Big Data Analytics for Passenger-Centric ATM

A Case Study of Door-to-Door Intermodal Passenger Journey Inferred from Mobile Phone Data

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Delft 8th of November 2016
The motivation of the BigData4ATM project is the lack of reliable and updated passenger-related information:

- **No information on the complete door-to-door itinerary**
  - Origin and destination beyond the airport
  - Transport modes to access/egress airport

- **Public data is highly aggregated**
  - Monthly aggregated, airport/country level

- **Typically, data is collected from surveys**
  - Several limitations: cost, declared information, does not capture unpredicted events
The goal of BigData4ATM is to investigate how different passenger-centric geolocated data coming from smart personal devices can be analysed and combined with more traditional demographic, economic and air transport databases to extract relevant information about passengers’ behaviour, and to study how this information can be used to inform air transport and ATM decision making processes.

- H2020 project - SESAR Exploratory Research
- Coordinator: Nommon
- Partners: IFISC, Fraunhofer, Hebrew University of Jerusalem, ISDEFE
- Start date: May 2016, duration: 24 months

http://www.bigdata4atm-sesar.eu/
BigData4ATM

Passenger-Centric geolocated data

Demographic and socioeconomic statistics

Air transport and ATM databases

Data analysis and modelling

Door-to-door mobility

Intra-airport movement

Expenditure patterns

Opinion and sentiments

Other

Application to ATM decision-making processes

Passenger-centric door-to-door delay indicators

Integrated optimisation of airport landside and airside

Improved traffic forecasts

Socio-economic impact of ATM disruptions

Other applications
Case Study

Introduction

Scope and Objectives

Characterise the Madrid-Catalonia corridor through obtaining:

- Modal split
- Airport and HST catchment area
- Door-to-door travel times

Temporal scope: one working day of March 2016

Dataset

- Anonymised call detail records (CDRs) provided by Orange Spain
- Data from Google Maps Directions API
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Dataset

• Anonymised call detail records (CDRs)
  – Spatio-temporal data: time and cell tower to which the user is connected every time an event occurs
  – Sociodemographic data for each user (age and gender)

• Orange’s clients + roamers that connect to Orange’s network

• Sample of around 20% of the total population
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Methodology

• Sample construction
• Identification of users’ home areas
• Generation of activity-travel diaries
• Expansion of the sample to the total population
• Determination of corridor users
• Determination of transport mode
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Determination of transport mode

Mainly through intermediate registers:
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Results – Catchment areas

High Speed Train

Plane
Case Study

Results – Catchment areas

High Speed Train

Plane
Case Study

Results – Catchment areas

Barcelona metropolitan area

Madrid metropolitan area
These results are coherent with the official data, both HST-plane market share and traffic counts across the main roads.
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Results – Door to Door travel times

![Bar chart showing distribution of trip durations for air segments and total door to door travel times.](Image)
Conclusions

• Results show that mobile phone data is able to replicate official aggregated data and can be used as a source of information useful for ATM

• Mobile phone data is also able to produce new, more disaggregated data that is not available from traditional data

• With mobile phone data, the full door to door trip can be characterised – something that is not available from traditional sources
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Future directions

• Perform a more comprehensive validation of the results
• Improve the activity detection algorithm to filter out outliers detected
• Explore other city pairs and replicate the analysis for more days
• Characterise purpose of the trips
• Identification of short distance modes used to access airport by blending mobile phone data with other sources
• Refine the expansion methodology to build a synthetic population that replicates more accurately the sociodemographic characteristics of the real population
Research questions

• Can we use mobile phone data to develop better airport accessibility indicators and passenger door-to-door travel time indicators?

• What is the impact of flight delays on passenger total travel time?

• Is it possible to improve air traffic forecasting models by introducing airport accessibility indicators and passenger-centric information (sociodemographic characteristics, trip purpose, etc.) obtained from mobile phone data?

• ...?
Big Data Analytics for a Passenger-Centric Air Traffic Management System

Thank you very much for your attention!

This project has received funding from the SESAR Joint Undertaking under the European Union’s Horizon 2020 research and innovation programme under grant agreement No 699303