Digital Applied Learning and Innovation

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Winter 2023

- Learning R and data analysis tools and techniques.

- Principal Component Analysis of Presidential Election Data.

- Agent-Based Modeling

Analysis

	PC1	PC2	PC3	PC4	PC5	PC6
Standard deviation	43.9113	26.9194	16.20763	12.47441	9.26507	9.659e-14
Proportion of Variance	0.6108	0.2295	0.08321	0.04929	0.02719	0.000e+00
Cumulative Proportion	0.6108	0.8403	0.92352	0.97281	1.00000	1.000e+00

The first PC explains 61.08% of the total variation in the data, while the second PC explains 22.95%. Together, the first two PCs explain 84.03% of the total variation in the data.

fips	2000	2004	2008	2012	2016	2020
01001	0.6969433	0.7567352	0.7361364	0.7261825	0.7276659	0.7143680
01003	0.7236544	0.7641518	0.7525948	0.7735827	0.7654571	0.7617137
01005	0.4902357	0.5473694	0.5043852	0.4822313	0.5209667	0.5345123
01007	0.6017462	0.7200000	0.7244331	0.7282660	0.7640322	0.7842626
01009	0.7047794	0.8085007	0.8401945	0.8646588	0.8933484	0.8957155
01011	0.2922104	0.3167267	0.2568790	0.2350620	0.2420382	0.2484284
01013	0.5288991	0.5916112	0.5649397	0.5356992	0.5612689	0.5752530
01015	0.5732864	0.6588875	0.6569189	0.6545604	0.6866330	0.6884844
01017	0.5101403	0.5848680	0.5393822	0.5219355	0.5642446	0.5726904
01019	0.5309983	0.6545475	0.7488969	0.7675631	0.8341563	0.8603366
01021	0.6669759	0.7685257	0.7849311	0.7978468	0.8210028	0.8329881
01023	0.4882018	0.5392279	0.5349633	0.5210843	0.5630828	0.5755627
01025	0.5569196	0.5906618	0.5557127	0.5393112	0.5479242	0.5575942

PCA Index

United States

Presidential Election Data of Republicans from 2000 to 2020

Republican Vote Estimate

	0.02
	0.01
	0.00
	-0.01
	-0.02
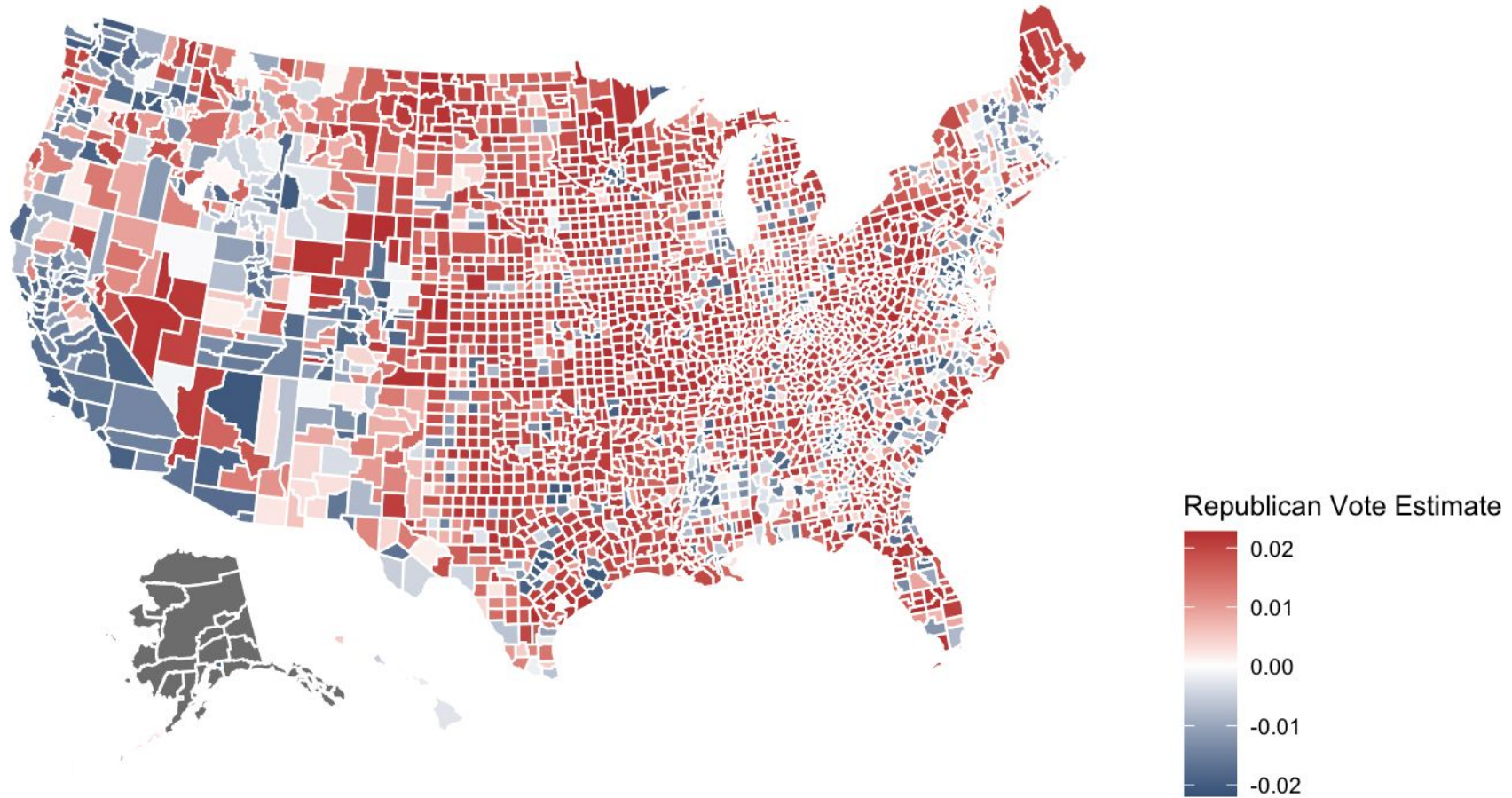
Agent Based Modeling

A computational modeling approach that focuses on modeling the behavior and interactions of autonomous agents in a complex system. In ABM, the system is viewed as a collection of agents that are capable of interacting with each other and with their environment.

The main components of an ABM include:

- Agents: These are autonomous entities that make decisions based on their local environment and interactions with other agents.
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- Environment: This is the setting or context in which agents operate. The environment can include physical space, resources, and other agents.
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- Rules: These are the behavioral rules that govern how agents interact with each other and their environment.
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- Emergent patterns: These are the complex, self-organizing patterns that arise from the interactions of agents and the environment.

# Agent Based Modeling

Agents in our data:

- Voters: Voters who participate in the election and cast their votes for the candidates of their choice. Can model each voter's behavior based on their past voting patterns, demographic information, political preferences, and other relevant factors.

- Candidates: Can model each candidate as an agent who competes for the voters' support by running a campaign, holding rallies, and using other means to convince the voters to vote for them. Can model each candidate's popularity, charisma, and other traits that may influence their chances of winning the election.

- Political Parties: Can also model each political party as an agent who tries to gain the support of voters by advocating for their party's ideology and policies. Can model each party's messaging strategy, organizational strength, and other factors that may influence their electoral performance.

Spring 2023

- Learning R animation.

- Creating a bunch of animations of provided data.

- Political Polarization Literature Review.
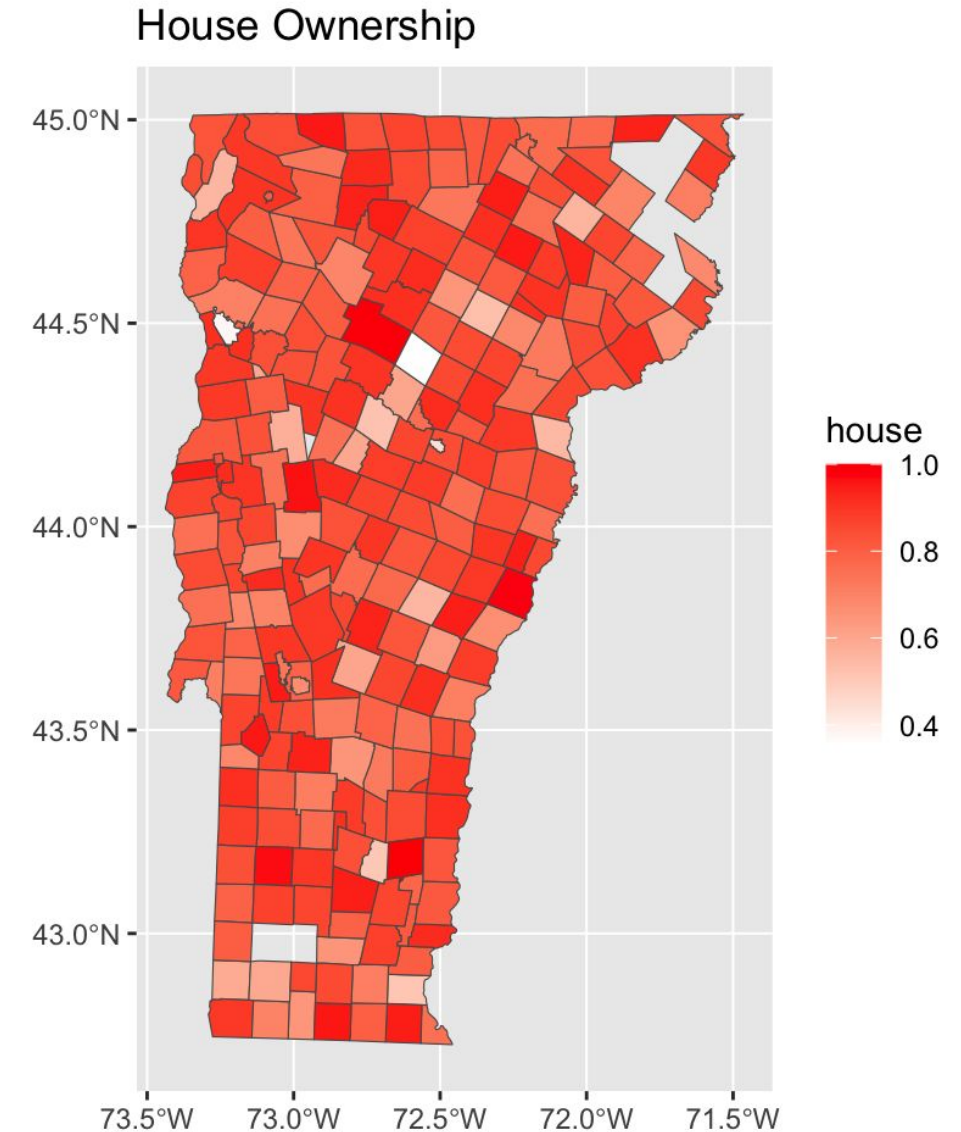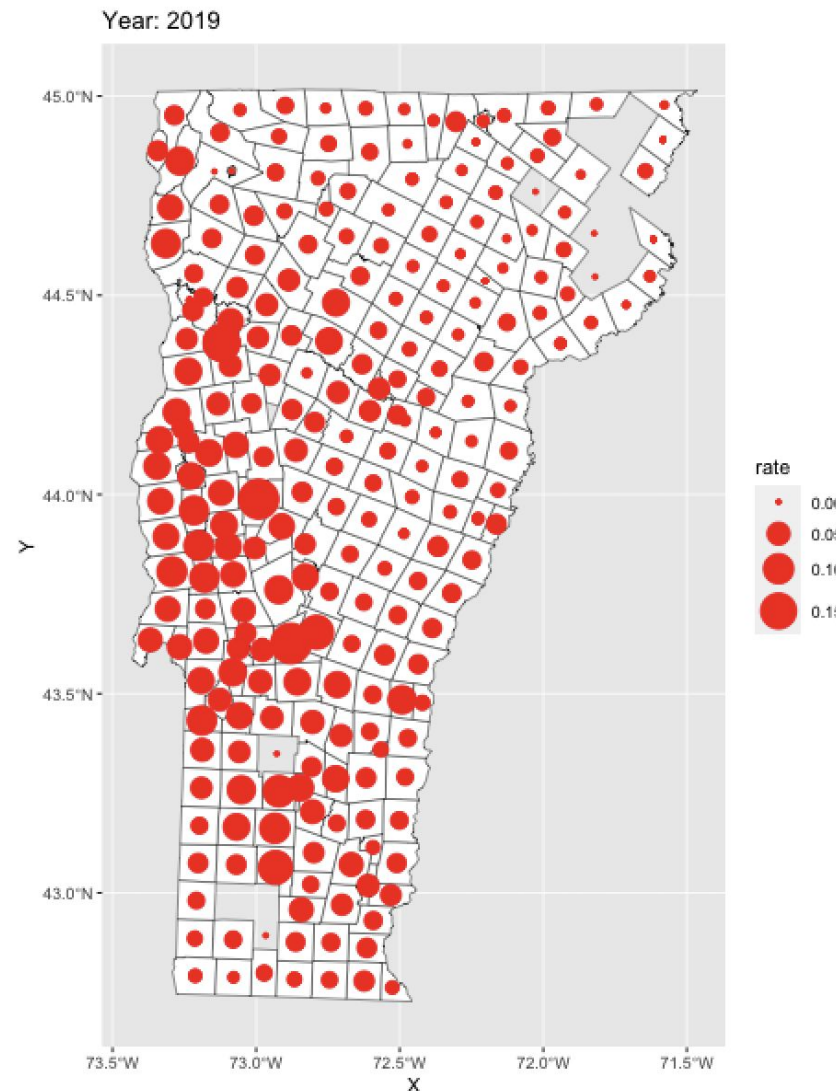
- Calculating Gini Coefficient of Political Data.

Plot of of rooftop solar data of each Towns
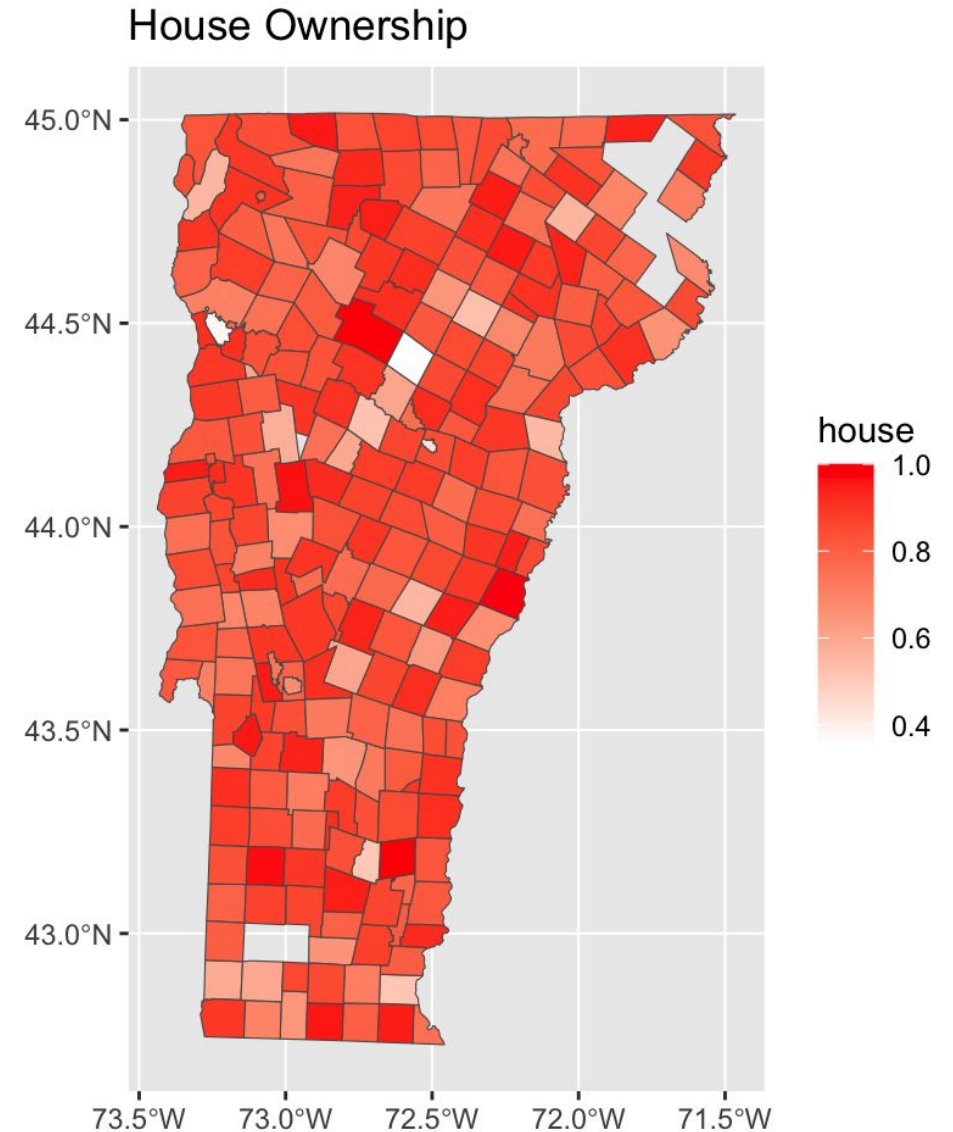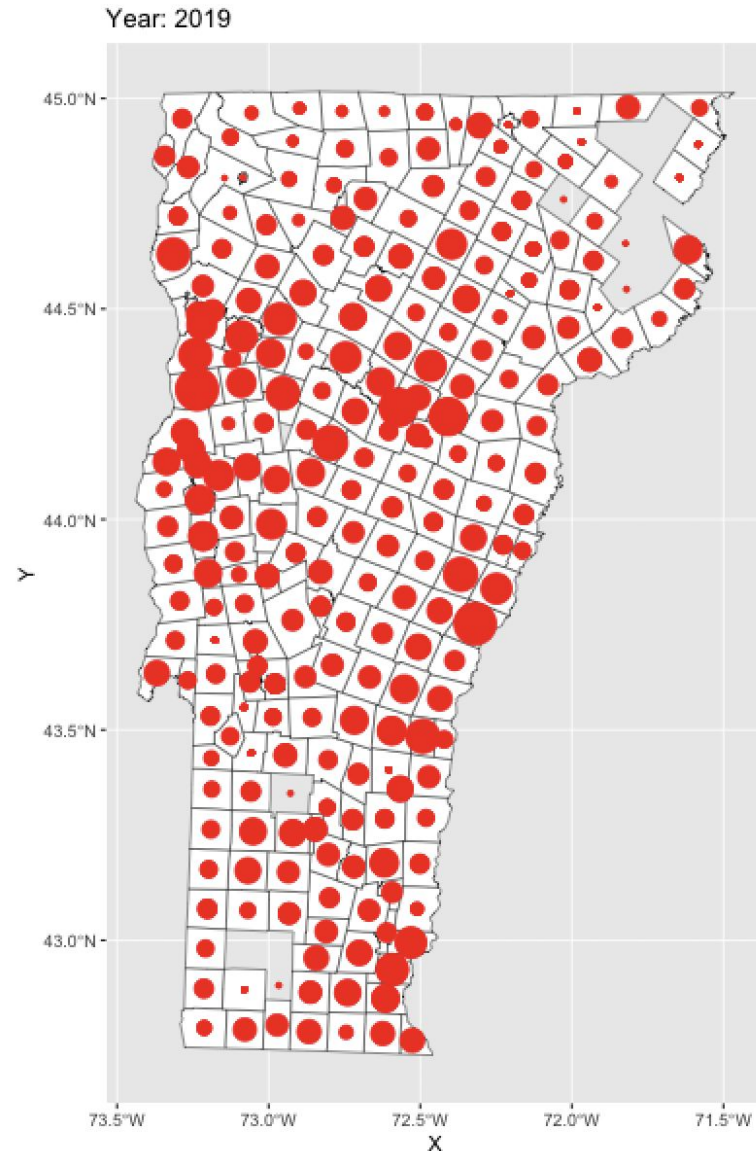
r_PV is the number of PV/ number of housing unit
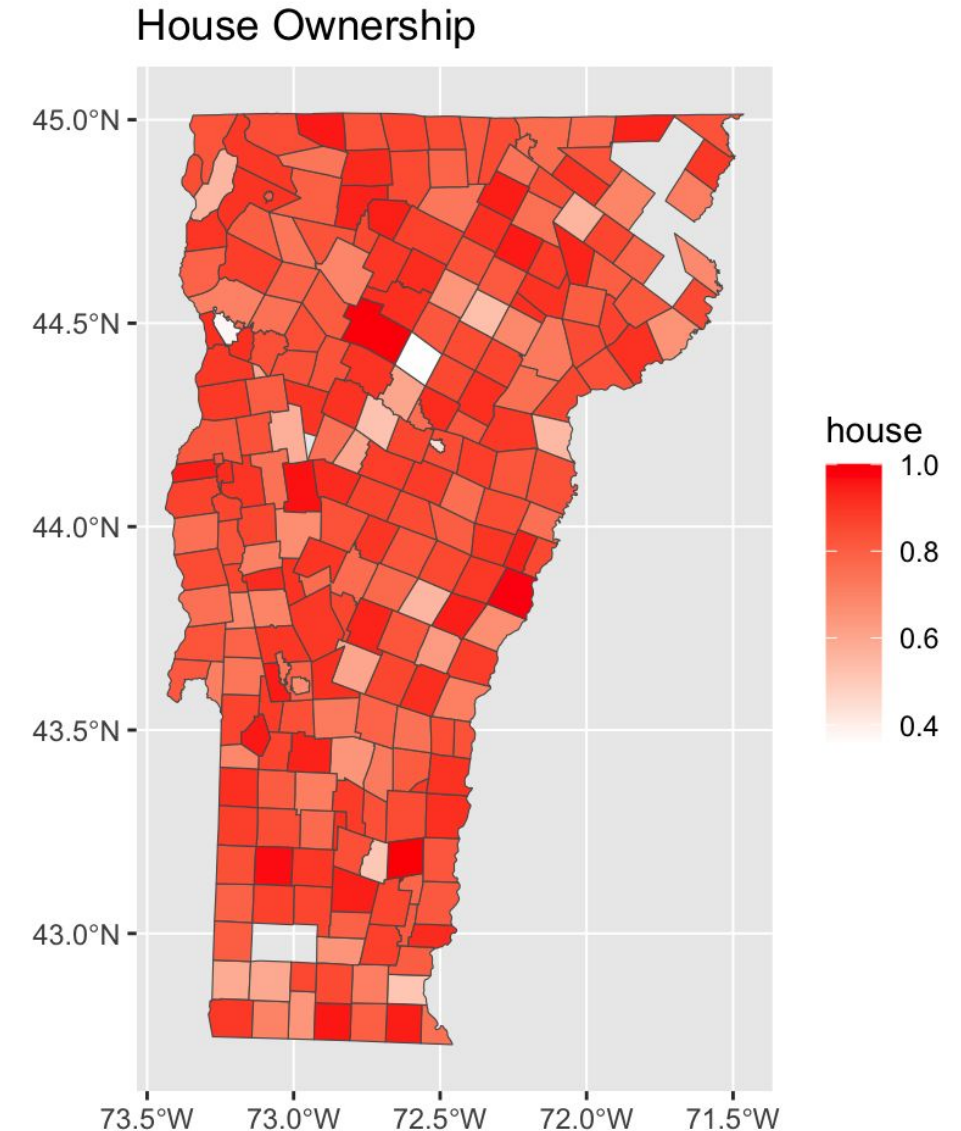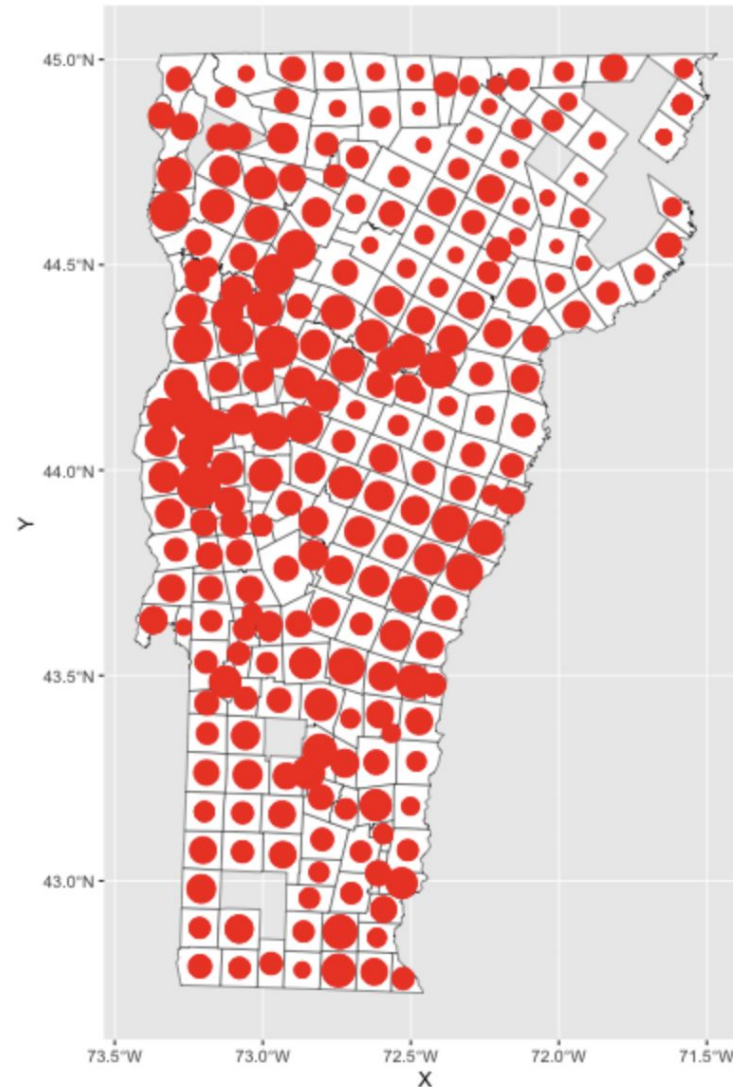
Plot of Pump data of each Towns

rate is the number of pump/ number of housing unit

Plot of EV data of each Towns

rate is the number of EV/ number of housing unit

Gini Coefficient Analysis

The Gini coefficient ranges from 0 to 1, where a score of 0 indicates perfect equality (all parties received an equal share of the vote) and a score of 1 indicates perfect inequality (one party received all the votes and all other parties received none).

The Gini coefficient is being used as a measure of the degree of polarization in each county during presidential elections.

A higher Gini coefficient indicates greater polarization, meaning that one or a few parties are receiving a disproportionately large share of the vote, while the other parties are receiving a disproportionately small share of the vote. Conversely, a lower Gini coefficient indicates less polarization, meaning that the vote share is more evenly distributed across the different political parties.

https://link.springer.com/article/10.1007/s11366-021-09772-1

United States
Presidential Election Data from 2000 to 2020

Political Polarization
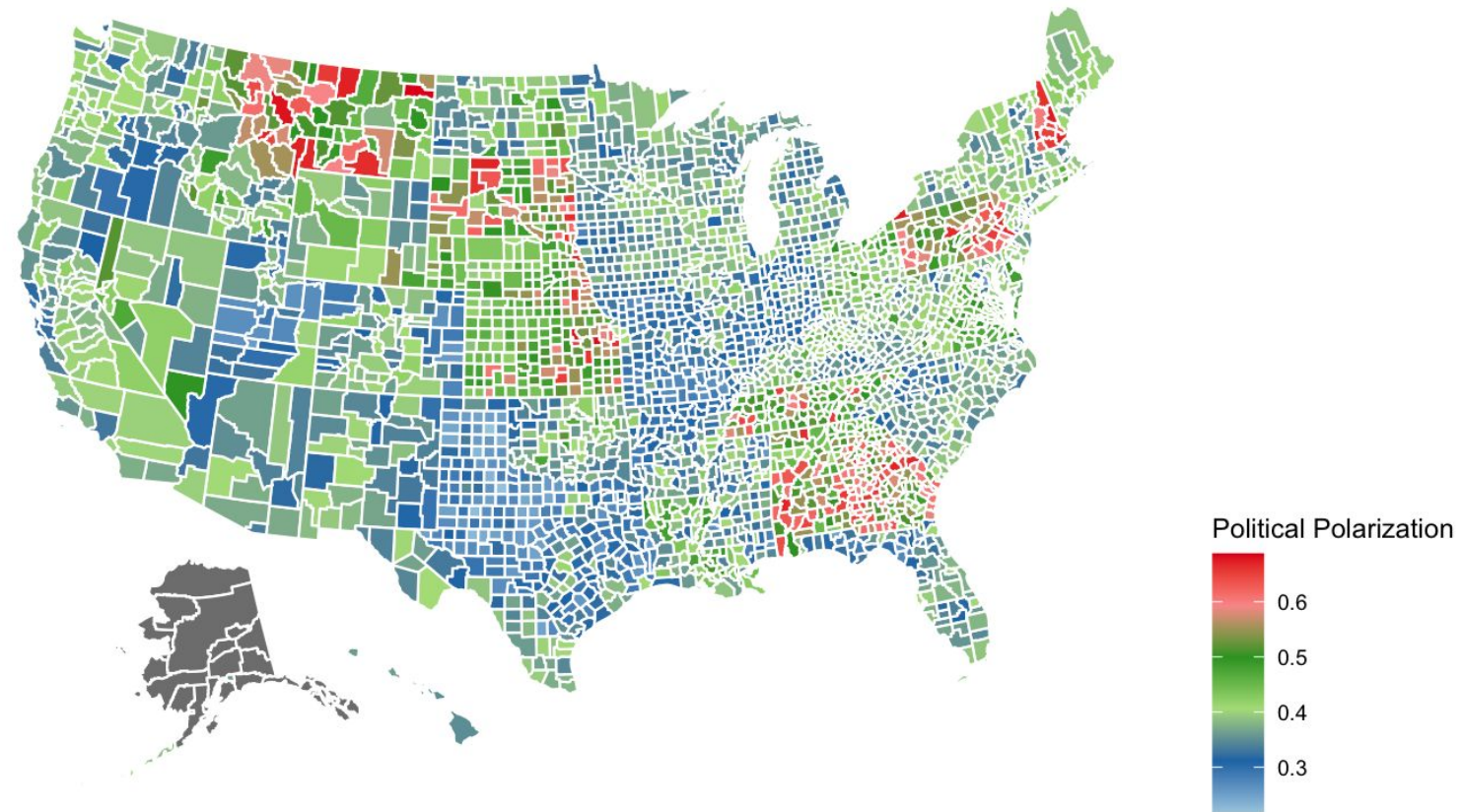
Partisan Voting Index (PVI)

The PVI is a measure of how strongly a county or district leans toward one political party or the other, based on the results of the previous two presidential elections.

It is calculated as the difference between the percentage of votes for the Republican and Democratic candidates in the two elections, divided by the total number of votes cast.

A positive PVI indicates a Republican lean, and a negative PVI indicates a Democratic lean. This metric captures the degree of partisan homogeneity in a given area, and can be used to assess the overall level of polarization between the two major parties.
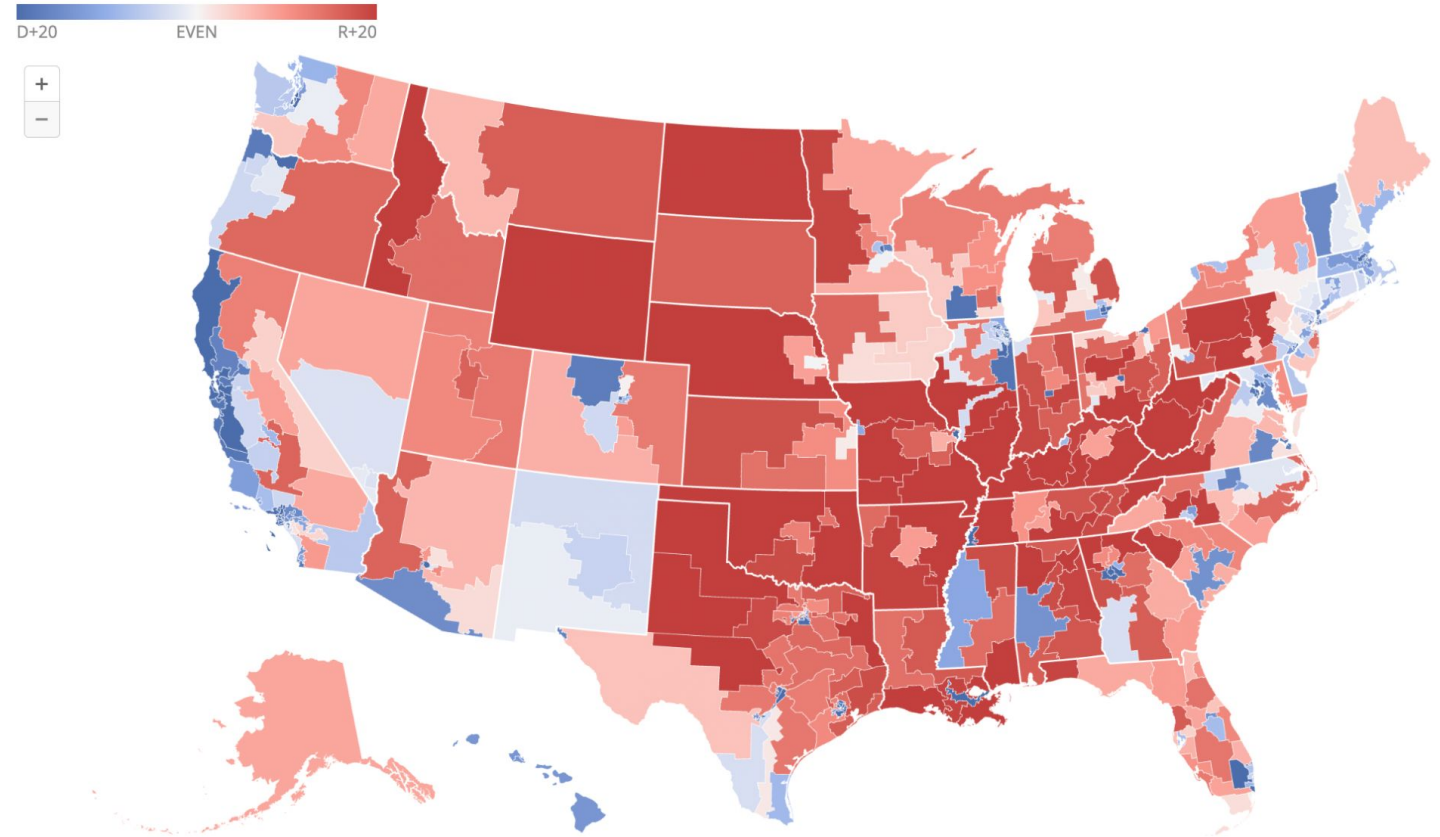

Fig: Cook PVI (2016 - 2020)
Source:
https://www.cookpolitical.com/cook-pvi/2023-partisan-voting-index/118-district-map-and-list

What's Next?

- Refining the animations.

- Calculating Partisan Voting Index (PVI) in our data.

- Perhaps finding better polarization metric.

- Visualization of political polarization in our data.

Questions?

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