UNIVERSITY OF TARTU
FACULTY OF SCIENCE AND TECHNOLOGY
DEPARTMENT OF GEOGRAPHY
Masters Programme in Geoinformatics for Urbanized Society

Analysing Spatial Mobility With GPS Data

Daiga Paršova, Willis Foley, Behzad Valipour Shokouhi and Alex Kevin Jarvis

Table of Contents

Background and Results

The project used GPS cellphone data to analyse the position of a participant by monitoring her cell phone's GPS signal within Tartu city on Thursdays and Saturdays from 9th September until 31st October 2017. Therefore the participant's mobility was tracked for 7 Thursdays and 8 Saturdays. The results are displayed in the four maps contained within this document.

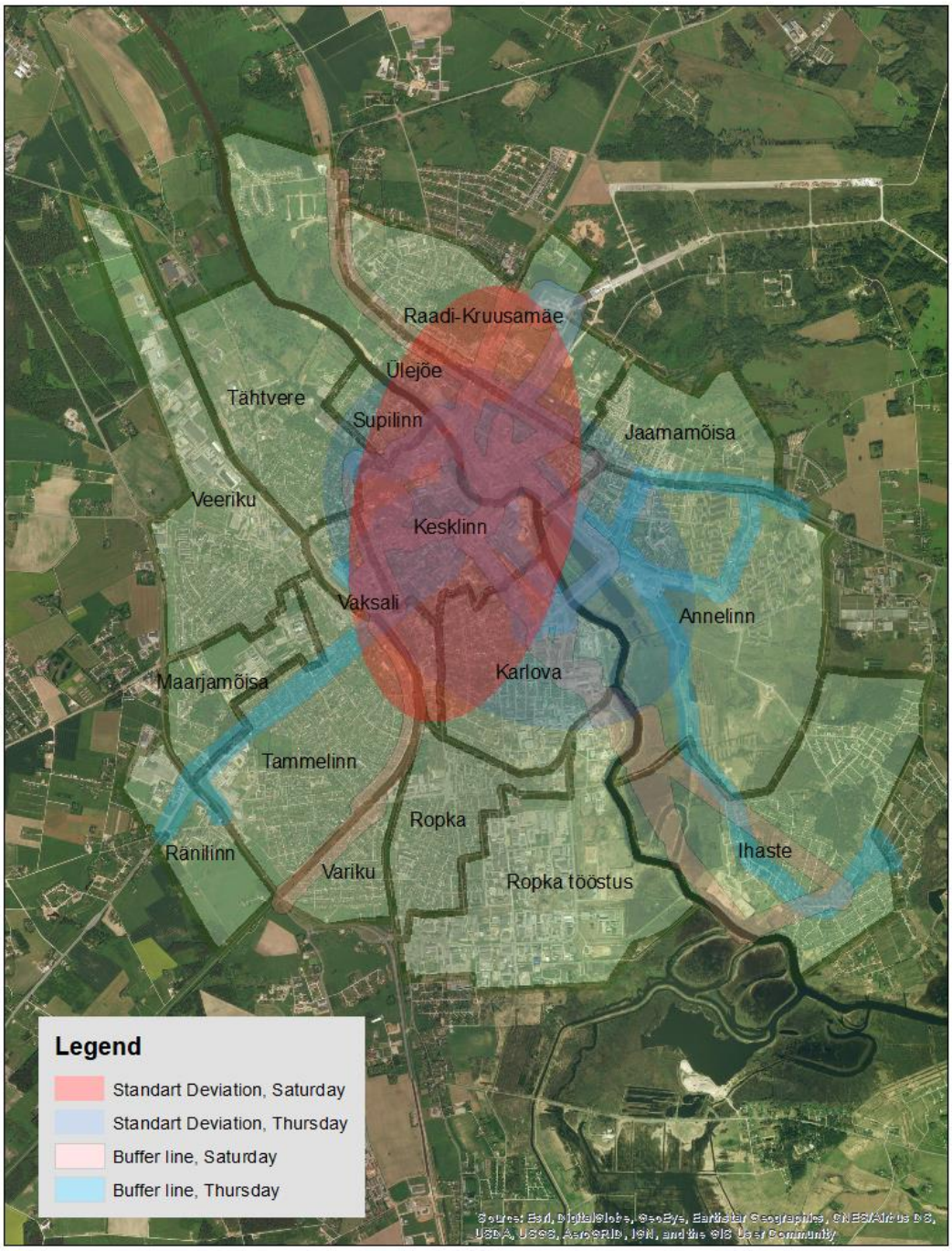

Figure 1 - Map showing the buffer line and standard deviation for both Thursdays and Saturdays

Comparison of the Results

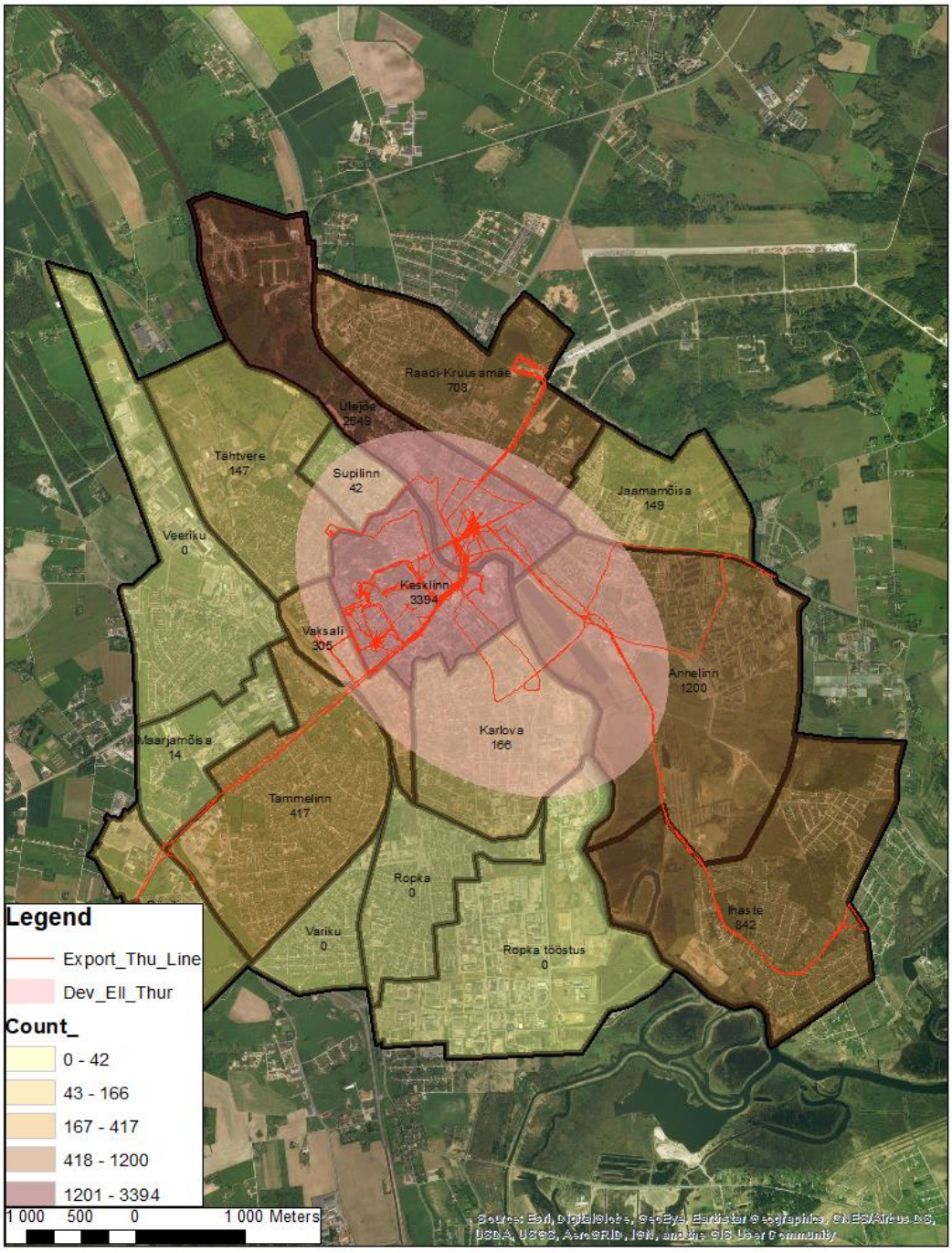

Figure 2 - a map showing the activity spaces of Thursday, including the routes taken, points in each district and standard deviation

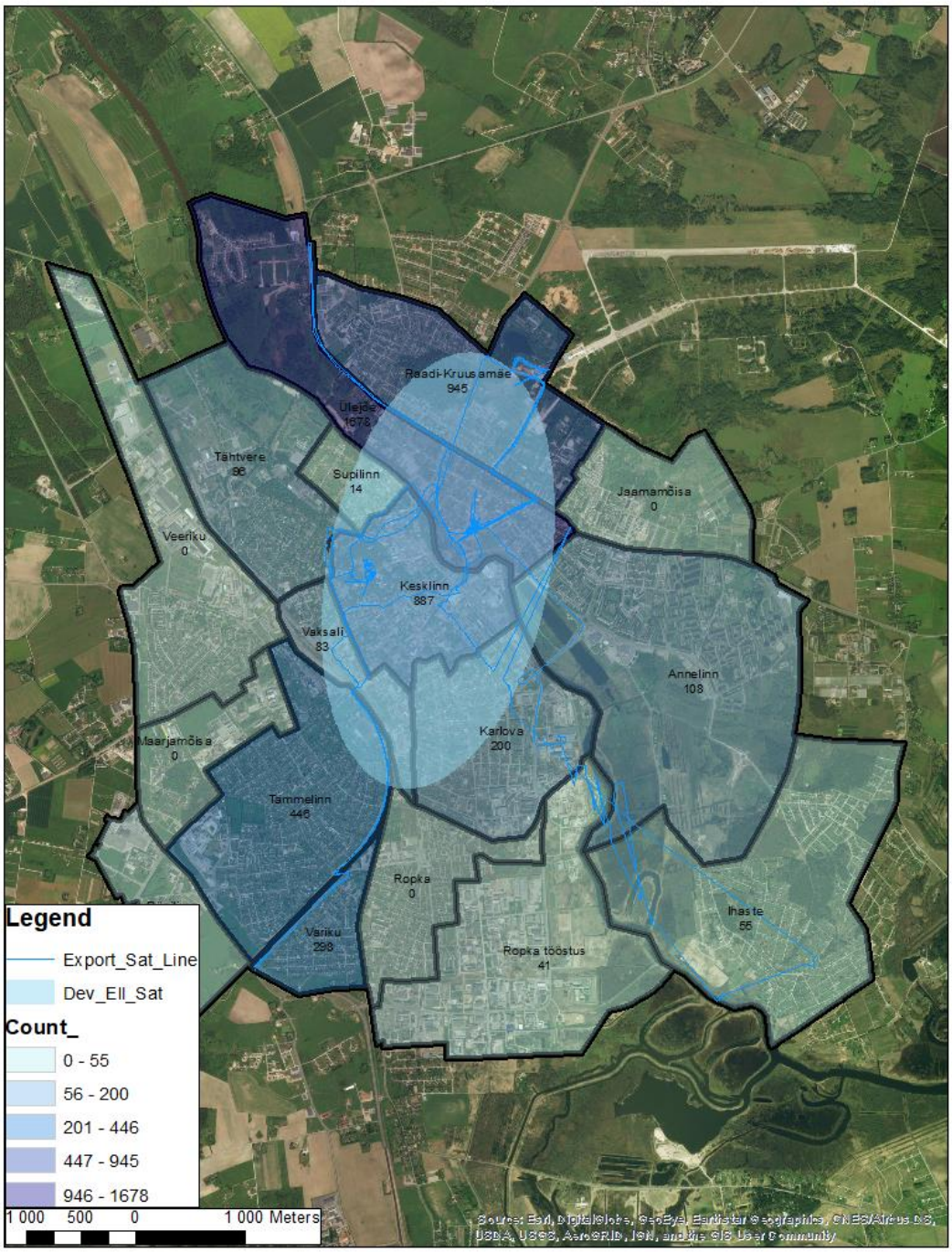

Figure 3 - a map showing the activity space of Saturday, including the routes taken, points in each district and standard deviation

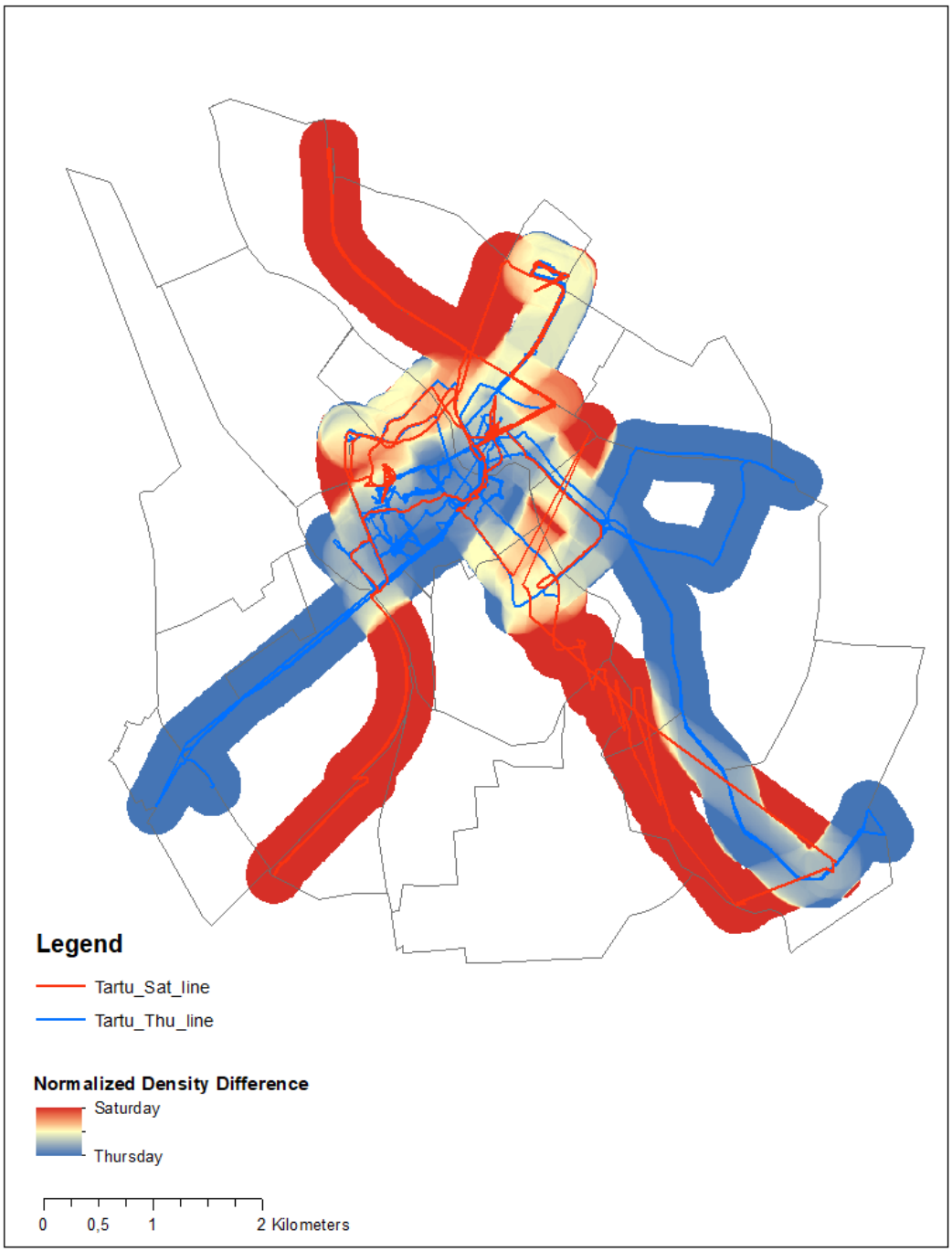

Figure 4 - a map showing the routes taken and the density difference in these locations between Thursday and Saturday.

Similarities and differences

The district that was visited most on Thursdays was Kesklinn (the city center) with 3394 points recorded on Thursdays over the period. This was by far the highest recording of any district on either of the two weekdays. The second highest point total for Thursdays was Annelinn with 1200. The district with the highest number of points on Saturdays was Raadi-Kruusamaa with 945 points; Kesklinn followed this with 887.

The difference between the movements of the participant over the two repeating days is noticeable. On Thursdays, no data was collected for 4 districts and the participant did not visit the southern quarter of the city.
On Saturdays, the participant did not visit 5 districts. These were also on the edge of the city. The districts of Veeriku and Ropka received no visits throughout the entire recorded period.

Figure 4 shows the routes taken by the user throughout the experiment. These show similar patterns of movement in the South east and south west of the city, but different roads taken to reach the destinations. The user appears to travel beyond the city boundary on both days in the southwest and stay within the city boundary on both days in the southeast.

The user appeared not to follow the same paths each Thursday or Saturday through the city center, thereby affecting the direction of the standard deviation of movement (Figure 1-3). It is also visible from figure 1 that the user's standard deviation was larger on Thursdays compared to Saturdays.

The Pro's And Cons Of Using GPS Data To Study Social Mobility

Mobile phone data allows social scientists to investigate peoples' movements and activities. It increases our understanding about contemporary issues such as social segregation more than traditional 'sleeping population' census-based statistics. With real-time 'big data', service planning can be better designed to meet the population's requirements and increase efficiency in terms of the use of time and resources (Shoval & Ahas, 2016).

GPS data is an active form of data collection, compared to passive mobile phone data. It is highly accurate for capturing spatial and temporal data. In the modern day, it is also present in mobile phones, meaning that participants do not need to carry a separate device.

It is limited however to the satellite signal and in the case of phones especially, whether the user has it switched on or not. It is also the case that GPS connection does not work indoors.

There are several other disadvantages to recording participants' movements with GPS. The first issue is the matter of ethics and privacy. Due to this, it is required to obtain the participant's permission. In this experiment, it was necessary for the participant to download an application onto their phone. Our participant said that the lack of interactivity with the app was a negative. It would be interesting to see whether greater interactivity so that the participant could see her results, would have affected participant performance and increased decision-making: both in terms of the locations the visited or avoided and whether it affected the distances travelled.

Another issue is reliability. Our participant noted that her phone has issues connecting to satellites. Her cell phone is designed primarily for the Chinese market and as such, the software might not be best optimized for European use.

Bibliography

Shoval, N., & Ahas, R. (2016). The use of tracking technologies in tourism research: the first decade . *Tourism Geographies An International Journal of Tourism Space, Place and Environment , 18* (5), 587-606.