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Spatial market analysis and visualization using synthetic mobility and census microdata

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Background

For decades, several geospatial-related methods have been used for market research analysis to identify the potential income and market share of commercial accumulations in human settlements. More recently, synthetic mobility data has become more widely available, opening new research possibilities in this field to help us enhance the current understanding of expenditure dynamics in brick-and-mortar commercial accumulations where footfall has a significant impact on sales. This is particularly important since this type of business has been disproportionately affected by sustained changes in the retail environment that were further accelerated by the COVID-19 pandemic

Contribution

1. We proposed a market area delineation method using synthetic mobility microdata
2. We proposed multiple variations of the method for market share estimation based on the trajectory purpose of the agents.
3. We used census data and business transaction data to evaluate our method.

Dataset

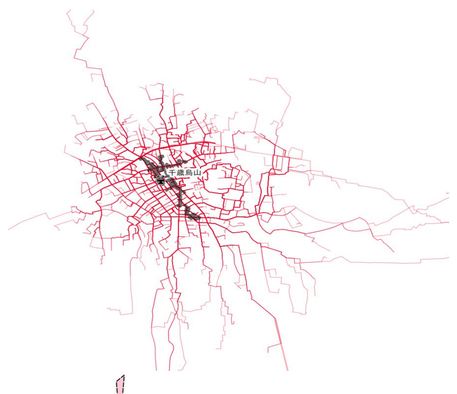
Data obtained for the Tokyo 23 Special Wards

1. **Commercial Accumulation Statistics:** geometric delineation and detailed information of commercial accumulations in Japan
2. **Pseudo-PFLOW Project:** synthetic mobility data at the agent level
3. **Teikoku Data Bank Business Transaction Database**: 1-year period business-to-business transaction data.
4. Census and Economic Census

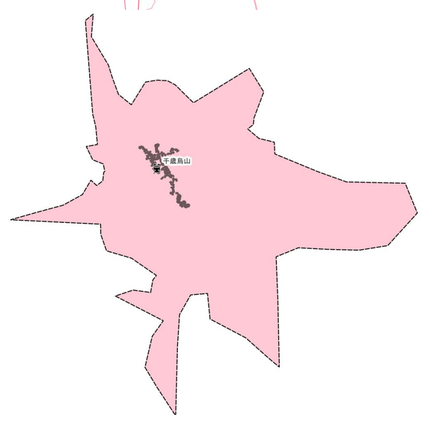
Methodology

Example:
Chitose-Karasuyama shotengai

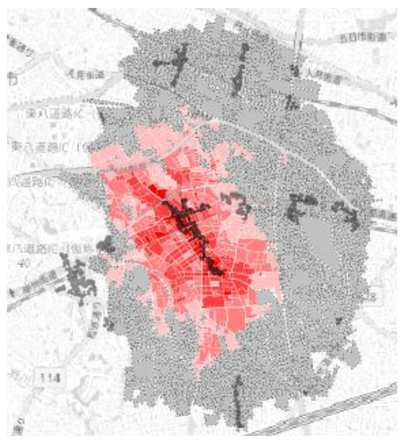
Identify all trajectories intersecting shotengai:
Limited to pedestrian routes to simulate footfall.



Market area delineation:
Creating a concave hull around from the trajectory data.



Market Area Weighting:
Identifying overlapping market areas and weighting according to the people flow.



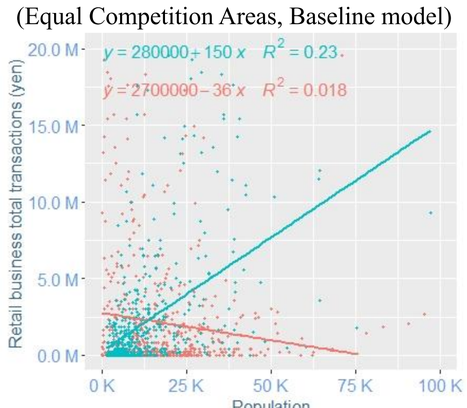
Result

We tested our method with the linear correlation coefficient between retail business transactions and workers and resident population. Our proposed method, especially the unweighted people's flow-based population estimation method outperformed the conventional market delineation method. This shows the potential of our proposed methods for more accurate market area delineation.

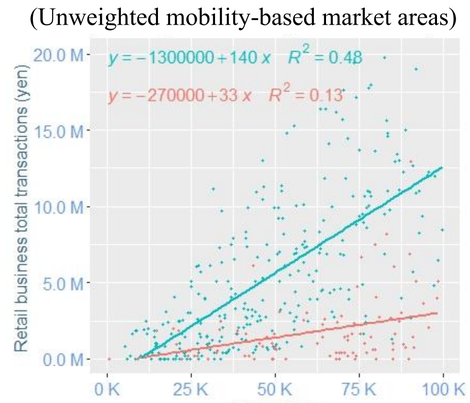
On the other hand, we observed that different trajectory information classified by the purpose of the trip results in completely different market share results, which opens many new opportunities for research into the effect of the different trip and population types affect the overall business transactions.

Retail Business Transactions to Population

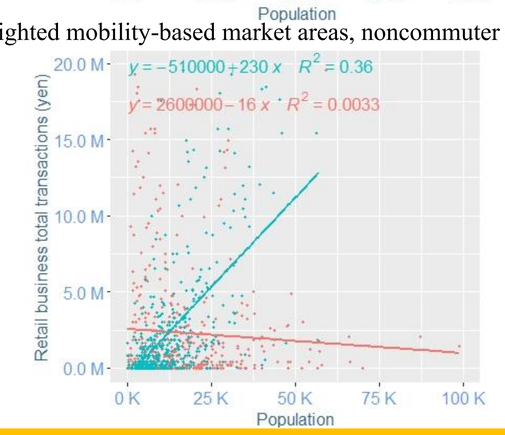
(Equal Competition Areas, Baseline model)



(Unweighted mobility-based market areas)



(Weighted mobility-based market areas, noncommuter dataset)



(Weighted mobility-based market areas, full dataset)