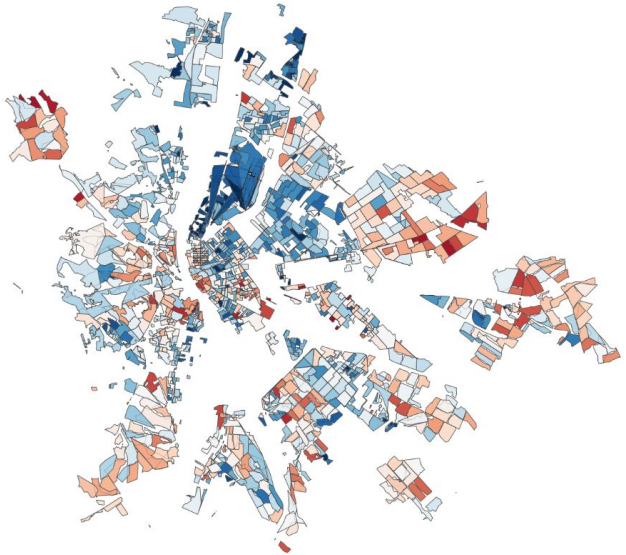
Electoral Polarization in Budapest: A Geospatial Analysis

Author: Justin Zhang

This project investigates the spatial structure of electoral behavior in Budapest, using voting station-level data from the 2024 European Parliament election. Through geospatial analysis, it seeks to uncover patterns of political support for the ruling party (FIDESZ) and the opposition, and to examine how these are shaped by urban geography and voter turnout.

The study applies vector-based spatial methods, including spatial autocorrelation metrics and hotspot detection, to assess whether partisan preferences are geographically clustered and whether participation levels follow systematic spatial gradients.

As a case study in urban electoral geography, the project illustrates how spatial inequalities in political engagement can emerge and persist within a metropolitan context—highlighting the role of geography in shaping democratic outcomes.

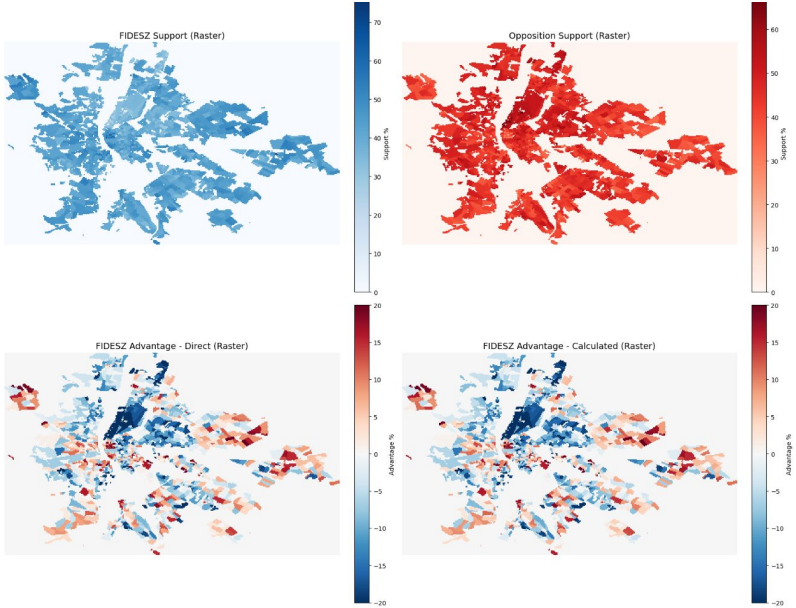


Data and Preprocessing

The dataset consists of voting station polygons and attributes, including registered voters, turnout, and vote counts for major parties. It was provided in GeoJSON format and contains several geometry-related issues.

Approximately **5% of the polygons were invalid or empty**, requiring geometric validation using geopandas. I removed empty geometries and repaired invalid ones with .buffer(0) and .is_valid checks. I also ensured all geometries were projected to EPSG:4326 to allow consistent spatial operations.

All variables were standardized to percentages (e.g., FIDESZ vote share, turnout rate) and stored for further analysis.

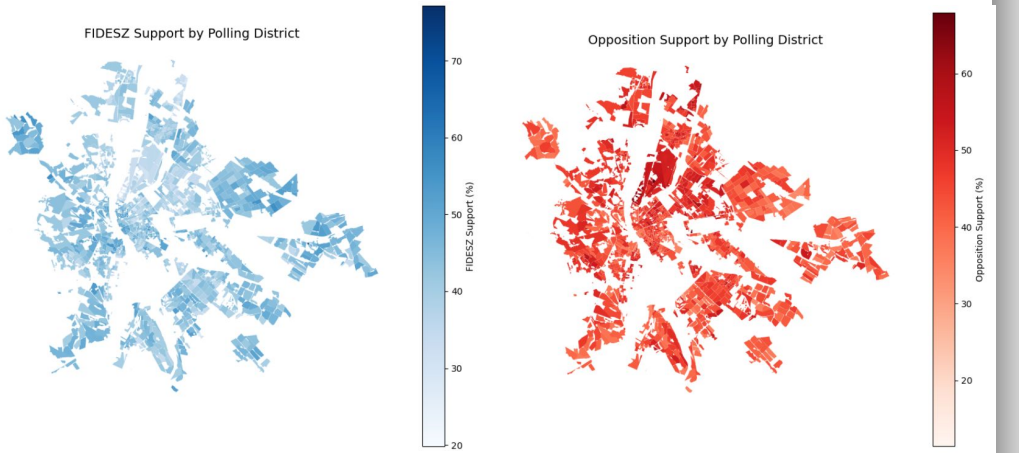


Spatial Patterns of Political Support

Thematic mapping reveals clear political segmentation within Budapest. The **central districts**, especially along the Danube, show higher support for opposition parties, while **outer districts** tend to favor FIDESZ.

This spatial division creates a recognizable **“red center, blue periphery”** pattern. The variation is not random but follows urban structure. The city core—denser, more educated, and often younger—leans opposition, while peripheral areas show more conservative preferences.

These patterns suggest deeper links between urban form and electoral outcomes.

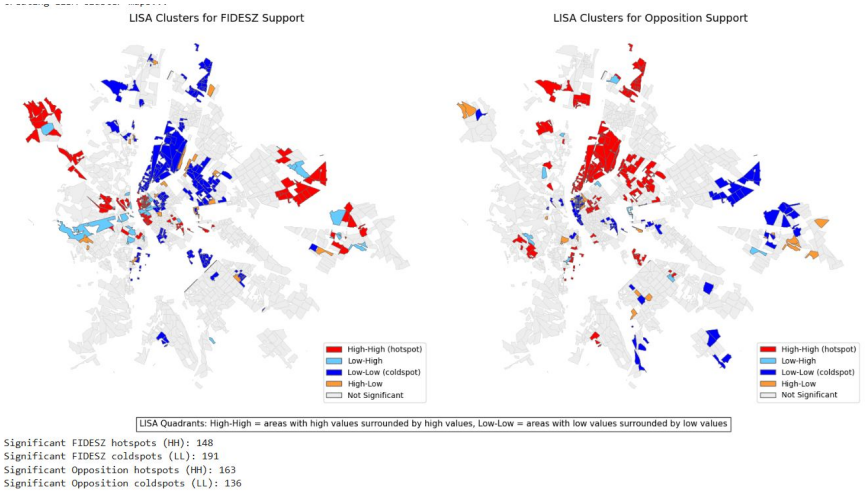


Spatial Autocorrelation: Local Moran's I

To test whether party support exhibits spatial clustering, I applied Local Moran's I using the esda package. The analysis shows statistically significant clusters of both high and low party support.

High-High clusters of FIDESZ support appear in outer northeast districts, while **Low-Low clusters** (opposition dominance) concentrate in central and western areas. These results confirm that political preferences are spatially autocorrelated.

Such clustering patterns reinforce the idea of **political polarization aligned with spatial segregation** in the city.

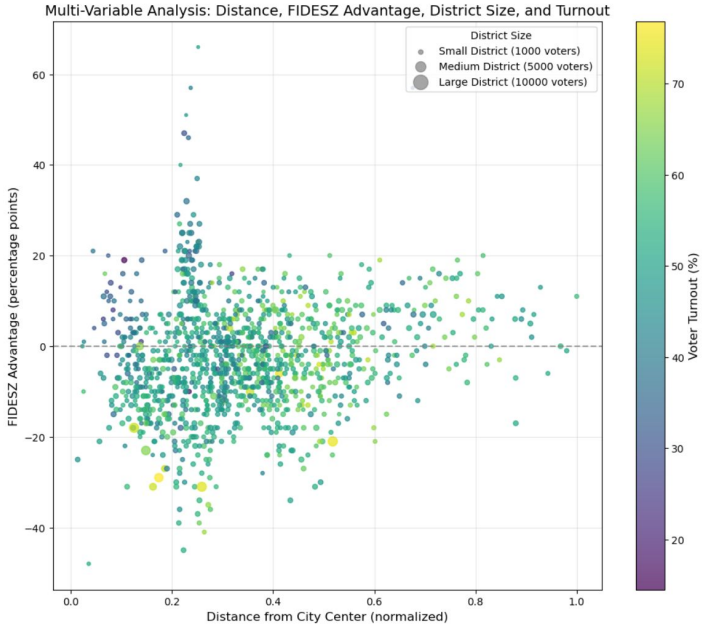


Turnout and Political Preference

I examined whether voter turnout is systematically associated with party support. The correlation between **turnout and opposition support** is **moderately positive** (≈ 0.22), while the correlation with **FIDESZ support** is **slightly negative** (≈ -0.09).

This pattern suggests that **opposition-leaning areas tend to have more mobilized electorates**, potentially due to stronger anti-incumbency sentiment or more targeted campaign efforts in central districts.

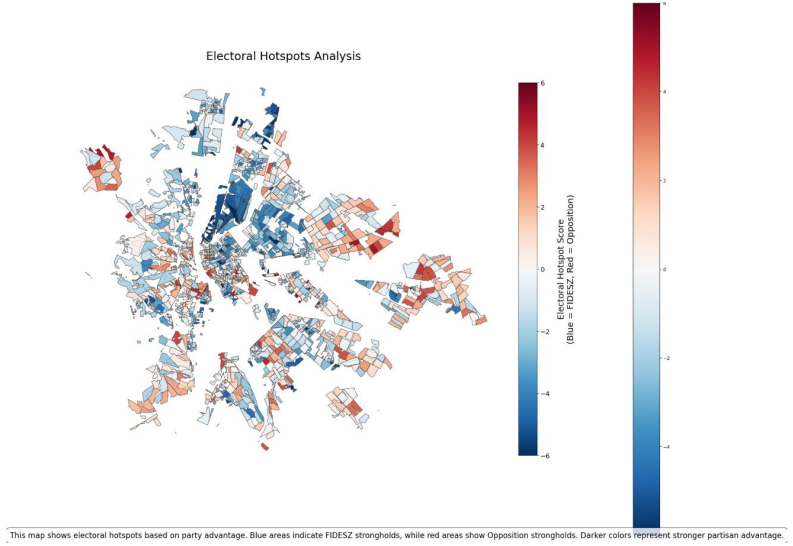
Although these findings are based on correlation analysis, they provide meaningful insight into how **spatial variation in political participation** relates to partisan dynamics in urban environments.



Conclusion and Implications

This study reveals a spatially polarized electoral landscape in Budapest, where:

- **Political support is strongly clustered**
  Global Moran's I: **FIDESZ = 0.511**, **Opposition = 0.513** ($p < 0.001$)
  → Clear spatial autocorrelation in party support.
- **Turnout correlates with political alignment**
  Turnout vs Opposition: **+0.225**
  Turnout vs FIDESZ: **–0.089**
  → Higher turnout in opposition-leaning areas suggests differentiated mobilization.
- **Urban-rural divide is evident**
  Distance to center vs FIDESZ: **+0.155**
  Distance to center vs Opposition: **–0.127**
- **Hotspots reveal entrenched partisan zones**
  FIDESZ hotspots: **148 districts**
  Opposition hotspots: **163 districts**
  → Some margins exceed **±20 percentage points**
  Few swing areas detected
  → Most districts show stable preferences with little electoral volatility.



This hotspot map visually summarizes the spatial polarization and identifies critical electoral zones.