Accessibility of Public Libraries in Washington – Spatial Data Analysis

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Course: Spatial Data Science

1. Introduction

Public libraries are vital community resources that provide equitable access to knowledge, technology, and information. However, geographic disparities in access can lead to unequal service delivery. In Washington, the number of libraries has grown, but not all regions benefit equally. This study analyzes the spatial distribution of public libraries across Washington state and evaluates their accessibility using geospatial and statistical techniques.

2. Problem Statement

This study explores spatial patterns in library accessibility to understand disparities across regions in Washington.

How Libraries are Distributed in Washington?

Is there a Regional Gap in Libraries Accessibility?

Which areas are underserved or overserved?

3. Data

- Public library location data (Latitude, Longitude)
- US Census Tract Shapefiles (TIGER/Line)
- Census population data (Contain the data of Population for each county)

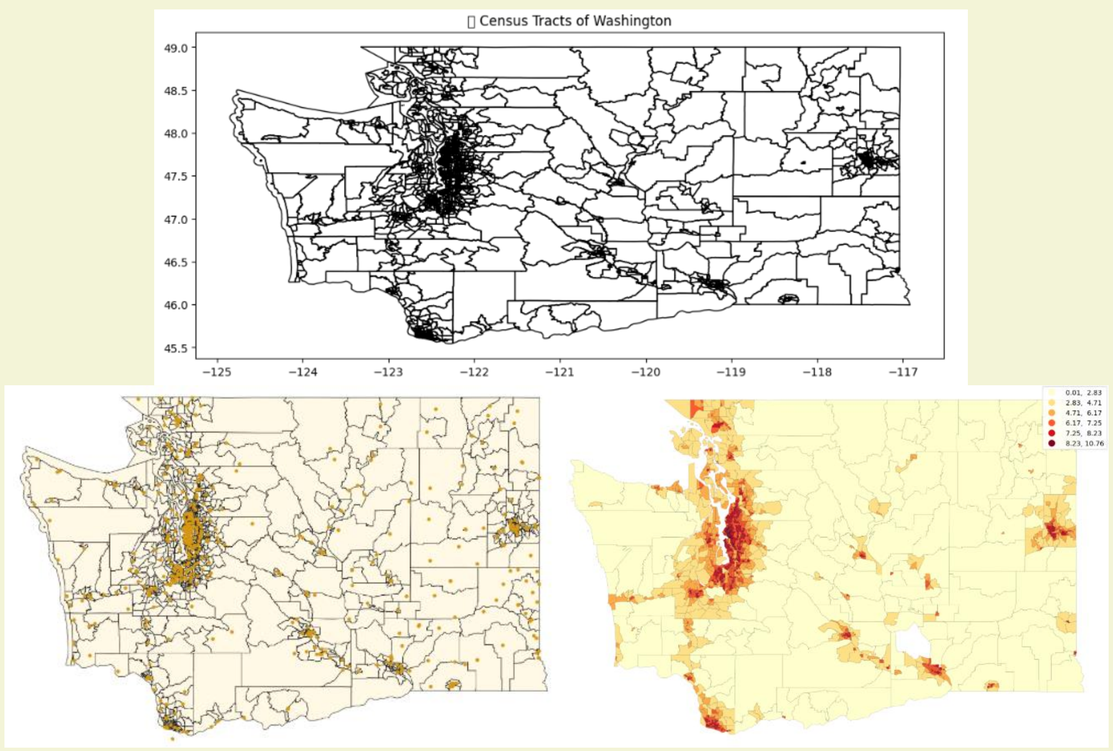


Fig. 1: It represent the data set of Census Tracks , which contain the data of Counties, Area of County, Geometry of County etc.

Fig. 2: It represent the Existing Libraries Location Dataset in the state of Washington.

Fig. 3: It represent the Population Density in each county which is extracted by the dataset of population in each county.

4. Methodology

Data Cleaning and Coordinate Alignment:
Standardized datasets and aligned coordinate reference systems to ensure accuracy in spatial operations.

Merging Population Data with Census Tracts:
Combined population data with census tract geometries using GEOID for spatial analysis.

Calculating Euclidean Distance:
Computed straight-line distance from each tract centroid to the nearest public library.

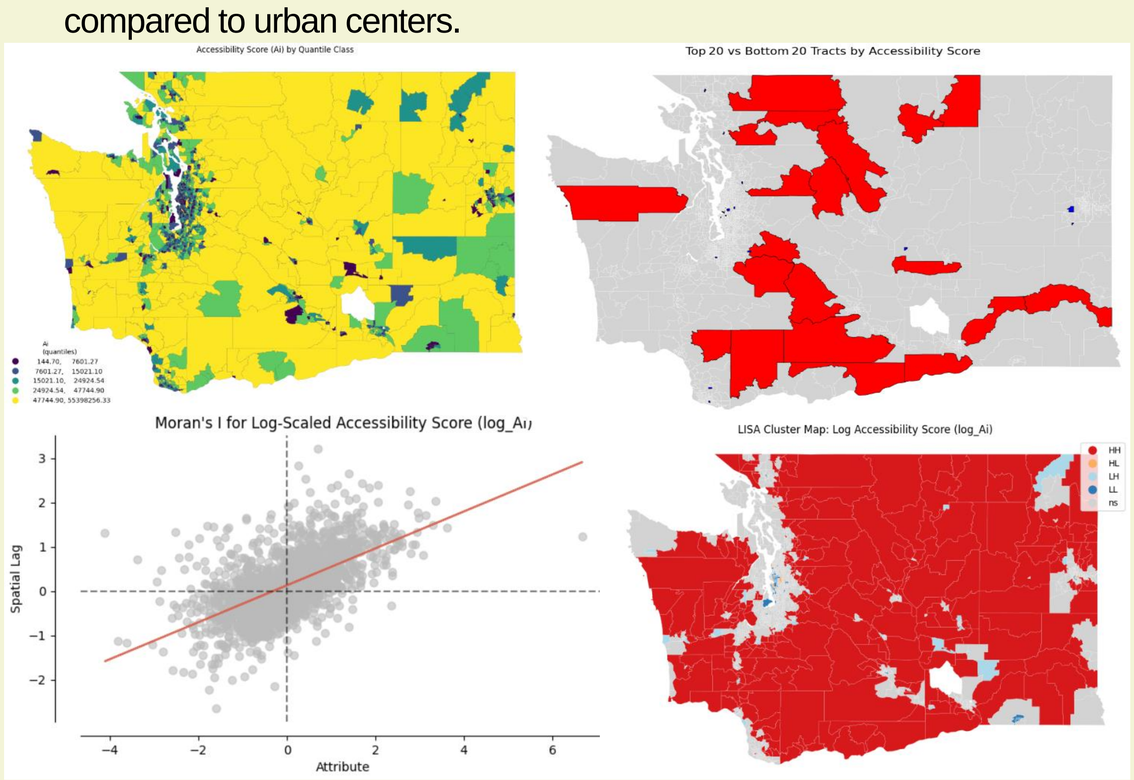
Accessibility Scoring and Log Transformation:
Calculated accessibility scores based on population and distance, then applied log transformation for normalization.

Spatial Autocorrelation (Moran's I):
Used Moran's I to detect clustering of accessibility values across space.

Hotspot Mapping (LISA):
Visualized spatial patterns and local clusters of high or low accessibility using LISA maps.

5. Results & Discussion

- **Map 1:** It represent the choropleth of Accessibility of Libraries by Accessibility Score.
- **Map 2:** It show the top 20 and bottom 20 counties based on the accessibility score.
- **Map 3:** It represent Plot of Moran's I for Log-Scaled Accessibility Score.
- **Map 4:** LISA map showing clusters of high and low accessibility. High-high areas mark well-served zones; low-low areas highlight underserved regions.
- **Insight:** Rural and peripheral tracts tend to have poorer access compared to urban centers.



Acknowledgments: The datasets used in this project were obtained from Washington State's open data portal for library locations (https://data.wa.gov), the U.S. Census Bureau for population data (https://data.census.gov), and U.S. Census TIGER/Line shapefiles from the Data.gov catalog (https://catalog.data.gov), all specific to Washington State.

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