel

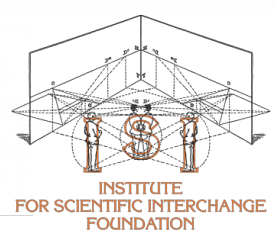
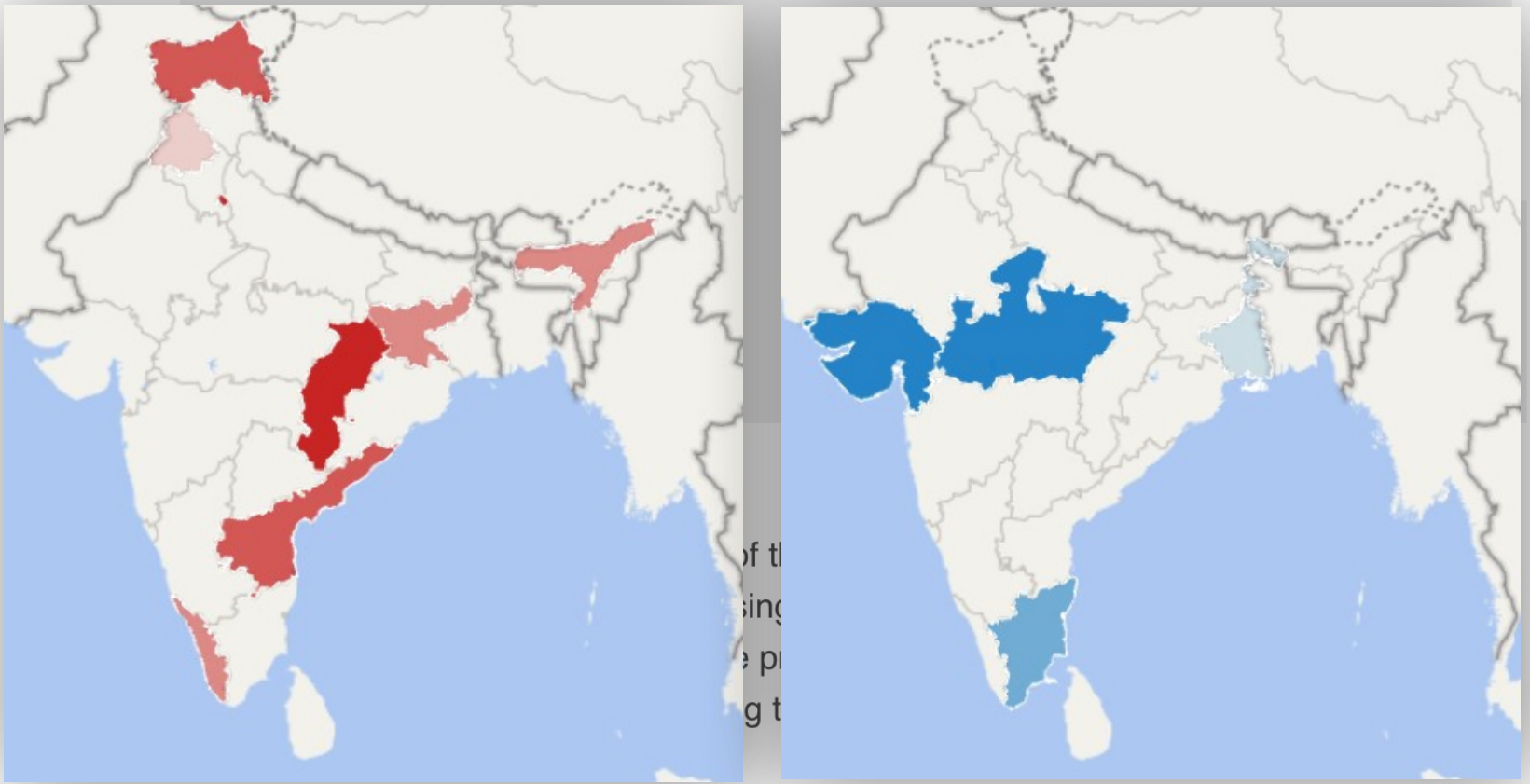
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India and Inform Prevention: Observational
Study
J Med Internet Res 2019;21(1):e10179
DOI: [10.2196/jmir.10179](#)
PMID: [30609976](#)

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RESEARCH + PHILANTHROPY

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DATA SCIENCE

+

“DATA SCIENCE FOR
SOCIAL IMPACT”
RESEARCH LAB

HUB ON DATA SCIENCE FOR PHILANTHROPY

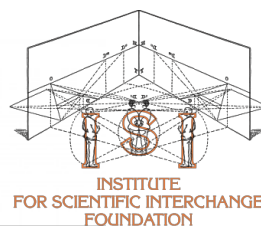
CASE STUDIES &
PARTNERSHIPS

CRT FOUNDATION

scientific network

partner network:
European Foundation Centre
NGOs, agencies

Gender Gaps in Urban Mobility



data2x^o

Big Data for Gender Challenge

www.data2x.org/big-data-challenge-awards

125+ proposals submitted
10 funded projects



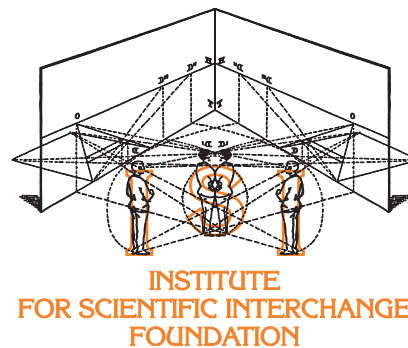
www.data2x.org

data2x^o
partnering for a
gender data revolution

Gender and Urban Mobility: Addressing Unequal Access to Urban Transportation for Women and Girls



policy and process



research



research



domain expertise



data provider



data provider

Are there gender differences in urban mobility ?

YES

women move *more*

Psylla *et al.*, PLoS ONE 12, e0189873 (2017)

- trip chaining
- child care

YES

women move *less*

Adeel *et al.*, Transportation 44, 1519 (2017)

- cultural/social factors
- safety concerns
- access to transport

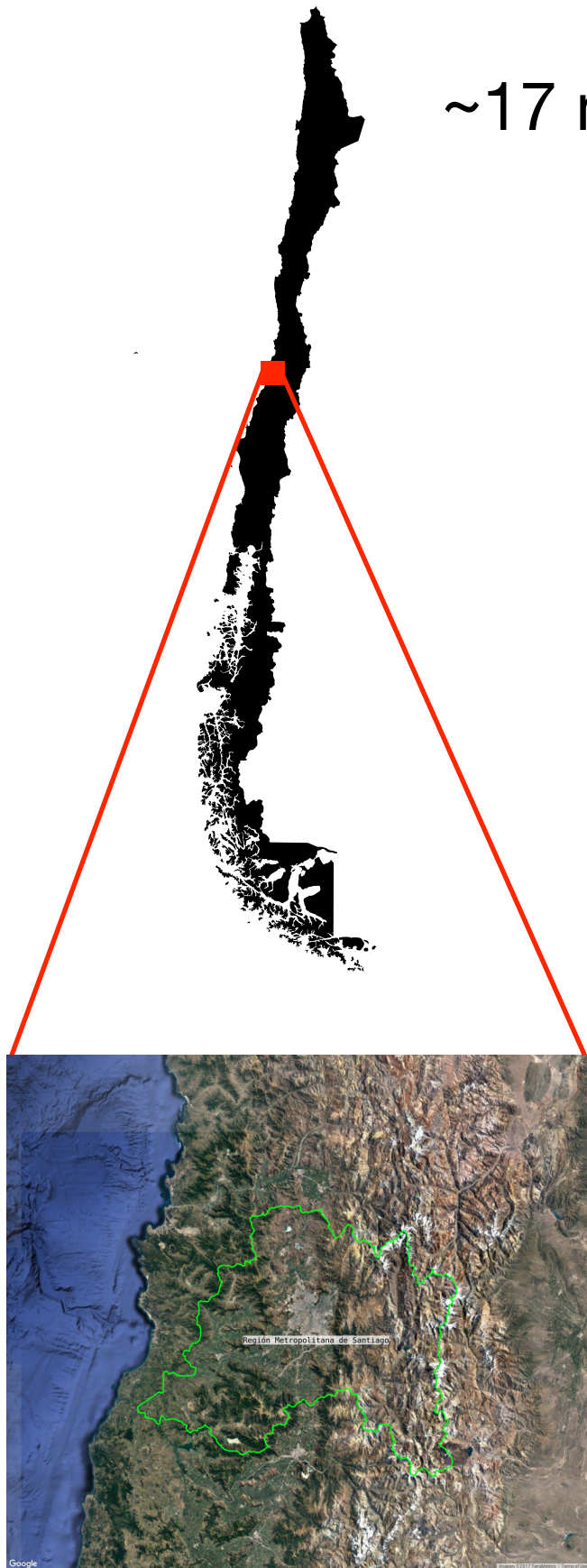
NO

there is no difference

Song *et al.*, Science 327, 1018 (2010)

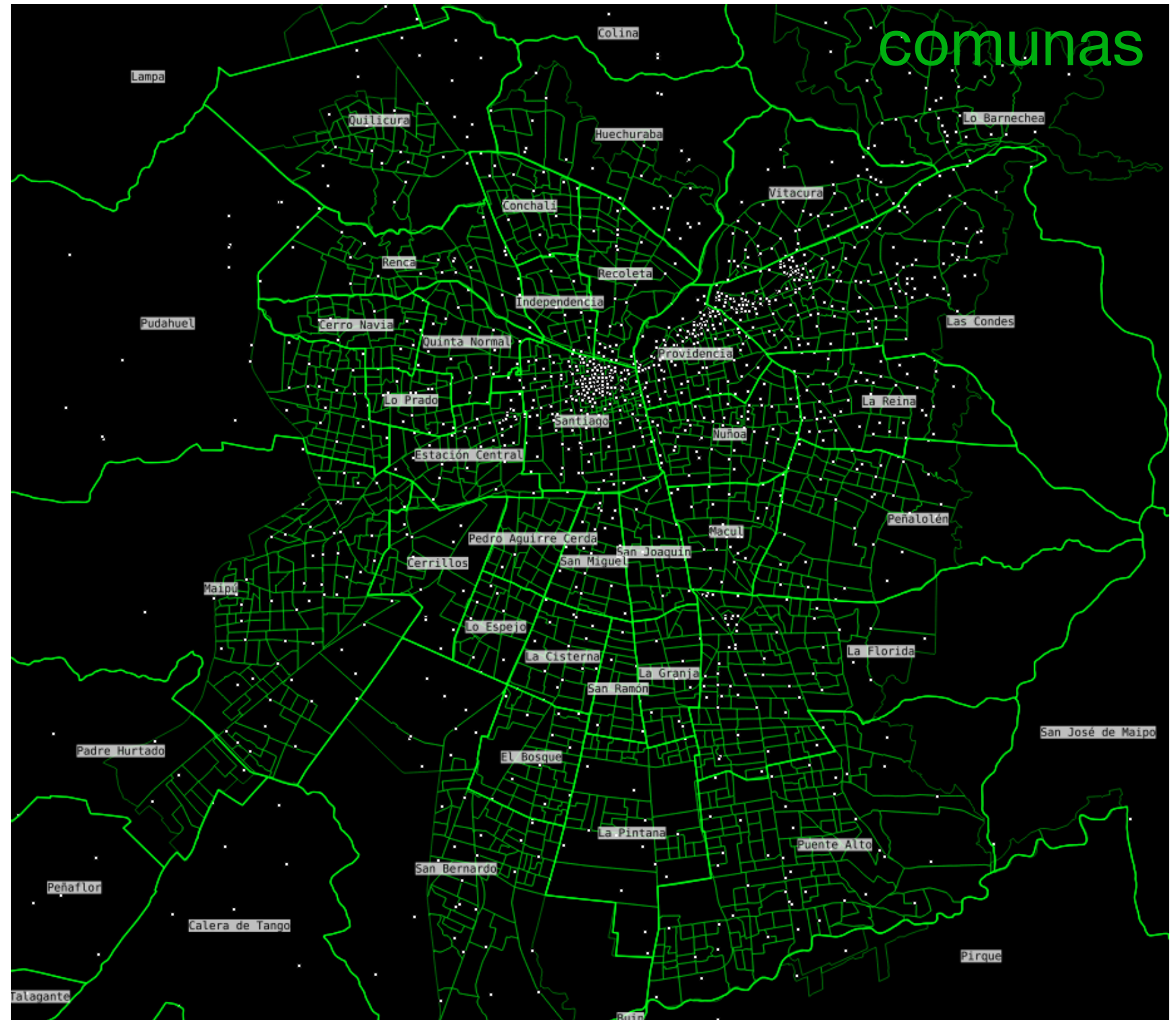
Chile

~17 million inhabitants



Santiago Metro Area

~8 million inhabitants



user selection

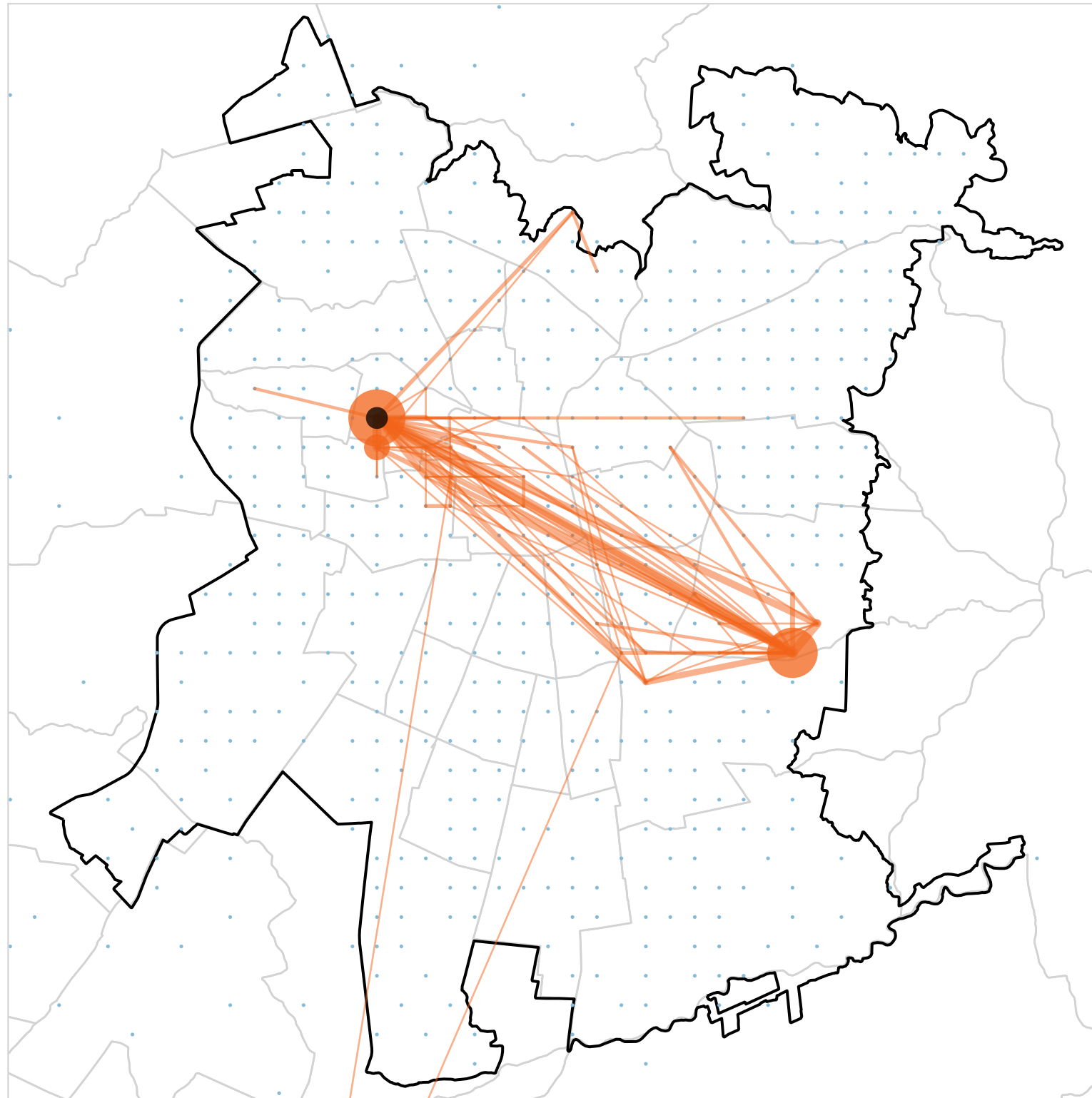
- **gender** information: **770,678** (50.2% F)
- **active** (> 1 call per day): **430,079** (51% F)
- identifiable **home location**: **416,257** (51.2% F)
- **Grupos Socioeconómicos (GSE)** labels:
315,844 (50.9% F)
- **representative at comuna level:**
 - ▶ population distribution
 - ▶ GSE distribution
 - ▶ F/M population ratio



cell towers

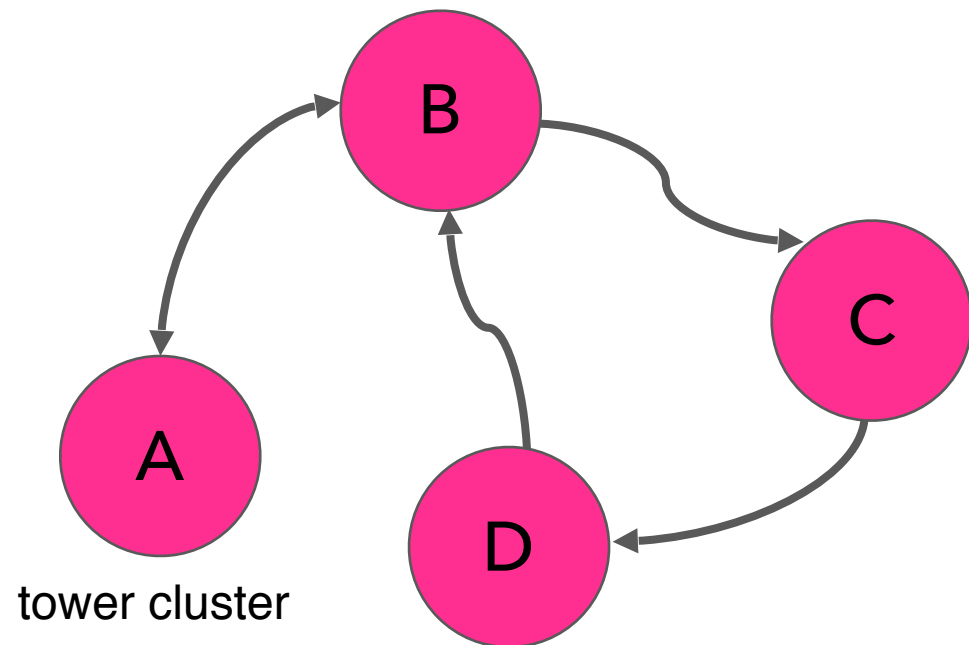


- ~1300 cell phone towers
- grouped in ~**700 spatial clusters**
- excellent coverage of Santiago metro area
- **1x1 km grid over the city**



*simulated data

diversity of visited locations



low entropy pattern



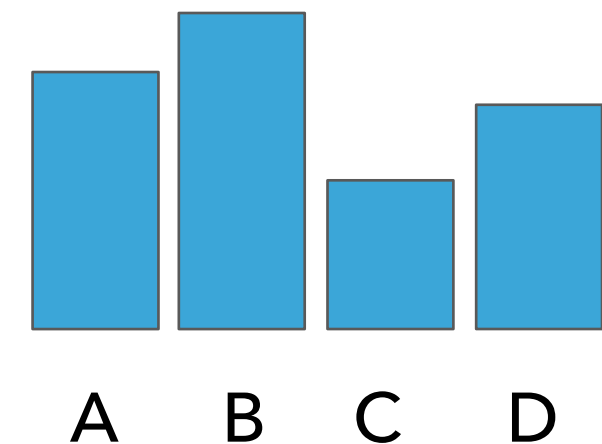
raw entropy:

$$E^{(u)} = - \sum_i p_i^{(u)} \ln p_i^{(u)}$$

number of core locations:

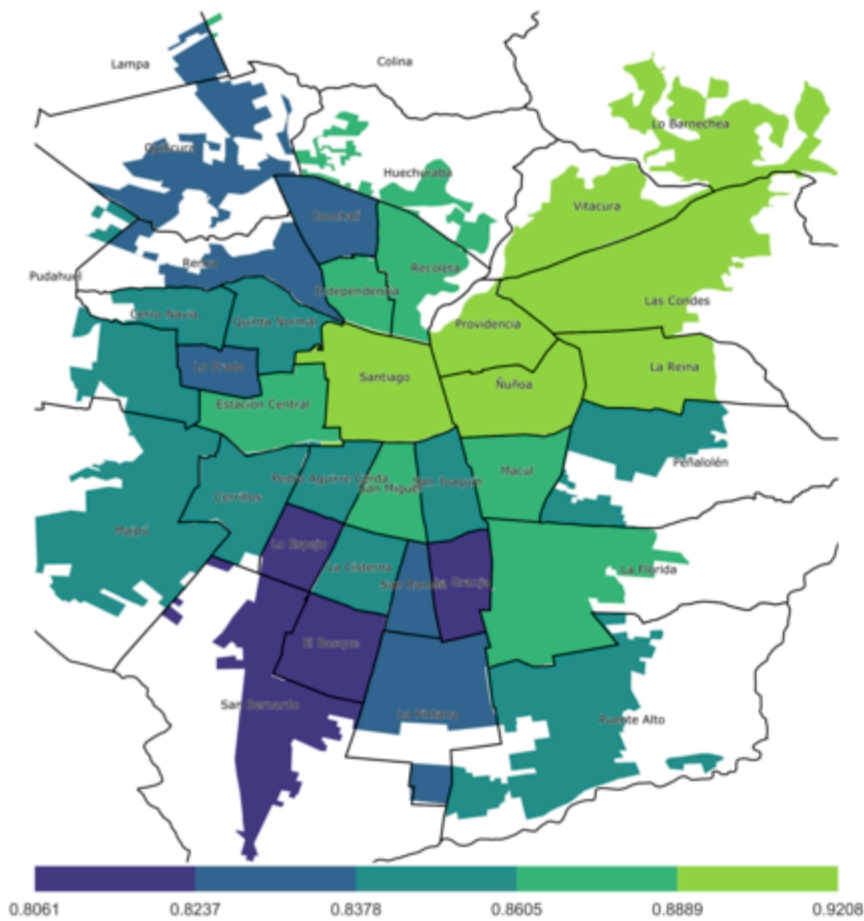
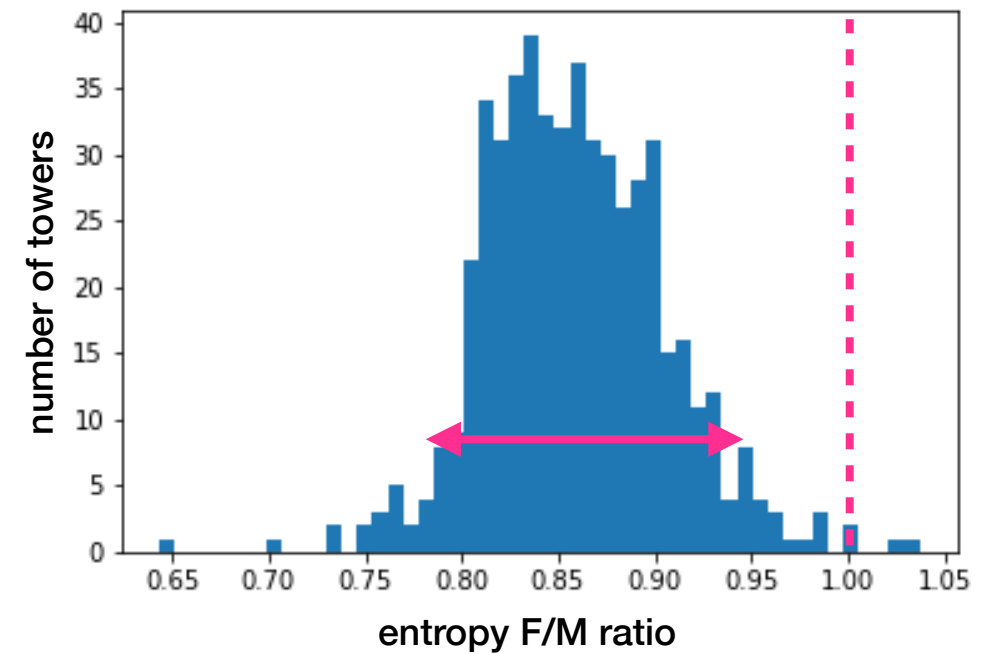
$n^{(u)}$ = # most frequently visited locations accounting for 80% of activity

high entropy pattern

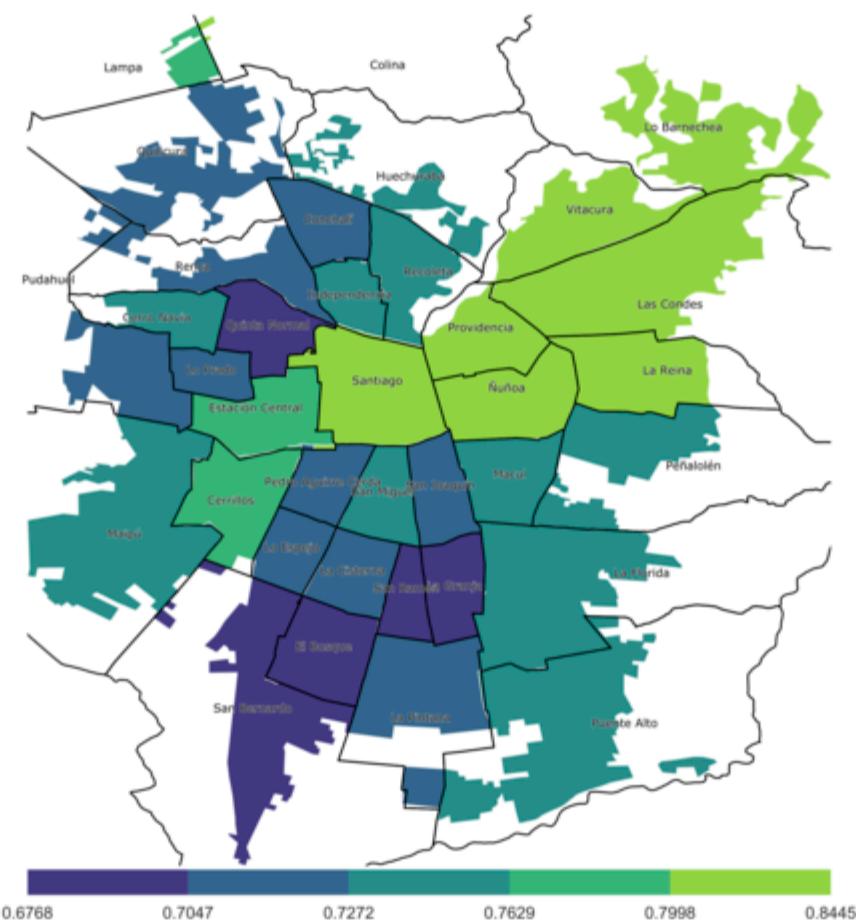


entropy ratio as a spatial feature

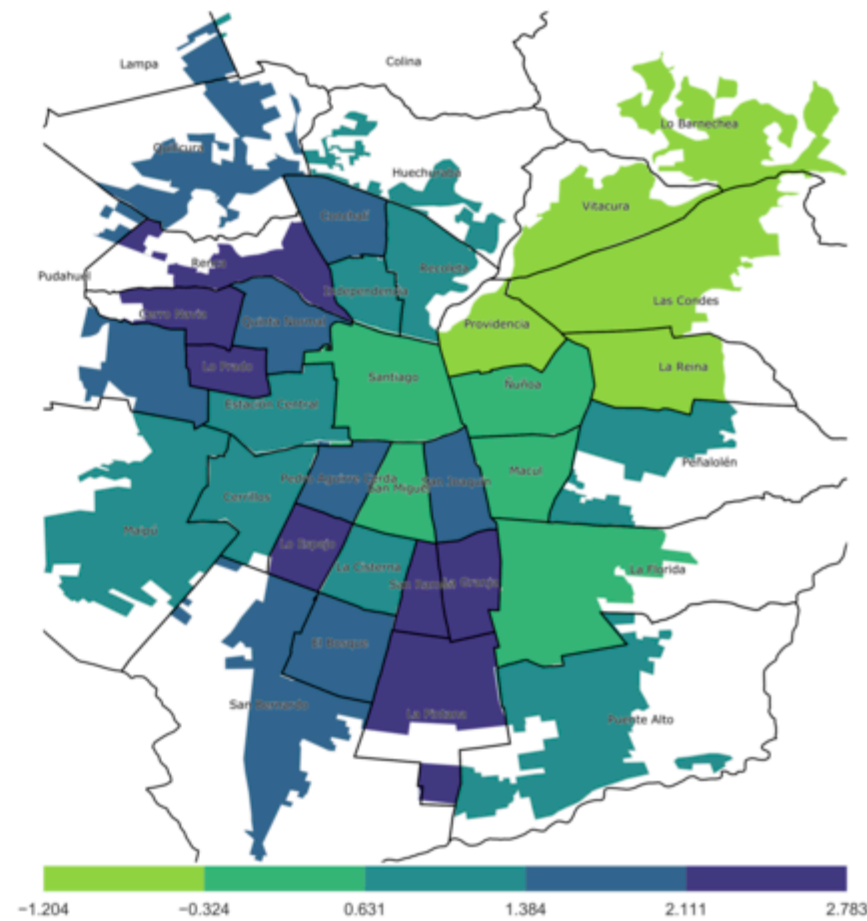
$$R_E(l) \equiv \frac{\langle E^{(u)} \rangle_{u \in \text{females living at } l}}{\langle E^{(u)} \rangle_{u \in \text{males living at } l}}$$



entropy F/M ratio

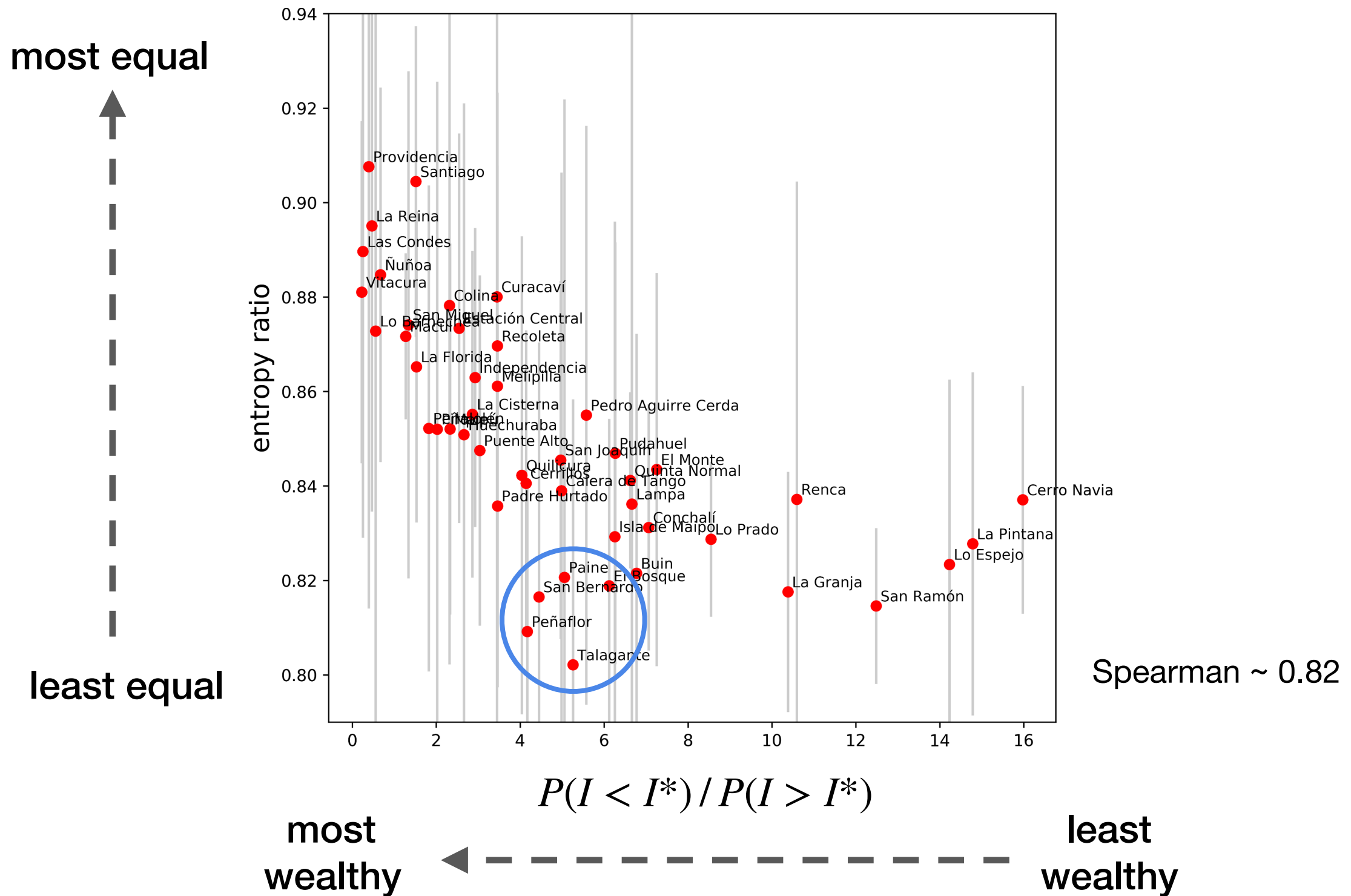


top visited locations F/M ratio



household income from census

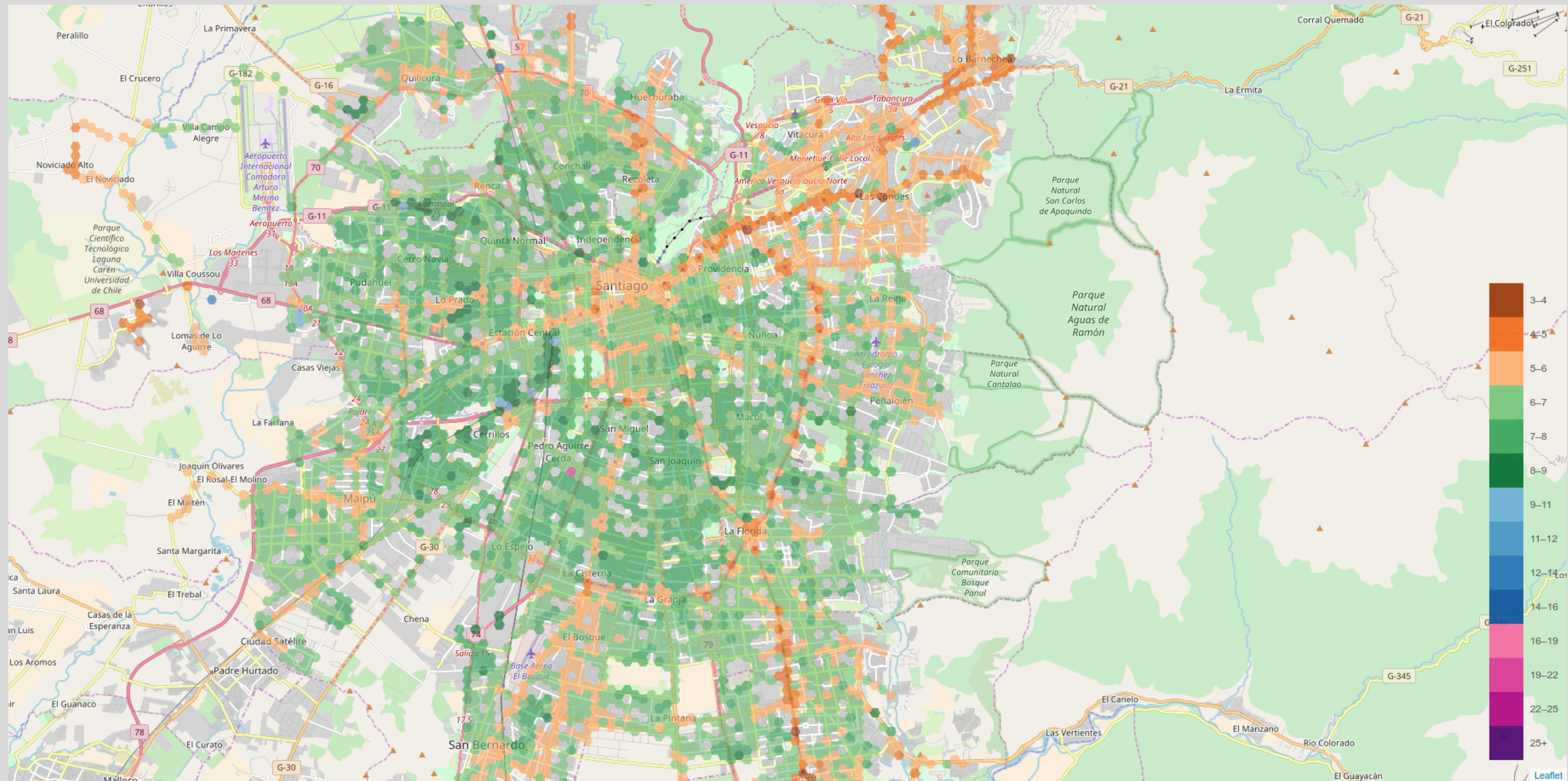
entropy ratio vs socio-economic composition



the role of public transport

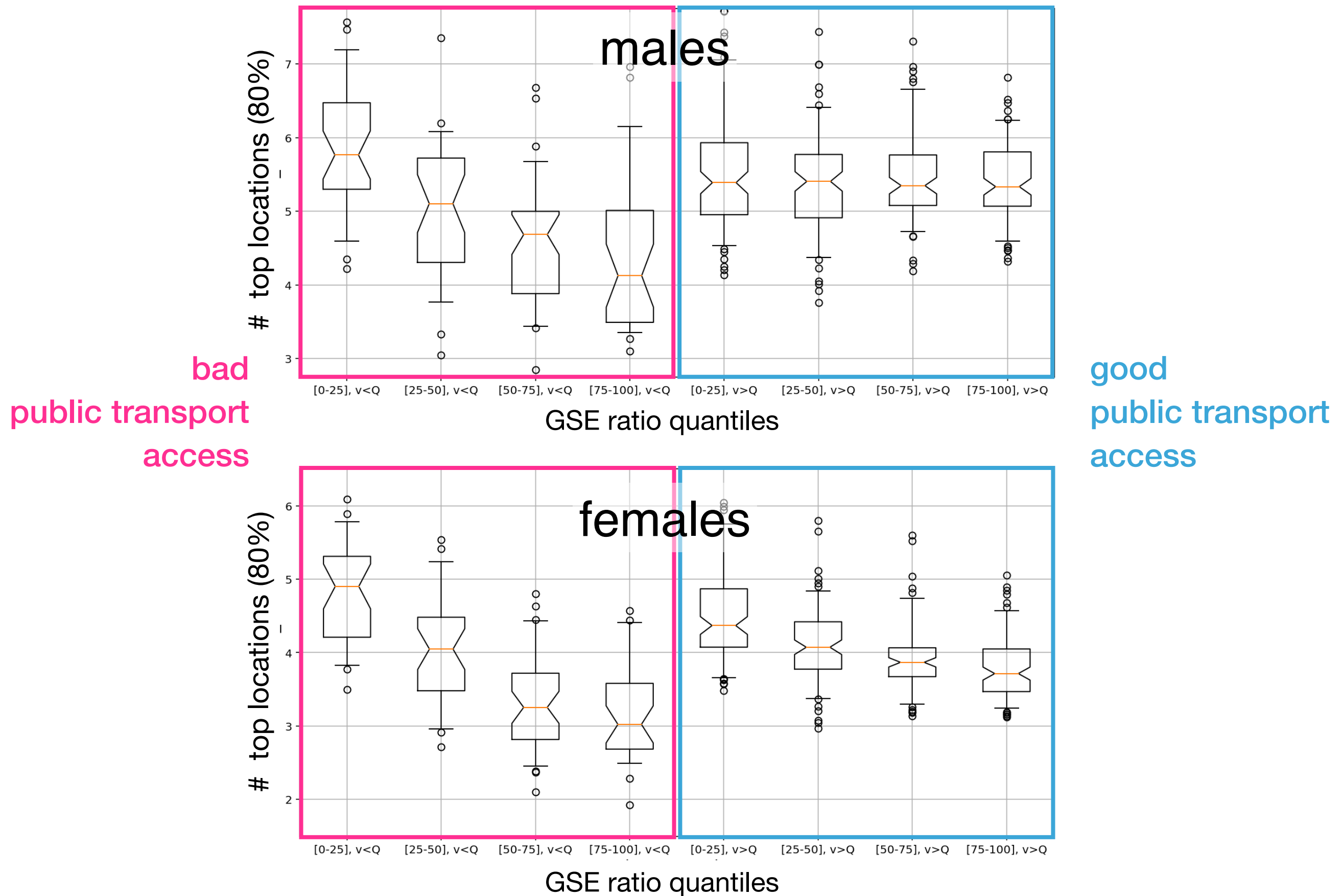


public transport network from GTFS data



- access to public transport
- number of reachable stations
- average velocity to reach other nodes in the network

number of visited locations vs public transport access



gender differences in visited locations

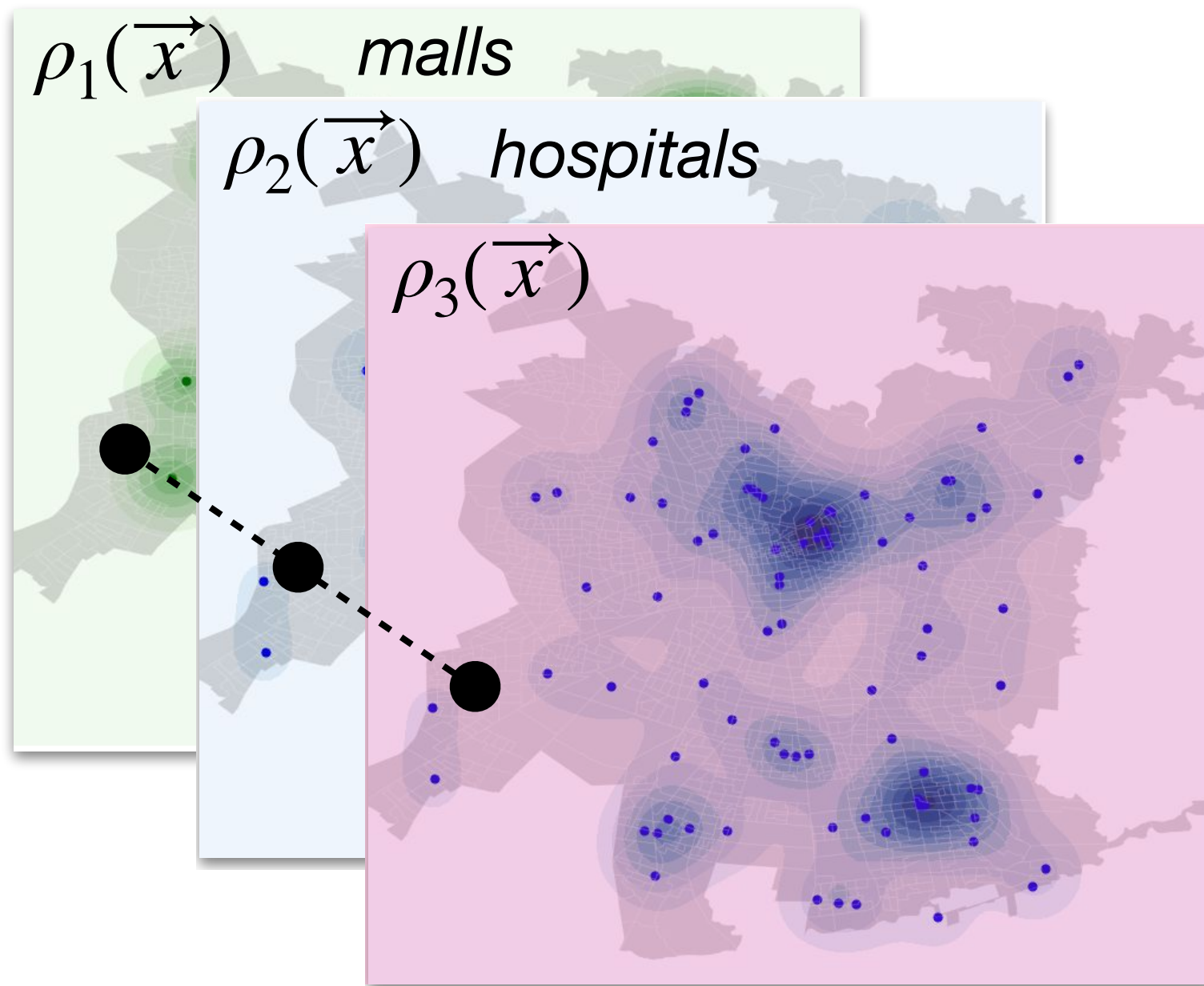


www.OpenStreetMap.org

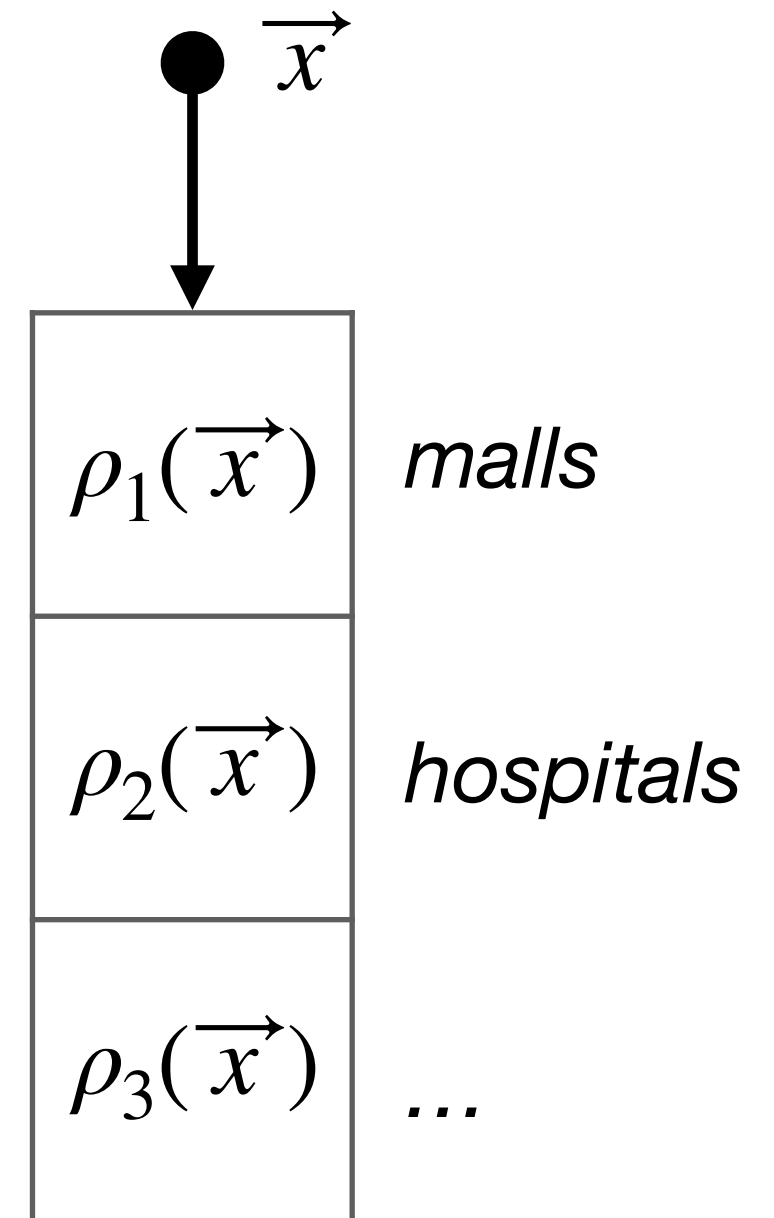


- ☒ Mapnik
- ☐ ArcGIS World Topo
- ☐ Positron (CartoDB)
- Overlays**
 - ☐ ATM
 - ☐ Bank
 - ☐ Bench
 - ☐ Bicycle parking
 - ☐ Bicycle rental
 - ☐ Cinema
 - ☐ Clinic
 - ☐ Embassy
 - ☐ Firestation
 - ☐ Fuel
 - ☒ Hospital
 - ☐ Library
 - ☐ Music school
 - ☐ Parking
 - ☐ Pharmacy
 - ☐ Police
 - ☐ Letter box
 - ☐ Post office
 - ☐ School/college
 - ☐ Taxi
 - ☐ Theatre

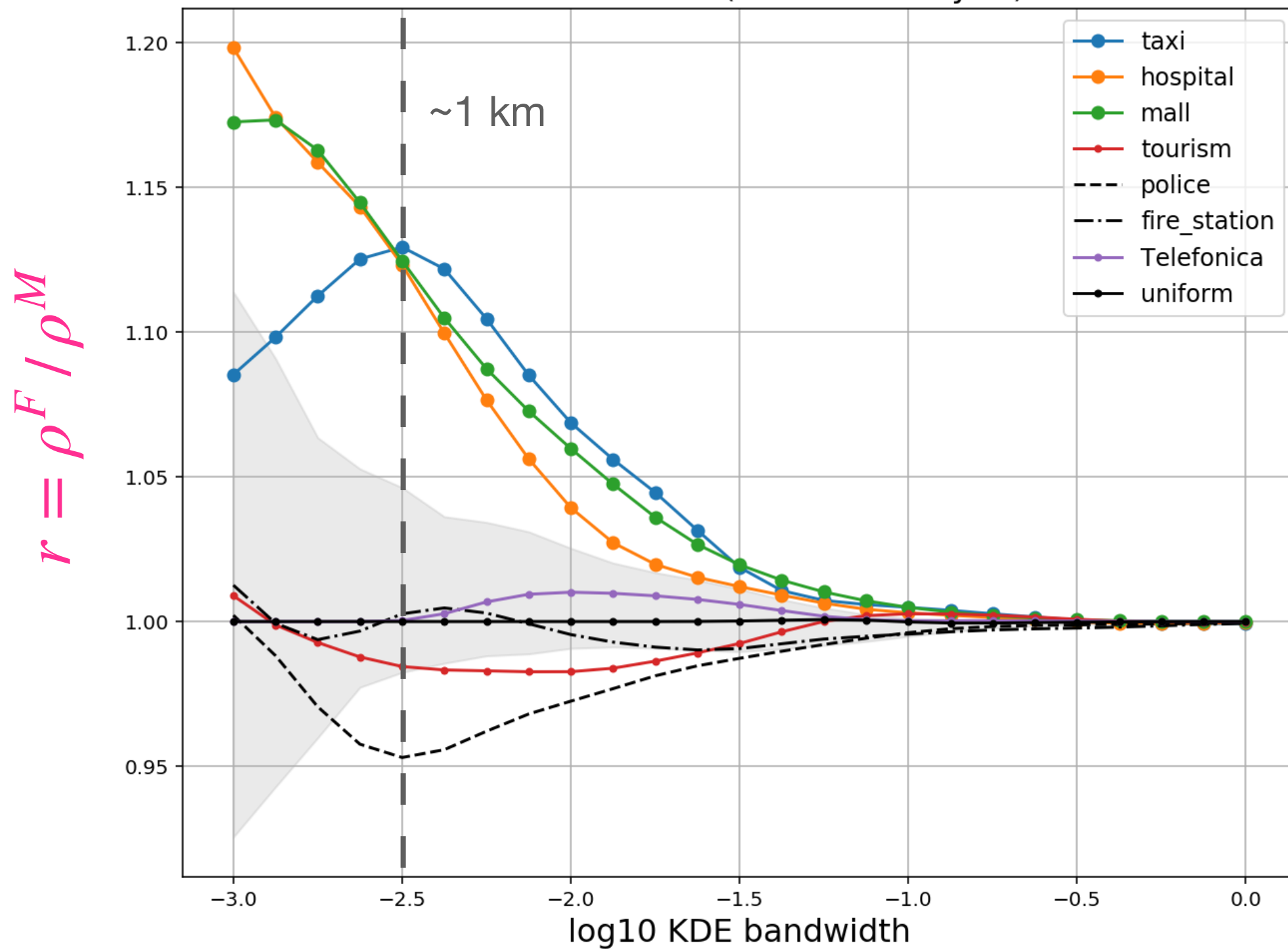
Points Of Interest density layers



Kernel Density Estimator
with variable spatial bandwidth



gender differences in visited locations



- only includes non-home visited locations
- robust wrt removal of inferred work location

- Stefaan Verhulst (NYU GovLab)
- Natalia Adler (UNICEF)
- Leo Ferres (UDD & Telefonica)
- Pablo Garcia (Telefonica R&D)
- Karim Touma (Telefonica Big Data)
- Andrew Young (NYU GovLab)
- Laetitia Gauvin (ISI Foundation)
- Michele Tizzoni (ISI Foundation)
- André Panisson (ISI Foundation)
- Daniela Paolotti (ISI Foundation)
- Simone Piaggese (ISI Foundation)

seeking:

- **problem owners**
 - public health
 - mobility / migration
 - online social networks
 - future of cities
- **partnerships & data collaboratives**

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