# Analysing NYC CitiBike Usage Patterns In 2019

## INTRODUCTION (joint, 10 marks – *250 words*): Problem definition, background and brief literature review

Citibike is a docked bike-sharing system in New York City, where users can rent a bike from one station, cycle to their destination, and dock it at another station close to their destination. This system generates detailed transaction-level data, freely available for analysis, enabling studies of spatial and temporal usage patterns.

Numerous studies have utilized this dataset to analyse usage patterns, revealing two key themes:

1. **Weather Influence:** Citibike usage is highly weather-dependent. Studies (An et al., 2019[[1]](#footnote-1); Jiang et al., 2020[[2]](#footnote-2)) have found that temperature, precipitation, humidity, and wind speed significantly impact trip volume. Hamad, Ma, and Antoniou (2021) observed peak usage during summer, followed by autumn, spring, and winter, indicating strong seasonal trends.
2. **Spatio-temporal Clusters:** Liu et al. (2021) [[3]](#footnote-3) identified distinct usage clusters, including leisure-oriented patterns, residential areas with high morning outbound and evening inbound trips, and workplace clusters displaying the reverse trend. Noland, Smart, and Guo (2018) [[4]](#footnote-4) also identified these weekday peak/off-peak and weekend usage clusters.

This project builds on these insights by analysing Citibike usage across three representative months—summer, autumn, and winter. It examines how spatial and demographic factors, such as population age, housing density, commercial activity, and school-related housing, influence seasonal variations in usage. Regression analysis will assess the significance of these variables, offering a nuanced understanding of Citibike’s role in urban mobility across different times of the year.

## Data description (joint, 10 marks – *250 words*): Justify your choice of data and provide sources

This study utilizes two primary datasets – the Citibike transaction data aggregated at census tract level. The property tax dataset supplements the demographic data by providing a distribution of different land uses across the city.

* **Citi Bike System Data[[5]](#footnote-5):**

A map of a bike

Description automatically generated  
The Citibike transaction dataset is sourced from Lyft, in collaboration with the NYC Department of Transportation. This dataset provides detailed trip-level information, including trip duration, origin and destination stations, and timestamps. To represent seasonal variations effectively, three months were selected—January (winter), July (summer), and October (autumn)—as they typically exhibit consistent temperature and precipitation within each month, minimizing weather-related fluctuations.

A graph showing the weather

Description automatically generated

Fig. 1: Historical weather data in New York City in 2019. The months January, July and October exhibit relatively less fluctuations and are selected to represent its respective seasons. Data source: Newark Liberty International Airport Weather Station, accessed through and visualised on © WeatherSpark.com

* **NYC 2020 Census Data[[6]](#footnote-6):**

A map of a city

Description automatically generated  
Demographic data is sourced from the NYC Department of City Planning and the US Census Bureau’s 2020 Census. A key limitation of the NYC Census dataset is its decennial nature, with the latest edition completed in 2020. Significant demographic shifts, particularly due to the COVID-19 pandemic, may have occurred since, making post-2020 census data less reflective of conditions relevant to Citibike usage. To address this, the study pairs 2019 Citibike transaction data with the 2020 Census dataset. This pairing is appropriate as 2019 represents pre-COVID patterns, aligning well with the demographics captured in the latest census. It also enables direct comparison with Liu et al.’s 2019 analysis of Citibike clusters, strengthening the study’s validity.

* **Property Land Use Data (PLUTO)[[7]](#footnote-7):**  
  The PLUTO dataset, maintained by the NYC Department of City Planning, provides extensive land use data at the tax lot level, including details on land use, zoning, and building characteristics. This data is critical for assessing spatial factors like office density and commercial activity, which may influence Citibike usage.

## Exploratory spatial data analysis (joint, 15 marks – *500 words*): Summarise the properties of your data

<Global Moran for Jan, July, Oct>

<Local Moran for Jan, July, Oct>

< Moran clusters (scatterplot) for Jan, July, Oct>

## Methodology & Results (individual, 25 marks – *2500 words*)

### Methodology & Results – Xiao Wei Lim

<Regression for Jan 2019 /800 words>

### Methodology & Results – Ruiyi Wu

<Regression for July 2019 /800 words >

### Methodology & Results – Jiazhuang Feng

<Regression for Oct 2019 /800 words >

## Discussion and conclusions (joint, 15 marks – *1000 words*): Combine and discuss results here (e.g. for final site selection, or to discuss the relative merits of approaches). Include limitations and future work

<Combined discussion for all regression – compare GWR coefficients>

<Limitations & Future Work>

## (remember: Presentation (Joint, 10 marks, individual, 5 marks): Quality of presentation (maps, tables, figures), report structure, use of markdown.)

1. An, R., Zahnow, R., Pojani, D. and Corcoran, J. (2019). Weather and cycling in New York: The case of Citibike. *Journal of Transport Geography*, 77(2019), pp.97–112. doi:https://doi.org/10.1016/j.jtrangeo.2019.04.016. [↑](#footnote-ref-1)
2. Jiang, G., Zhang, R., Qu, X. and Zhao, D. (2020). A Dynamic Model Averaging for the Discovery of Time-Varying Weather-Cycling Patterns. *IEEE Transactions on Intelligent Transportation Systems*, 22(5), pp.2786–2796. doi:https://doi.org/10.1109/tits.2020.2974930. [↑](#footnote-ref-2)
3. Liu, Y., Chen, M., Arribas-bel, D. and Singleton, A. (2021). Profiling the Dynamic Pattern of Bike-sharing Stations: a case study of Citi Bike in New York City. *Proceedings of the 29th Annual GIS Research UK Conference (GISRUK).*doi:https://doi.org/10.5281/zenodo.4665706. [↑](#footnote-ref-3)
4. Noland, R.B., Smart, M.J. and Guo, Z. (2018). Bikesharing Trip Patterns in New York City: Associations with Land Use, Subways, and Bicycle Lanes. *International Journal of Sustainable Transportation*, 13(9), pp.664–674. doi:https://doi.org/10.1080/15568318.2018.1501520. [↑](#footnote-ref-4)
5. Citibike/Lyft and NYC Department of Transportation (2025). *Citi Bike System Data | Citi Bike NYC*. [online] citibikenyc.com. Available at: https://citibikenyc.com/system-data [Accessed 14 Jan. 2025]. [↑](#footnote-ref-5)
6. NYC Department of City Planning (2025). *2020 Census -DCP*. [online] www.nyc.gov. Available at: https://www.nyc.gov/site/planning/planning-level/nyc-population/2020-census.page [Accessed 14 Jan. 2025]. [↑](#footnote-ref-6)
7. NYC Department of City Planning (2025). *PLUTO and MapPLUTO*. [online] www.nyc.gov. Available at: https://www.nyc.gov/site/planning/data-maps/open-data/dwn-pluto-mappluto.page [Accessed 14 Jan. 2025]. [↑](#footnote-ref-7)