Extracting urban mobility QoL indicators and individual activity pattern from mobile phone-based human mobility trajectories

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(1) Motivation: Recent issues such as work-life balance and work-style reform requires cities to support diverse lifestyles and consider new indicators for urban planning. The Quality of Life (QoL) is one of the indicators and using real-world mobility data, the QoL indicators can now be estimated for each individual, while spatial aggregation could help to identify QoL problems in local groups and tackle region-specific issues. Our main idea is to develop a model to extract key urban QoL indicators from a city-scale low-sampling rate mobile phone mobility trajectory data.

(2) Approach: The target area is the greater Tokyo Area. We adopt the result from Kobayashi et al. (2019), followed by the activity detection based on the users' location and time. The activities we extract are follows:

- Commute (mobility from estimated home to estimated workplace)
- Staying at home (lack of mobility from home)
- Excursion (mobility does not involve workplace location)

(3) Result: Table 1 summarizes the result compared to the activity and mobility panel statistics. The commuting time and excursion time are overestimated while at-home time is underestimated. Figure 1 shows the average commuting time of municipalities based on each user's estimated home location. Generally, the commuting time increases as the home location gets further from the center of Tokyo. We aim to improve the estimation based on this evaluation result.

(4) Data:

- Point type floating population data (Agoop Corp., 2016)
- Survey on Time Use and Leisure Activities (Statics Bureau, Ministry of Internal Affairs and Communications, Japan, 2017)
- National Time Use Survey (Broadcasting Culture Research Institute, Japan Broadcasting Corporation, 2016)

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(6) References:

- Kobayashi, R., Miyazawa, S., Akiyama, Y., and Shibasaki, R. (2019) Identification of the Homes, Offices, and Schools from Long-Interval Mobile Phone Big Data Using Mobility Pattern Clustering. *Accepted Short Papers and Posters from the 22nd AGILE Conference on Geo-information Science.* Limassol, Cyprus: Stichting AGILE, pp. 1–5.

Table 1: Estimated aggregated time for each activities and comparison to the activity and mobility panel statistics

Indicator	Average (hours: mins)	Statistics (hours: mins)
Commuting time	2:06	1:42
At-home time	9:03	13:07
Excursion time	0:50	0:29

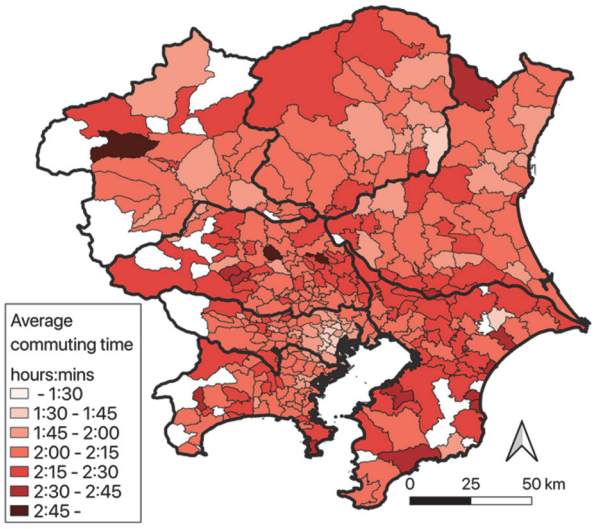

Figure 1: Average commuting time of users in each municipality