Using Passive Mobile Positioning Data in Tourism and Population Statistics

Laura Altin (laura.altin@positium.ee)\textsuperscript{1,2}, Margus Tiru\textsuperscript{1}, Erki Saluveer\textsuperscript{1}, Anniki Puura\textsuperscript{2}

**Keywords:** passive mobile positioning, Estonia, tourism statistics, population statistics

1. Introduction

Recent developments in information and communications technologies (ICT) have left their mark on tourism, travel and everyday activities: individual GPS tracking, internet-based picture uploading websites, location-based social media check-ins, and interactive tour-guides.

One of the ways of studying the movement and behaviour of people is through the use of mobile telephones. Mobile positioning data in this paper refer to the large-scale location data of subscribers of mobile network operators that are processed and stored in operators’ systems. This is highly sensitive but also very valuable data that could be used anonymously and aggregated thus ensuring the privacy of the subscribers and providing valuable insights in fields like tourism and population statistics (Eurostat Feasibility Study 2014).

The aim of this paper is to assess the possibilities of enhancing tourism and population statistics through the integration of positioning data from mobile communication networks.

2. Methods

In this paper passive mobile positioning data is used. Using mobile positioning data is a relatively new method in the area of tourism and population statistics (Tiru et al 2010).

The data from Estonia’s biggest mobile operator EMT (Estonian Mobile Telephone) was used. EMT covers nearly 99.9% of total land area of Estonia. Market studies show that EMT has a 46% share of the local mobile phone market (TNS Emor 2008). The method for data collection and analysis has been developed in Estonia in cooperation between the private company Positium LBS, mobile operators and the Department of Geography at the University of Tartu. The database used in this paper consists of a spatial and temporal register of call detail records of domestic and foreign mobile phones using EMT’s service. Call detail record is any active use of a mobile phone in networks – incoming and outgoing calls, SMS, GPRS etc. Roaming service means that mobile phones registered in countries other than Estonia can be used on the Estonian network. The register includes the following parameters for every call activity (Ahas et al 2007; Ahas et al 2008):

\textsuperscript{1} Positium LBS
\textsuperscript{2} University of Tartu
• The exact time of call activity;
• The randomly generated unique ID number for the phone (not related to the phone or SIM card number);
• The antenna ID with the geographical coordinates of the antenna;
• The phone registration country – used as the nationality of the phone owner.

The geographical precision of the data is determined by the level of the GSM network cell (Cell ID). The spatial accuracy of the location information depends on the density of the mobile network. The accuracy is higher in urban areas, where the mobile network is denser and lower in less populated rural areas, where the mobile network is sparse and where less people dwell and move. The measurements by Positium LBS show that the spatial precision in Estonia varies from 100-1,000 meters in larger cities (Tallinn, Tartu, Pärnu) to 1,5-20 km in rural areas. Quality of positioning data has been compared with accommodation statistics and a correlation between the two databases has been found.

Due to privacy issues, the database is anonymous and does not contain any back-traceable personal information about the user of the phone. To recognize a person, which is essential in order to analyze repeat visits and loyalty, a randomly generated unique ID number is assigned to every phone. The ID generated by the mobile operator enables the identification of the CDR-s made by one person during the study period.

The collecting, storage and processing of the data obtained complied with European Union requirements regarding the protection of personal data according to EU directives on handling personal data and the protection of privacy in the electronic communications sector. Separate approval was also sought from the Estonian Data Protection Inspectorate (Directive 2002/58/EC of the European Parliament).

3. Results

In the presentation perspective of tourism and population statistics will be introduced based on case studies in Estonia.

3.1. Tourism statistics

The main benefit of passive mobile positioning data compared to traditional methods like population survey, border statistics etc. is the ability to evaluate the indicators for a much larger sample (indicators: country of origin of visitors, repeat visits, number of days/nights spent). It is also possible to distinguish same-day and overnight visits, transit visits from longer stays, tourists from long-term visitors (residents).

All indicators can be distinguished on the level of a particular event (concert of Robbie Williams, which took place in august 2013). The results show that visitors to this kind of event (e.g. musical performance) originate from nearby countries (while regular tourists also come from more distant countries), and have a duration of visit that is longer than in regular tourists and attract new segments of tourists (first-time visitors).

3.2. Population statistics

Based on passive mobile positioning data home anchor points, work-time locations and other everyday activity places can be distinguished. Compared to population census data, MPD helps to evaluate place of usual residence and also distinguish second home
anchors (where person spends more most of the time from one month in some place which is not persons home – temporary home, summer houses, holiday homes etc).

In this research the case of Põhja-Tallinn district in Estonia is introduced. For example home (fig 1) and work-time (fig 2) activity spaces are described (on the accuracy level of 100x100m grids).

Fig 1. Home-anchor points in Põhja-Tallinn district  
Fig 2. Work-time anchors in Põhja-Tallinn district

4. Conclusions

Despite some obstacles there exists substantial potential in using mobile positioning data as new and alternative data source in tourism and population statistics. The benefits of an increased adoption of this data are: cheaper price, timeliness, quicker delivery to end-user, bigger sample sizes, more comprehensive data.

References

Eurostat Feasibility Study on the use of mobile positioning data 2014).  
http://mofbs.positium.ee


