

人の流れから都市の姿を描く

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Addressed problem: How to visualize human flow on map?

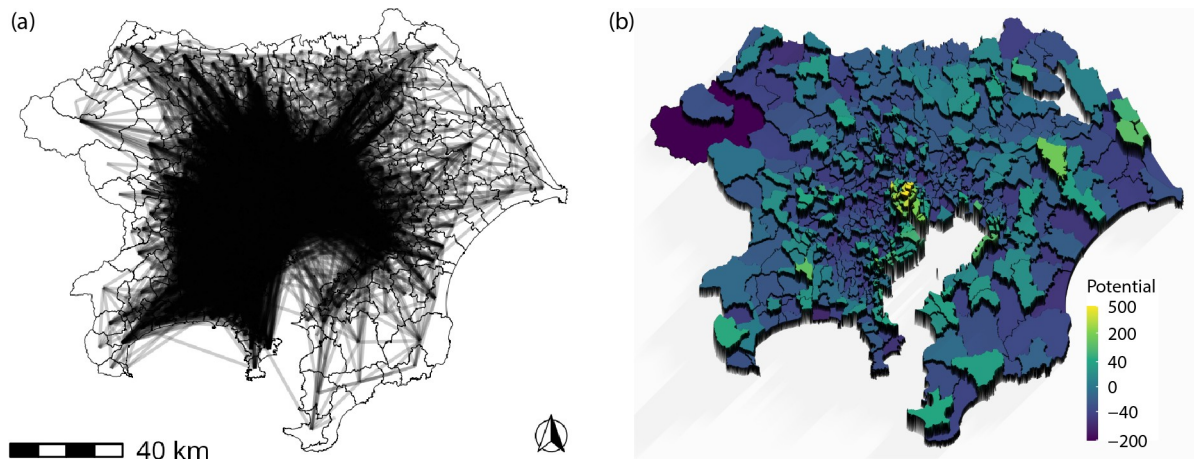
People are moving from one location to another in their daily lives, for commuting, shopping, entertainment, schools, etc. This human flow provides vital information for unfolding the actual shapes of cities based on lively human behavior by place-to-place interactions from origin to destination.

However, it is not easy to handle massive data on human flows as it is because, for example, when there are 1,000 locations on a map, the flow dataset is depicted by a million links from the origin to the destination.

Our solution: Use combinatorial Hodge theory to obtain the potential of the human flow

In this study, we identified the potential of human flow directly from a given origin-destination matrix. By using a metaphor for water flowing from a higher place to a lower place, the potential landscape visualizes an intuitive perspective of the human flow and determines the map of urban structure behind the massive movements of people. From the map, we can easily identify the sinks (attractive places) and the sources of human flow, not just populated places.

The detected attractive places provide beneficial information for location decision making for commercial or public buildings, optimization of transportation systems, urban planning by policy makers, and measures for movement restrictions under a pandemic.



Potential landscape in Tokyo from home-work trips in 2018.

[1] **Urban spatial structures from human flow by Hodge-Kodaira decomposition**, Takaaki Aoki, Shota Fujishima & Naoya Fujiwara, *Scientific Reports*, vol. 12, 11258 (2022).

[2] **Identifying sinks and sources of human flows: A new approach to characterizing urban structures**, Takaaki Aoki, Shota Fujishima & Naoya Fujiwara, *Environment and Planning B: Urban Analytics and City Science*, vol. 51(2), 419-437 (2024).