

Paper review for *Revealing Spatiotemporal Travel Demand and Community Structure Characteristics with Taxi Trip Data*

– Zhongren Zhao

This paper is publication in November 2021, on PLOS ONE and already have 19 cite on the latest check.

Quality Assessment:

1. Journal: PLOS ONE is an open-access journal with about 3 impact factors, while not a top-tier conference or journal, is still reputable.
2. Citation count: for papers published in 2021, 19 citations in just over 2 years have a moderate impact. Although the article is very new and has not been cited many times, it can also show that it has a certain influence in the field.
3. Novelty and Relevance: The study applies network science and community detection methods to analyze taxi trip data, which is relevant to urban mobility research.

Paper summary:

1. Problem Addressed:

This paper investigates spatiotemporal travel demand and urban community structures using large-scale NYC taxi trip data. The goal is to understand how different parts of the city are connected through travel demand patterns.

2. Research Questions:

- a) How does taxi travel demand change over time in different areas of NYC?
- b) What are the structural characteristics of NYC's urban mobility network based on taxi trips?
- c) What are the differences in travel hotspots and community structures at different peak hours?

3. Methods:

- a) Data Processing: The study preprocesses NYC taxi data to extract trip records, including pickup/drop-off locations and timestamps.
- b) Temporal Analysis: The paper analyzes taxi demand variations at different times of the day and across different days of the week.
- c) Network Construction: The city is represented as a graph where nodes correspond to regions (e.g., taxi zones), and edges represent travel flow between regions.
- d) Kernel density estimation: Identifying travel hotspots.
- e) Community Detection: The Louvain algorithm is used to identify clusters of

regions that share similar travel patterns, revealing city structures.

4. Novelty:

- a) Spatial statistics and complex network theory are combined to analyze the spatio-temporal pattern of taxi data from the dual perspectives of geography and topology Unfolding.
- b) Quantification of the index of "weighted degree distribution" and "node-community interaction intensity" is proposed to reveal the nonlinear influence of critical traffic area on community formation

5. Relevance to Our Project

This paper is relevant to our study because it provides a methodological approach to analyzing taxi demand distribution and spatial mobility structures, which align with our research goal of understanding NYC taxi demand variations. Additionally, its use of network science methods could inspire our analytical framework.

6. Pros and Cons Discussion:

- a) Pros 1: Method rigor, combining spatial statistics and network science, the method system is complete, and data preprocessing removes noise improves the reliability of the results.
- b) Pros 2: Data source disclosure, code, and parameters are clear description.
- c) Pros 3: The structure and Reference are well and clearly, this also shows the professionalism of the author
- d) Cons 1: Data bias, only taxi data were analyzed, other modes of transportation like Uber and Lyft were not included, which may lead to one-sided conclusions
- e) Cons 2: No code repository is provided, which increases the verification cost.
- f) Cons 3: External considerations are limited. The study did not consider the impact of external factors on taxi demand, such as weather, public transport disruptions, or socioeconomic factors.
- g) Cons 4: Some of the method didn't clarify, they didn't clarify why to use this method but not others, like Louvain algorithm.
- h) Cons 5: The figures need better annotations and explanations are needed to improve readability.

Reference:

Liu, X., Gong, L., & Liu, Y. (2021). Revealing spatiotemporal travel demand and community structure characteristics with taxi trip data: A case study of New York City. *PLOS ONE*, 16(11), e0259694. <https://doi.org/10.1371/journal.pone.0259694>