Big Data Analytics for Passenger-Centric ATM

Understanding Door-to-Door Travel Times from Opportunistically Collected Mobile Phone Records

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Project motivation
Analysis of passenger behaviour

Traditional approach
Travel surveys
Aviation passenger intelligence solutions

New opportunities
Official data
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

Data analysis and modelling

Application to ATM decision-making processes

Demographic and socioeconomic statistics

Air transport and ATM databases

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
Evaluate the potential of mobile phone records to extract information about passengers’ door-to-door mobility.

- Door-to-door origins and destinations
- Door-to-door travel times
- Duration of each leg of the trip

Temporal scope: July 2016

Geographical scope: Spanish domestic passengers that arrive to Madrid airport

Datasets
- Anonymised call detail records (CDRs) provided by Orange Spain
- Data from Google Maps Directions API
- Flight durations from DDR 2 data
Case Study

Anonymised mobile phone 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)
- Sample of around 20% of the total population
Case Study

What we see
Case Study

Methodology

• Sample construction
• Identification of users’ home areas
• Generation of activity-travel diaries
• Determination of target passengers
• Travel times adjustment
• Expansion of the sample to the total population
• Extraction of indicators
Case Study

Results – D2D origins
Case Study

Results – D2D destinations
Case Study

Results – D2D destinations

A Coruña  Barcelona  Palma
Case Study

Results – Door to kerb distance distribution

![Door to Kerb distance distribution chart](image-url)
Case Study

Results – Kerb to door distance distribution
Case Study

Results – Door to door travel time distribution

![D2D graph showing travel time distribution by different origins and locations. The x-axis represents travel time intervals (0-1, 1-2, 2-3, etc.), and the y-axis represents the percentage of service instances. Each interval has bars for All origins, Barcelona, Mallorca, and A Coruña.]

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Case Study

Results – Door to kerb travel time distribution

![Diagram showing door to kerb travel time distribution for different regions.

- **D2K**

  - **Y-axis**: %
  - **X-axis**: Time ranges (0-0.25, 0.25-0.5, 0.5-0.75, etc.)
  - **Legend**:
    - All origins
    - Barcelona
    - Mallorca
    - A Coruña

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Results – Kerb to gate travel time distribution

![Graph showing travel time distribution](image-url)
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Results – Gate to gate travel time distribution
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Results – Gate to kerb travel time distribution
Case Study

Results – Kerb to door travel time distribution

![K2D Graph]

- All origins
- Barcelona
- Mallorca
- A Coruña

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Conclusions

• Results show that mobile phone data, when adequately analysed, can be a valuable source of fine-grained passenger behavioural information.

• Different types of airport/passengers were identified, leading to different D2D travel times and catchment areas behaviour.

• Different strategies might be needed in order to achieve the 4h D2D goal.
Case Study

Future research

• Extend the analysis to other airports.

• Extend the analysis for different periods.

• Analyse the impact of disruptions. Impact of air traffic delays in D2D travel times.

• Evaluate strategies for achieving the 4h D2D target.

• Look for alternative data sources with international coverage.
Thank you very much for your attention!

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