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Mobilkit: A Python Toolkit for Urban Resilience and Disaster Risk Management Analytics

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Summary

The availability of mobility data is increasing thanks to the widespread adoption of mobile phones and location-based services. This data generates powerful insights on people's mobility habits, with applications in areas such as health, migration, and poverty estimation. Yet despite the growing academic literature on the usage and application of mobile phone location data in this field and despite the raising awareness of the importance of disaster preparedness and response and climate change resilience, large-scale mobility data remain under-utilized in real-world disaster management operations to this date (Barra et al., 2020).

At present, only few tools allow for an integrated and inclusive analysis of mobility data. While several tookits allow users to perform some basic analytics on large mobility datasets (e.g., (De Montjoye et al., 2016) or (Pappalardo et al., 2019)), these cover only some of the steps in the mobility data pipeline. These toolkits also do not provide adequate data pre-processing and visualization functionality which causes users to seek additional external options. Also, there is a lack of clear documentation to enable policymakers and planners to understand the analytics process, outputs, and potential questions that mobility data can answer, particularly in the context of post-disaster assessment.

Statement of need

`Mobilkit` is an open-source Python software toolkit that enables policy makers to conduct post-disaster assessment using large-scale mobility data. The toolkit allows the user to conduct pre-processing of data, validation of the data representativeness, home and office location estimation, post-disaster displacement analysis, and point-of-interest visit analysis. The purpose of `Mobilkit` is to provide urban planners, disaster policy makers, and researchers an easy-to-use and practical toolkit to visualize, analyze, and monitor post-disaster disruption and recovery. The software is freely-available on GitHub along with online documentation and Jupyter Notebooks that provide step-by-step tutorials.

`Mobilkit` allows the user to 1) pre-process the dataset to select users who have sufficient amount of observations, 2) evaluate the representativeness of the mobility data by combining with census population statistics, 3) conduct post-disaster displacement and recovery analysis, 4) estimate the recovery of businesses and social services by using point-of-interest (POI) data, and 5) measure and characterize the spatial structure of cities.

Use Case

The usefulness of `Mobilkit` was demonstrated in a recent study carried out in collaboration with the World Bank Global Facility for Disaster Reduction and Recovery (Yabe et al., 2021). The study focused on assessing the impact of a 7.1 magnitude earthquake that occurred on September 19, 2017 where the epicenter was located around 55 km south of Puebla, Mexico (about 100 km south-east of Mexico City, Mexico). `Mobilkit` was also leveraged to conduct an analysis of the spatial structure of ten cities around the globe using smartphone location data, provided by Quadrant, to generate insights about mobility management options[1]. Similar analysis could also be explored using `Mobilkit` for planning and recovering activities related to climate, man-made, and other natural disasters.

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[1] See the notebooks covering Urban Spatial Structure analyses and an inter-city comparison of Urban Spatial Structure indicators.