BIG DATA AND AI TO ANALYZE MOBILITY IN SPAIN

Tania Gullón Muñoz-Repiso
1. Introduction and Overall framework
2. Methodology
3. Studies and results
4. Conclusions
Introduction and Overall framework

2030 Safe, Sustainable and Connected Mobility Strategy

5.1.2. Analysis of mobility flows at the national level and creation of the national transport model
Introduction and Overall framework

es.movilidad

2030 Safe, Sustainable and Connected Mobility Strategy

TRANSPORT INFRASTRUCTURES

TRANSPORTATION SERVICES

MOBILITY

HERMES GIS

NAP Transporte Multimodal

BIGDATA

NTM
Advantages of using bigdata for measuring mobility

**SURVEYS**
- High investment
- Small Sample
- Not seamless
- Subjective info

**BIGDATA**
- Low investment
- Large sample
- Seamless
- Comparable

30% Spanish population
METHODOLOGY
Estudio 2022-2024

Transport network

Tpt. Service data: schedules, stops

Demand data

Origin Activity

Destination Activity
 Workflow (1/2)

- Mobile Devices
- Cell map-Network topology
- Land Use and POIS
- Transport Network and transport services supply and demand data
- Sociodemographic statistics

- Pre-processing and data cleansing
- Sample selection
- Activity and travel detection algorithms
- Sample expansion
- Transport and mobility indicators generation

Data validation

O/D Travel Matrix
Workflow (2/2)

We get this...

Large amount of raw data (11 million records per day)

Storage

Automatic Data validation

Visual Data validation

Quality Assurance

Processing Viewers implementation Publication

Advanced data analytics
STUDIES AND RESULTS
BIGDATA Studies:

- **2017**: Jul/oct
  - 2 weeks
  - Modal split
  - Regions: 60 areas + abroad

- **2020**: may
  - Every day
  - Municipalities: 2600 areas

- **2021**: feb
  - Every day
  - Modal split
  - Districts: 3800 areas + abroad

- **2022**

- **2025**
  - + accurate
  - + ambitious
2022-2024 Study

1) General Mobility

2) Modal split

3) Road Routes

District level

3.743 study areas + foreign countries
Monitor Real time Mobility - O/D trips per hour

- By Origin Destination
- By hour
- By distance
- By sociodemographic profile
- By activity (home/work/frequent/not frequent)
- By residence
- Overnight stays
- N ° trips per person
1) General Mobility:

- **Main flows** between regions

- **Mobility patterns:**

- **Compare** different regions / different dates

- **Analyze** mobility by activity/ distance/ age/ gender/ income..
2022-2024 Study

1) General Mobility

2) Modal split

Trips > 5km

- Smartphones+ external sources
- Trips+Stages matrixes
- 15 days per month

Trips >0 km

Urban modes

*Pilot for 2 cities + surveys

Monthly Trip rate

PT Terminals study

Cross-border study

3) Road Routes

- Monthly Trip rate
- PT Terminals study
- Cross-border study
2022-2024 Study

1) General Mobility

2) Modal split

3) Road routes
1) General Mobility

2) Modal split

3) Road routes

a) Routes for each O/D

b) For each road section

For each Route:
- #trips
- Average travel time
- Distance

For each section:
- #trips
- ODs
- Distribution of distances
Results:

Open Data Mobility

Results:

Modal split
Road Routes
BIGDATA PLATAFORM
Usage

- National and International Research projects
- Mobility analysis in the Murcia metropolitan area
- R&D projects at the AEI
- Transport planning in A Coruña
- Public transport analysis at the Murcia Region
- Digital twins
- Multimodality studies for high-speed train stations
- Analysis of traffic flows into Madrid
- Transport planning in the Balearic Islands
- National Transport Model (NTM)
- National and International Research projects
- Mobility Studies in the island of Tenerife
- New infrastructure planning
- Mobility planning and monitoring in Vitoria-Gasteiz
- Flu outbreak models based on mobility patterns
- AMB bigdata platform
- Analysis of high traffic areas
- Sustainable Urban Mobility Plans
- Transport Carbon footprint
- Studies on demand of Multimodal transport
- Sustainable and inclusive strategies for the optimization of transport in rural areas
- Correlation Analysis between Real Estate price and origin and destination of commutes
- Mobility reports for other government bodies
- PMUS
- Reports and public communications on mobility in Andalucia
- Studies on the evolution of the pandemic and its impact on mobility
CONCLUSIONS:

- Bigdata applied to telephone records is **very useful and has a lot of potential** but:
  
  - Limited by the **Data Protection regulation** - Rural mobility
  
  - Has biases (children, elderly)
  
  - **For interregional mobility:** Demand data fusion required for modal inference (and data is not easy to get)
    - Incomplete or non existing data (bus, boat)
    - Not shared data (railways)
  
  - **For urban mobility:** Surveys data fusion (+demand data) required for urban modes inference
  
  - Investment required for Data validation and Data processing
  
  - The evolution in quality is linked to evolution in technology and data sharing - **MOBILITY DATA SPACES**
Collaboration
Innovation
Sustainable
Mobility Data Spaces
¿Y TÚ...

...Para qué vas a usar estos datos?

...Cómo querrías consultarlos/descargarlos?

THANK YOU VERY MUCH

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**Challenges**

- **Intercity modes discrimination:**
  - Calibration required: demand data
  - Bicycle: ???

- **Urban modes discrimination:**
  - Surveys required
  - Public modes: Transport Smart Cards
  - Active modes: ???

- **Rural mobility:** Area coverage and data protection
- **Mobility by age and gender:** data protection

- **Skewedness:** Children, elderly people...
- **Surveys Vs:** reasons for choice of modality...

**Solutions**

- **Agreements/Legislation**
- **Bus and boat:** Digitization and improvement of counting techniques
- **Bicycle R&D&I:** ML GPS, Strava..

**Cities:**
- Surveys **designed for big data**
- **Collaboration** municipalities, consortiums
- **R&D&I** (GPS, cam metering, ML GPS)

**Ad-hoc products**
- Collaboration with the Data Protection Agency
- Technological evolution: 5G

- Surveys **designed for big data**
- **R&D&I**
- **Mobility Data Space**