Analyzing the Effect of Urban Function Distribution on Overall Mobility Patterns

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Situation Analysis

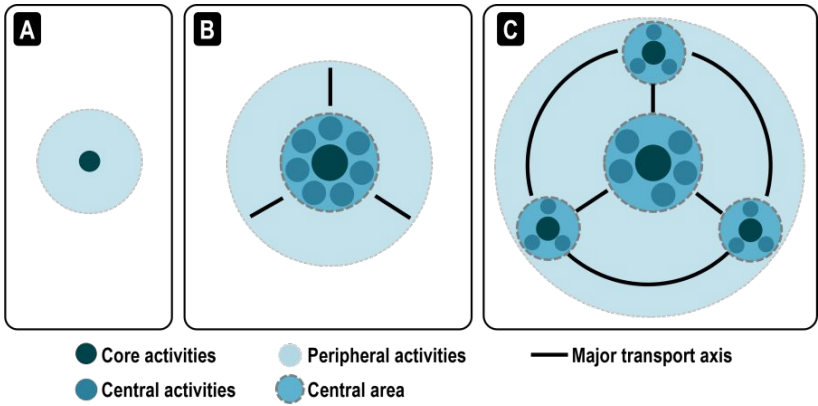
- Diverse Urban Forms: LA's sprawl vs. NY's dense vertical growth.
  - These structural differences influence commute times and housing availability.
- Shifts in Transportation Modes: High car use in LA, extensive public transit in NY.
- Compare City Structures (POI): Examining how POI distribution reflects city planning and accessibility.
- Compare Workplaces: Analyze the distribution and accessibility of workplaces in LA and NY. Understand how workplace distribution relates to residential areas, commute patterns, and overall city structure.
- Goal:
  - Compare Urban and Transportation Dynamics: Insights into how urban environments influence mobility patterns and daily routines.

Project Objectives

- The primary aim of this project is to conduct a comprehensive analysis of urban functional distributions and their influence on human mobility within metropolitan areas.

- By integrating diverse datasets, we seek to explore how different urban functions impact the movement patterns of city dwellers and understand the various factors that drive urban mobility.

- This analysis will provide valuable insights into how mobility is affected by various urban elements, contributing to better urban planning and management strategies.



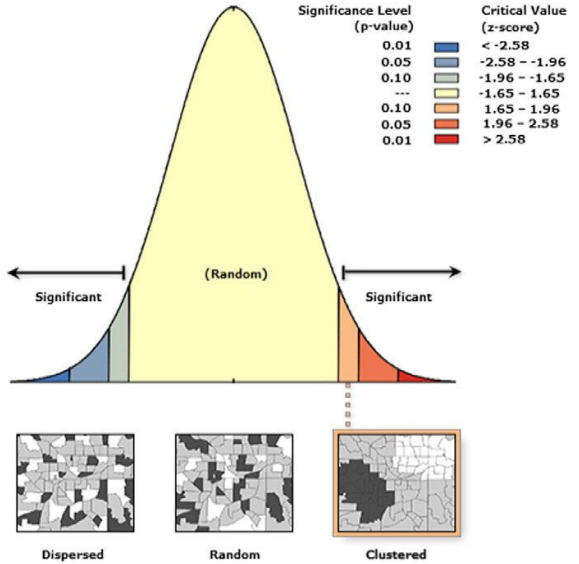
https://transportgeography.org/contents/chapter8/transportation-urban-form/evolution-spatial-structure-city/

Approach—Data

- OpenStreetMap POI data__For POI Data
- COVID19USFlows__For Human Mobility Data (June 2019)
- TIGER/Line Shapefiles__For Census Data Mapping (2019 for consistency)
- LEHD Origin-Destination Employment Statistics (2019 for consistency)__For Workplaces and Homes
- New York Turnstile Usage Data__ Subway Data For Reference(New York only)

Approach—Tools

- Python GeoPandas and Shapely for Geospatial Analysis
- Python Matplotlib for Data Visualization
- ArcGIS for Multivariate Spatial Clustering and Data Visualization
- An Index for Density and Distribution—Moran's I



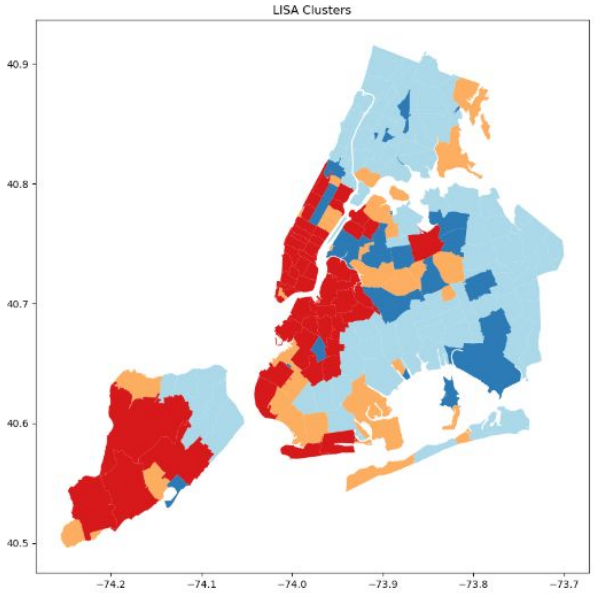
https://www.researchgate.net/publication/305954162_Spatial_cluster_analysis_of_Crimean-Congo_hemorrhagic_fever_virus_seroprevalence_in_humans_Greece

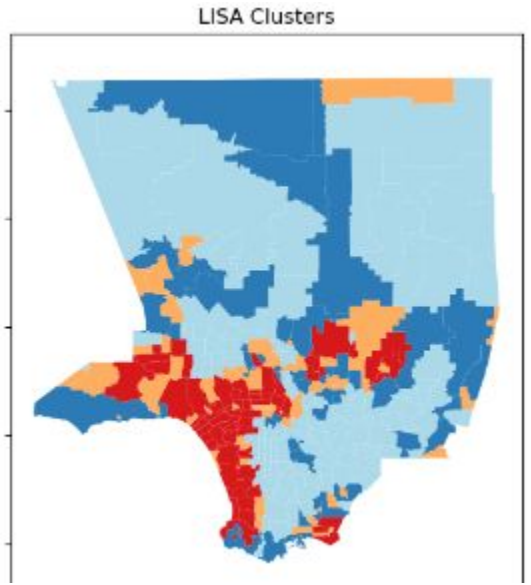
Results-Moran's I

- New York shows denser clustering near Downtown areas
- Los Angeles is more distributed and gets dense near coastal areas

City	Moran's I	P-Value
New York	0.469	0.001
Los Angeles	0.296	0.001

Global Moran's I based on POI distribution

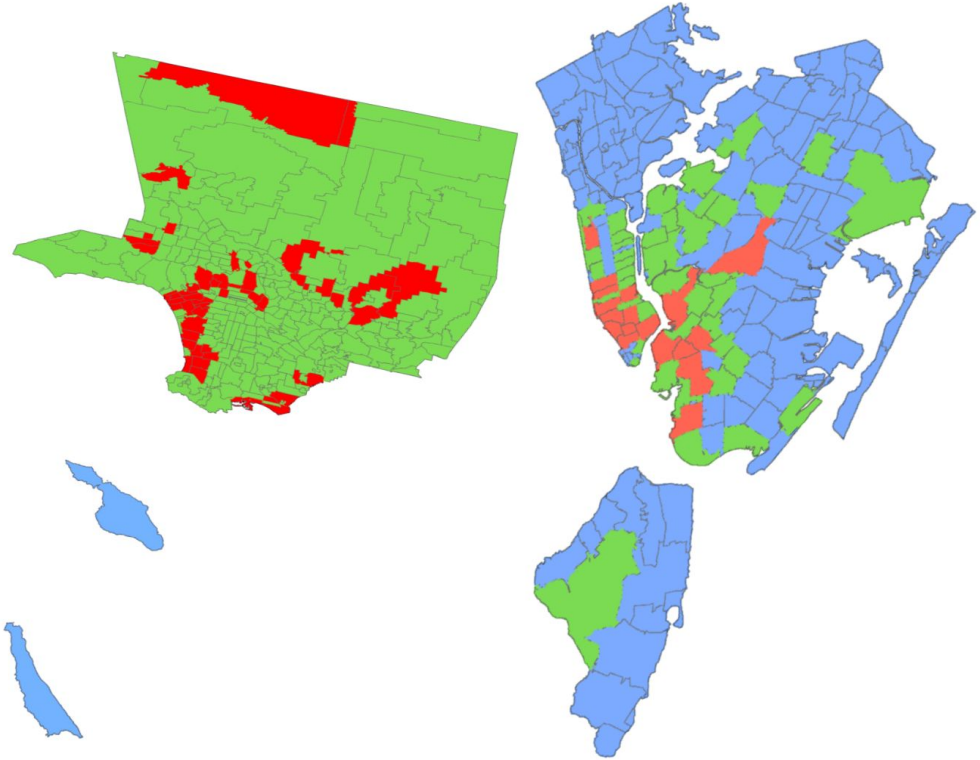




Local moran's I clustering based on POI distribution

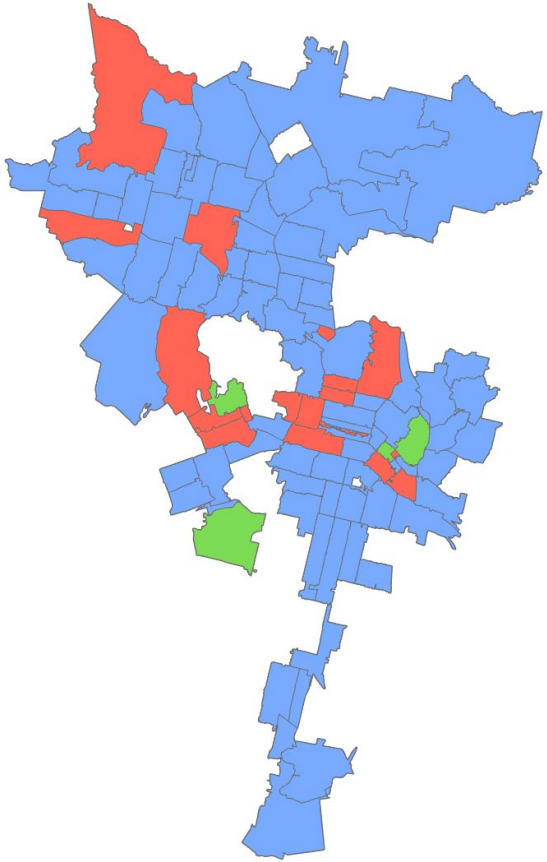
Results-POI Clustering

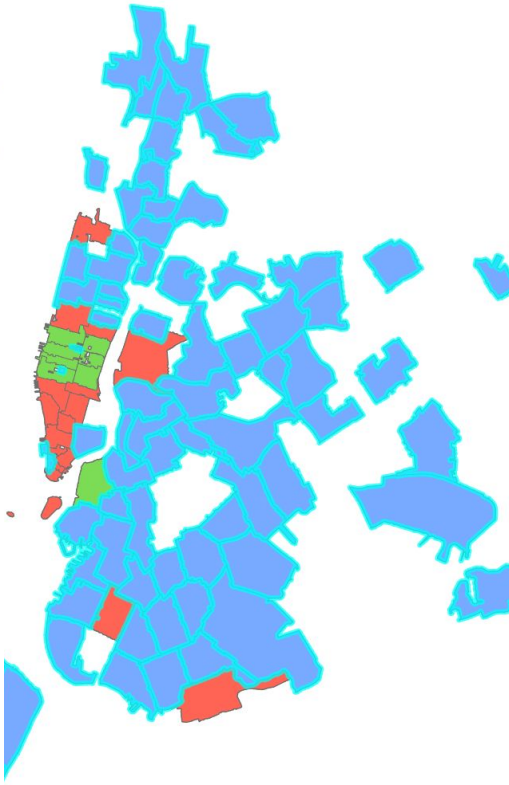
- New York:
  - Dense Urban Centers
  - Transit-Oriented Development
  - Economic Hotspots
- Los Angeles:
  - Spread of Activity Hubs
  - Car-Centric Connectivity
  - Uniform Access



Results-Workplaces

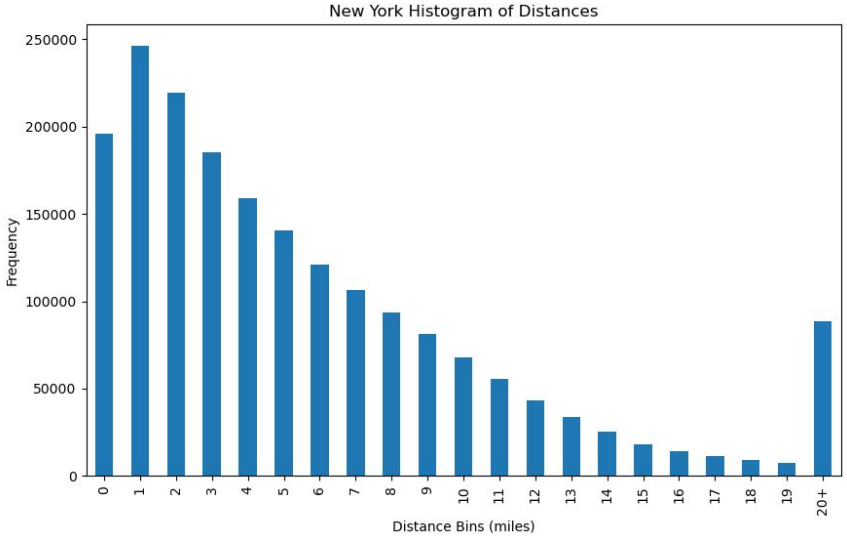
- New York:
  - Concentrated Workplaces
  - Impact on Commuting:
    - Short-distance travel peak
- Los Angeles:
  - Distributed Workplaces
  - Influence on Travel Patterns
    - Longer-distance travel peak

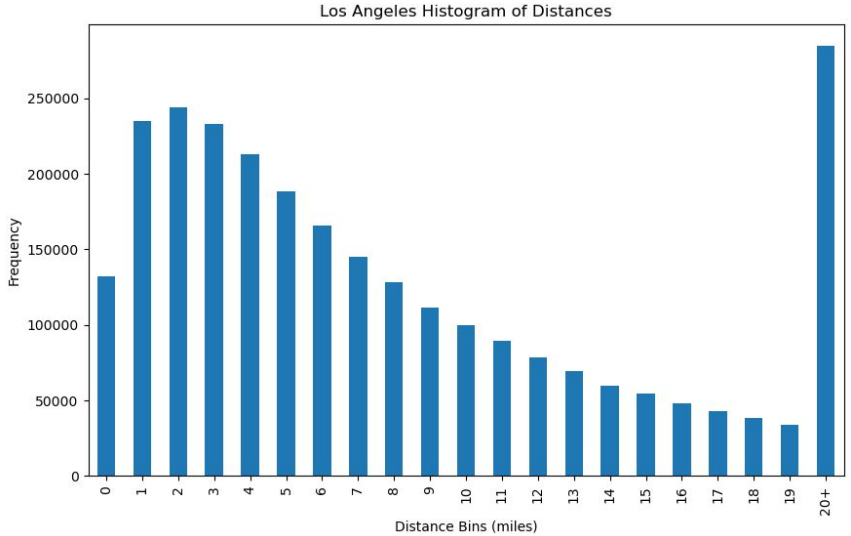




Results-Travel Distance

- New York: Peak at 1-2 miles; Los Angeles: Peak at 20+ miles





Conclusions

- NY's Compact Nature
- LA's Sprawling Layout
- Shared Short-Commute Trend
- Workplace Distribution Alignment
- Distance scaling metrics shall be included for better comparison between cities to reduce bias
- Urban Planning Implications:
    - Efficiency and accessibility
    - Development of local hubs and improved transit infrastructure
- Policy Considerations:
    - Minimize the need for long-distance travel

Future Works

- Delve further in network analysis.
- Include more data sources.
- Involve machine learning techniques.

Thank You