Origin-Destination estimation using mobile network probe data

Patrick Bonnel a, Mariem Fekih b, Zbigniew Smoreda b

a Laboratoire Aménagement Economie Transports, ENTPE, Lyon, France, patrick.bonnel@entpe.fr
b SENSE, Orange Labs, Paris, France, mariem.fekih@orange.com, zbigniew.smoreda@orange.com

Objectives

Mobile phone operators produce enormous amounts of data. These data contain information regarding individual positions both in time and space. Several researches have been performed using these data to produce origin-destination (O-D) matrices for planning, modelling... But few researches confront mobile phone O-D matrices with “ground truth”.

O-D matrix construction methodology

- zoning: travel survey sector;
- trip definition: a movement in space with an activity (stationarity) at origin and at destination;
- Stationarity definition: at least two successive (or a succession of) events with a time interval above a threshold (30mn-1h) and within the same zone;
- Mobile data expansion factor: \( \exp \) = \( \frac{\text{Population of RA region}}{\text{Nb of users using 3G network}} \)

Results

30 mn threshold: \( y_t = 1.01 \times x_t + 6,517 \), with \( R^2=0.79 \); student t constant = 2.31 slope = 14.5
40 mn threshold: \( y_t = 0.87 \times x_t + 4,912 \), with \( R^2=0.79 \); student t constant = 2.13 slope = 14.39

With \( Y \) number of mobile phone trips, \( X \) number of travel survey trips

Synthesis and perspectives

- origin-destination matrix (volume and structure) are very sensitive to trips ends (stationarity) definition;
- Correlation between mobile phone data and travel survey rather good (close to 0.8);
- But at origin-destination level, differences might be quite big for some O-D (up to 100%);
- Mobile phone overestimations mainly concern adjacent zones which might illustrate zone delimitation problem or ping-pong effects;
- Strong hypothesis were defined which need research development to overcome:
  - Mobile phone data contain all trips on territory, while travel survey collect resident trips;
  - Orange operator mobile phone users are representative of the whole population;
  - Trip definition, stationarity threshold, mobile base station = Voronoï polygon...