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Mobile Phone Tower Tracking

What this chapter will cover:

- The process of collecting big data from mobile phone companies.
- Methods that have been developed to differentiate tourists from locals using mobile phone data.
- The contributions that mobile phone data has made to understanding crowding, visitor numbers, event goer behaviour and repeat visitation.
- The limitations with this form of big data.
- The ethical issues associated with this form or data.

Introduction

Tracking tourists using mobile phone data involves collating mobile phone call detail records (CDR), that can determine travel patterns of mobile phone users. The size of the data involved in this style of research is enormous; Xiao, Wang, and Fang (2019) received 600 – 800 million records per day when they used mobile phone data from Shanghai, resulting in over 10 billion mobile phone trajectories. However, mobile phone data does not provide precise travel itineraries. Rather, the data is a series of time-space points, showing where mobile phone users were when they made or received calls or text messages. Inferences are required to determine which mobile phone users are tourists, and when they entered countries or regions. However, the ubiquity of

mobile phone use and the size of the data sets available to researchers means that this form of data can be used as a proxy for accommodation and visitation (Xiao, Wang, and Fang, 2019; Ahas et al., 2008; Ahas et al., 2007). Many significant findings regarding travel behaviour have emerged from this technique, including understandings of the impacts of seasonality, the impacts of nationality, and the impacts of events. This chapter will review these findings as well as the challenges that arise from the use of this data.

How data is collected from mobile phone towers

Mobile phones are designed to send text messages or phone calls as radio waves from their antenna to a phone mast/base station and finally, to a receiving phone. Signals from the phone's antenna generally go to base stations with the strongest coverage, or those which are closest (Ahas et al., 2008). Base stations cover 'cells', which are areas of land that have been divided up, and the stations provide coverage to phones within their particular land area. If there are excessive amounts of users, phones may switch to a farther base station that is not being heavily used. The coverage of cells form the network (Ahas et al., 2008). When mobile phones cannot connect to a base station, they are regarded as being out of range.

There are a vast array of technologies used by different mobile phone networks, and these impact upon the strength of signals that mobile phones send to base stations. Typically, mobile phones can reach base stations 60 km away (Ahas et al., 2008). When a mobile phone is used to make a call or send a text message, their location coordinates are stored automatically in the memory files of the phone's mobile phone company. Each mobile phone has a random ID number, that stays with the phone and this is logged when the phone is used (e.g. text message, phone calls or use of the internet).

Mobile phone companies can track the location of phones that are registered with the company, plus those that are registered outside the country – called 'roaming' phones (Ahas et al., 2007). When 'roaming'

phones enter a country, the mobile phone company can access information such as the phone's country of registration, when the phone entered and left the country, and the phone's random ID.

There are two types of tracking data that mobile phones can produce (Ahas et al., 2008). The first, and most commonly used in research, is 'passive positioning' which occurs when a mobile phone connects via a signal to mobile phone towers.

Zhao et al. (2018) argue that four situations create passive positioning of a mobile phone:

1. When a call is made or received;
2. When a text message is sent or received;
3. When the mobile phone changes position and switches to a different cell tower;
4. Via periodic reporting to mobile phone towers, outside of the previous three behaviors.

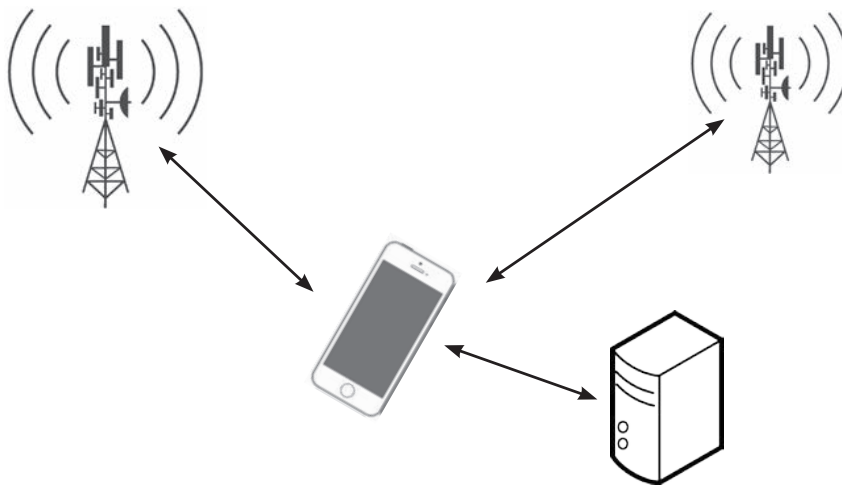


Figure 7.1: The process of collecting location-based mobile phone data.

When a mobile phone makes or receives a call or text message, the phone communicates with mobile phone towers. The mobile phone receives signals from towers that are within range. This information is then sent to a server which computes the position of the mobile phone, before sending this information back to the mobile phone.