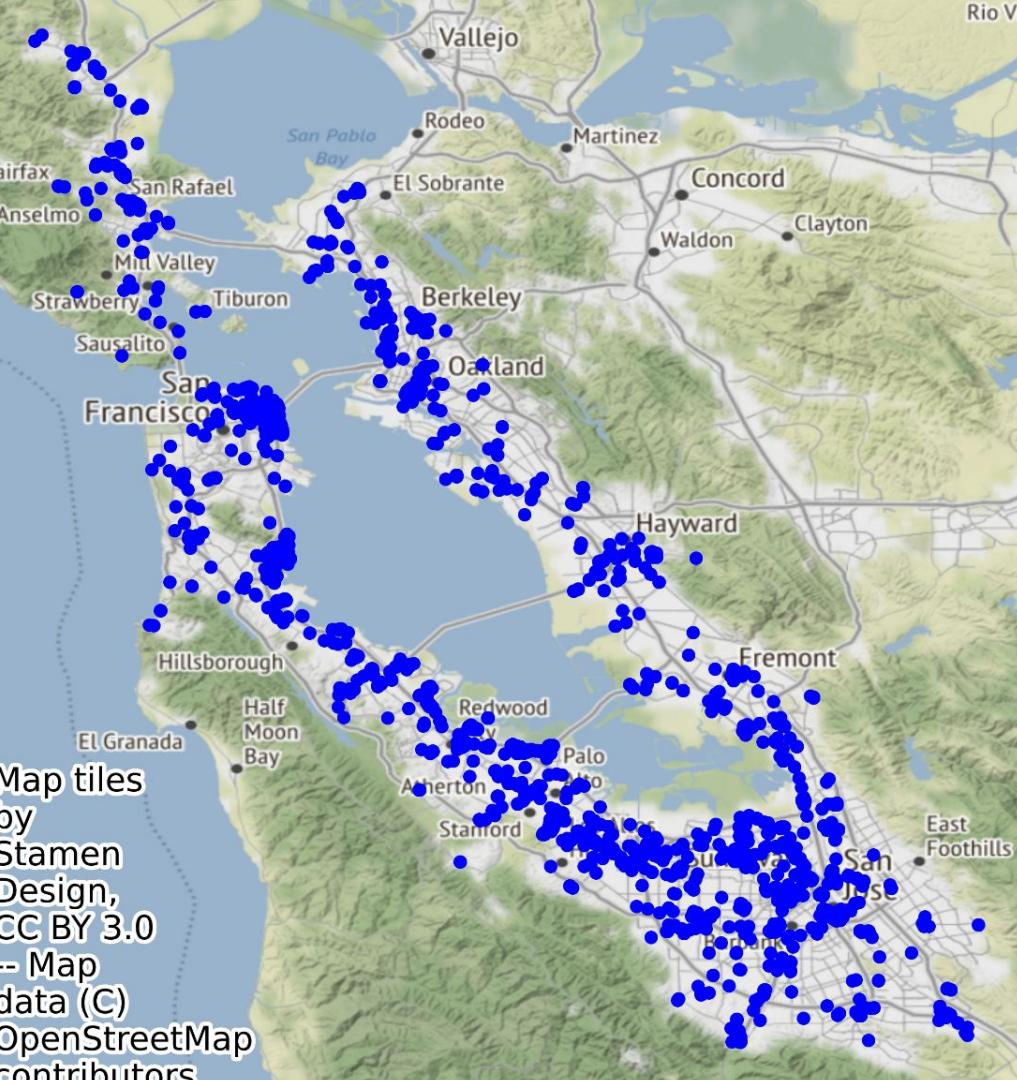


Electric Vehicle Charging Stations

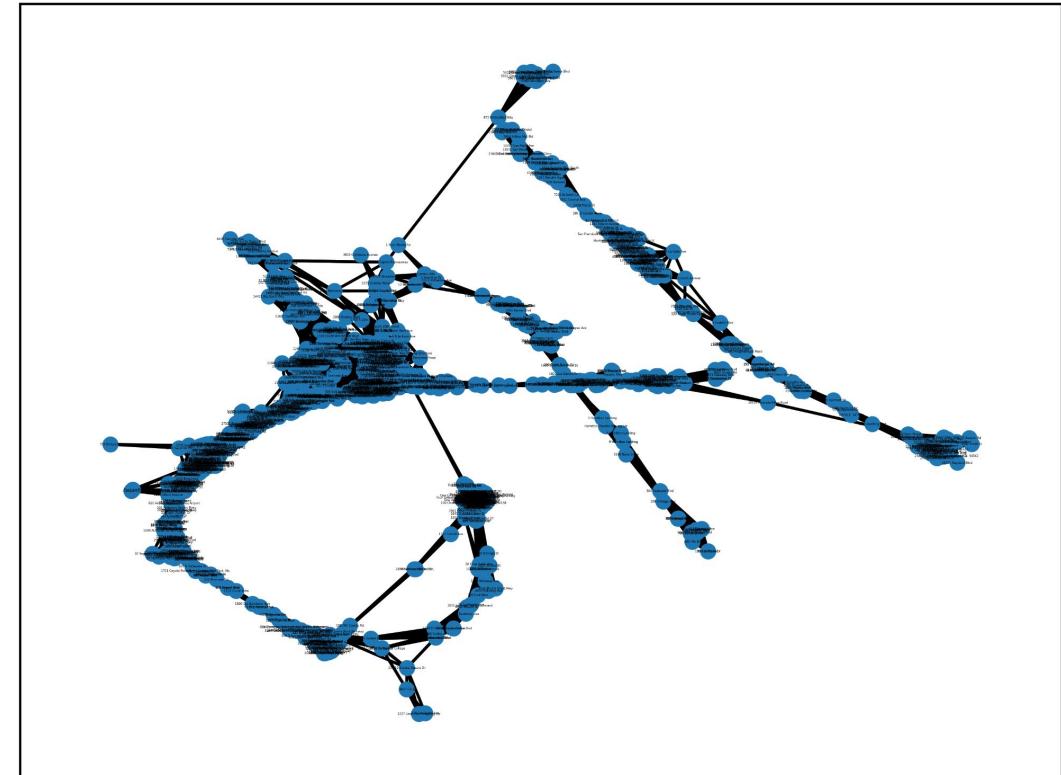


CP 88
Spring 2023
Youcan Liang

My network

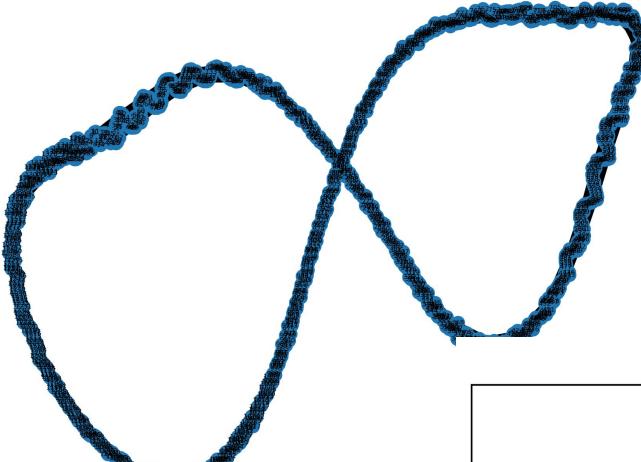
- Node: Each EV charging station
- Link: happen if the distance between two stations is less than 3 miles

Empirical network

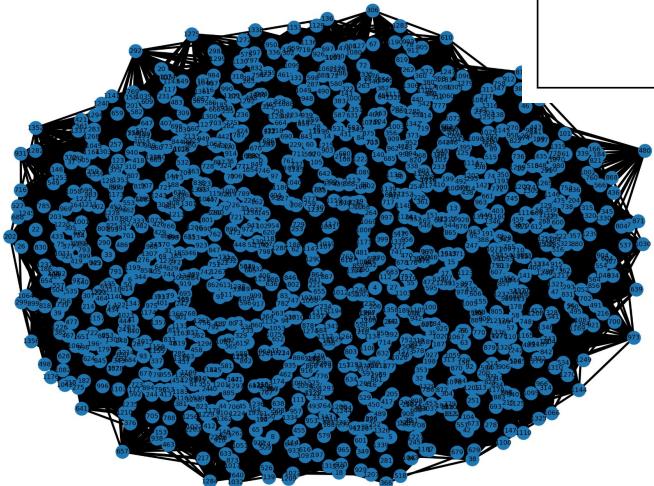


Three models

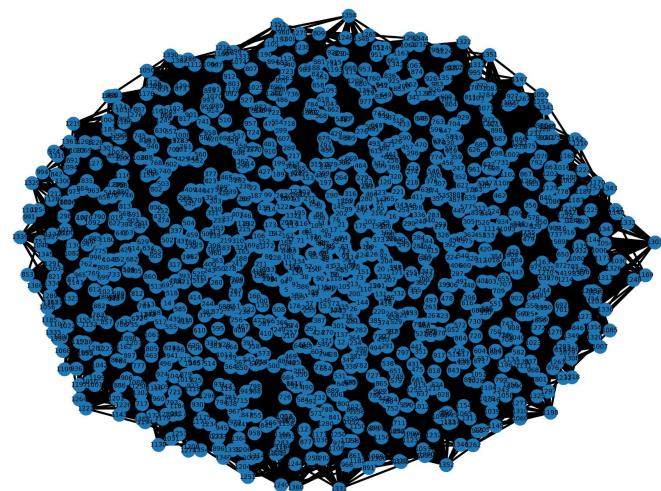
Small world model



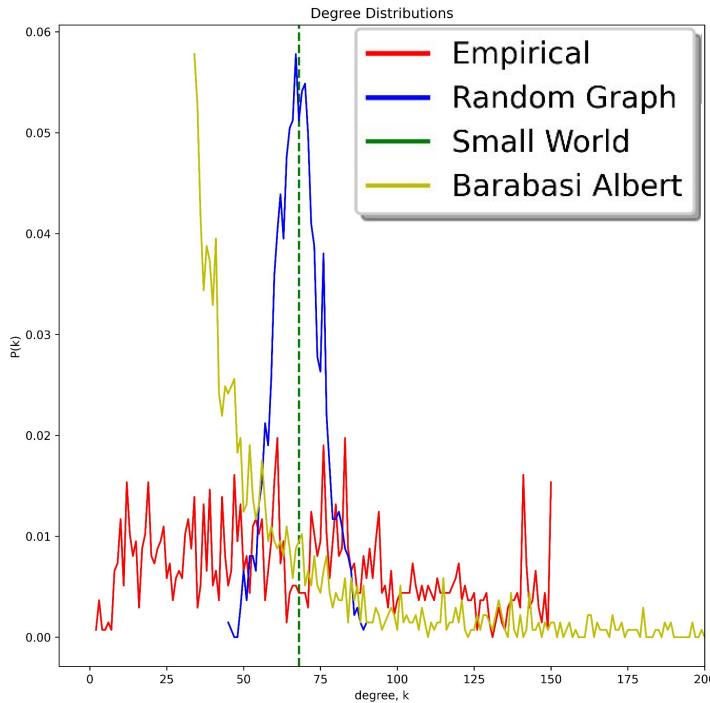
Random graph model



Barabasi Albert model



Characteristics about each model

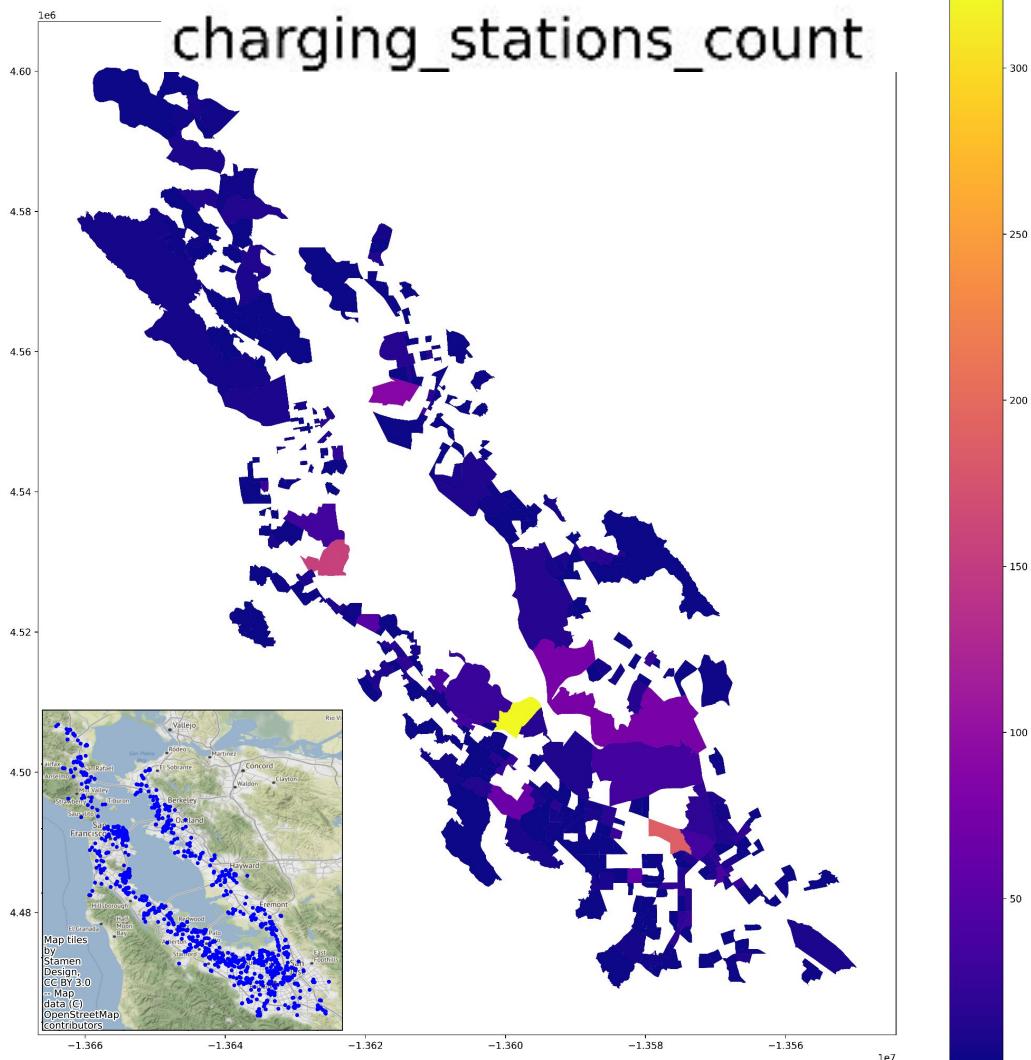


Graph	Avg Clustering Coefficient $\langle C \rangle$	Avg Degree $\langle k \rangle$	Avg Shortest Path Length $\langle l \rangle$	#Nodes	#Links
My network	0.784886	33.982443	11.744445	1367	46454
Random graph model	0.049249	67.964887	1.983302	1367	46264
Small world model	0.738806	68.000000	10.546120	1367	46478
Barabasi-Albert model	0.111894	34.000000	2.012644	1367	45322

Where are most EV charging stations located?

Charging station count in each tract

- mean 8.5
- std 23.9
- min 1
- 25% 1
- 50% 2
- 75% 8
- max 322

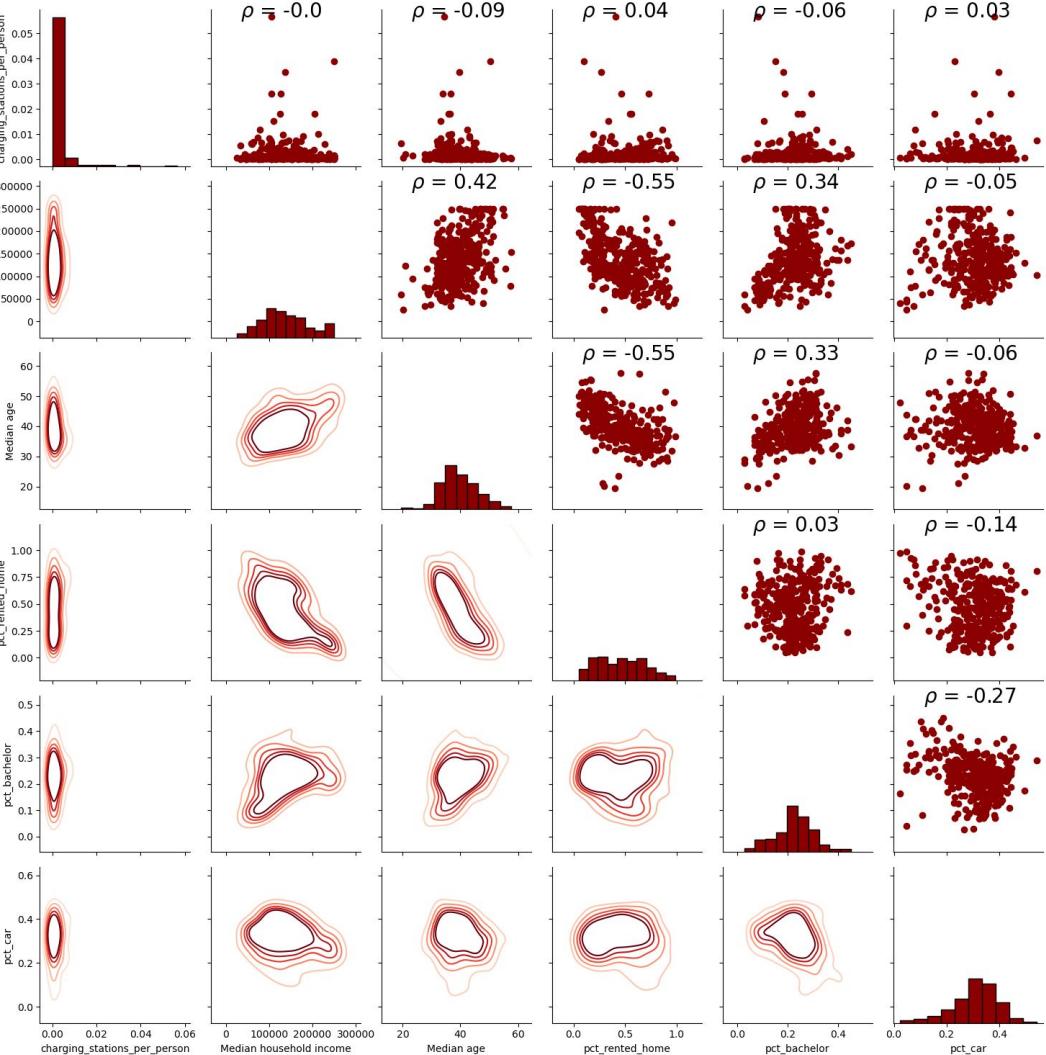


* insufficient data caused broken map

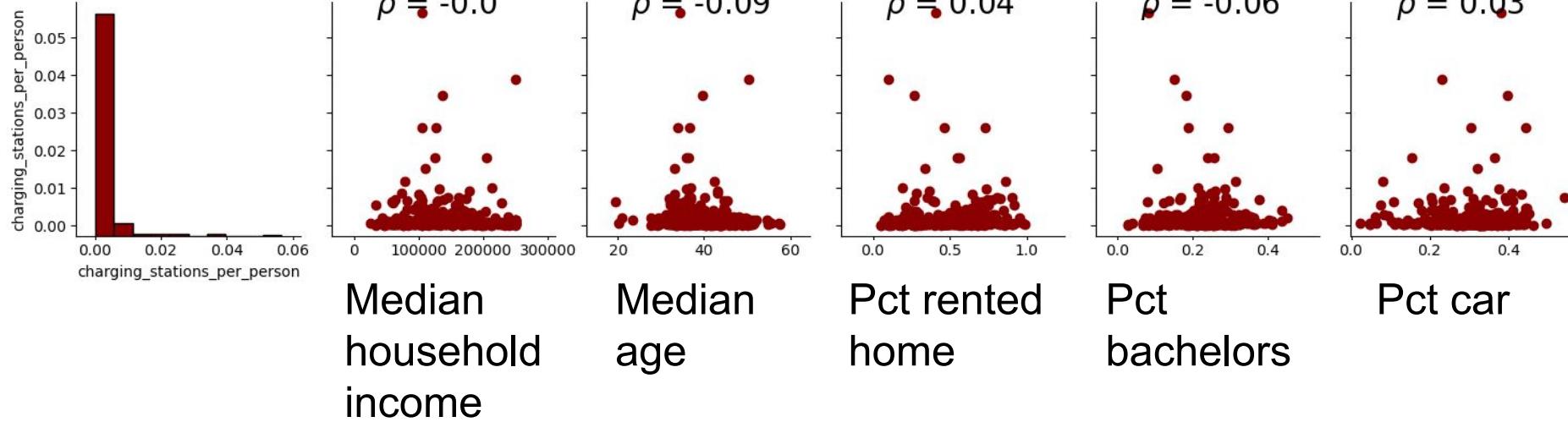
Finding correlations

Variables:

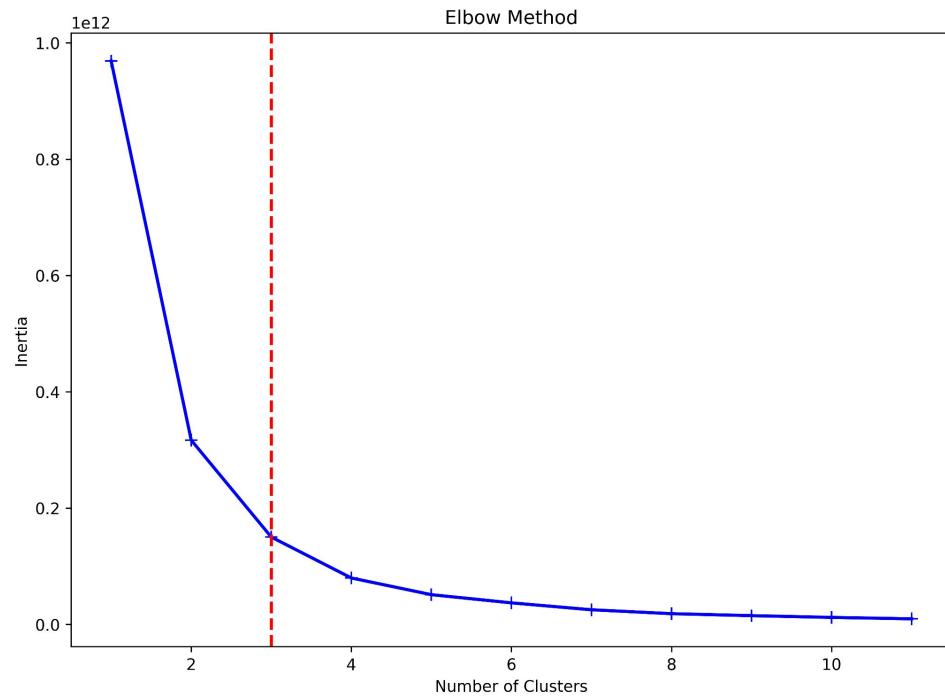
- Charging_stations_per_person
- Median household income
- Median age
- Pct_rented_home
- Pct_bachelor
- Pct_car



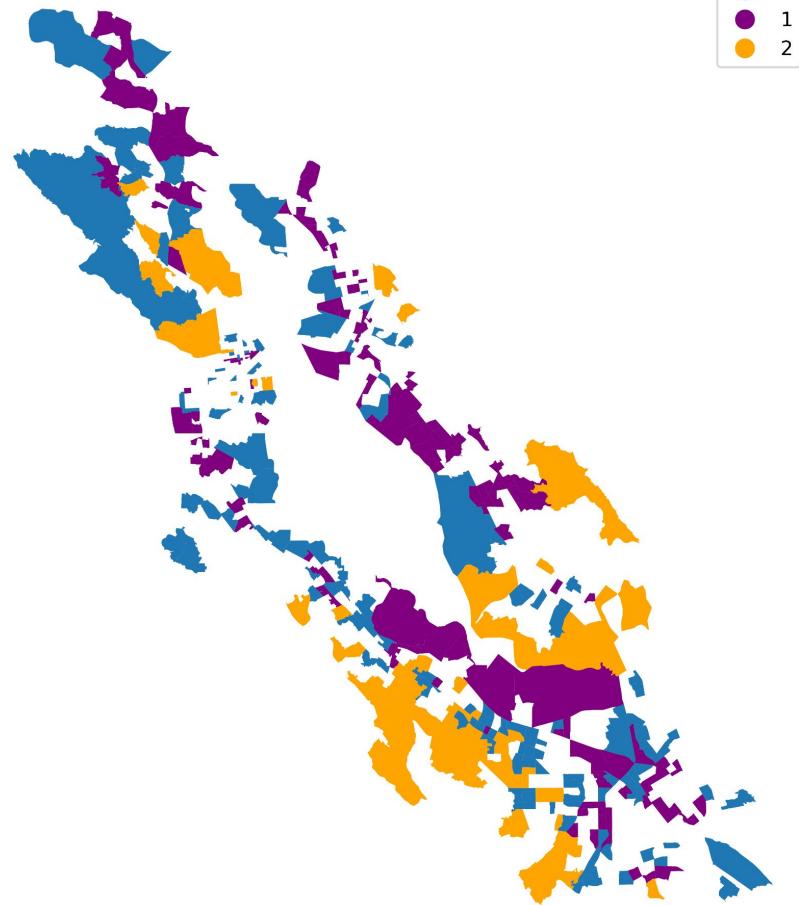
Finding correlations



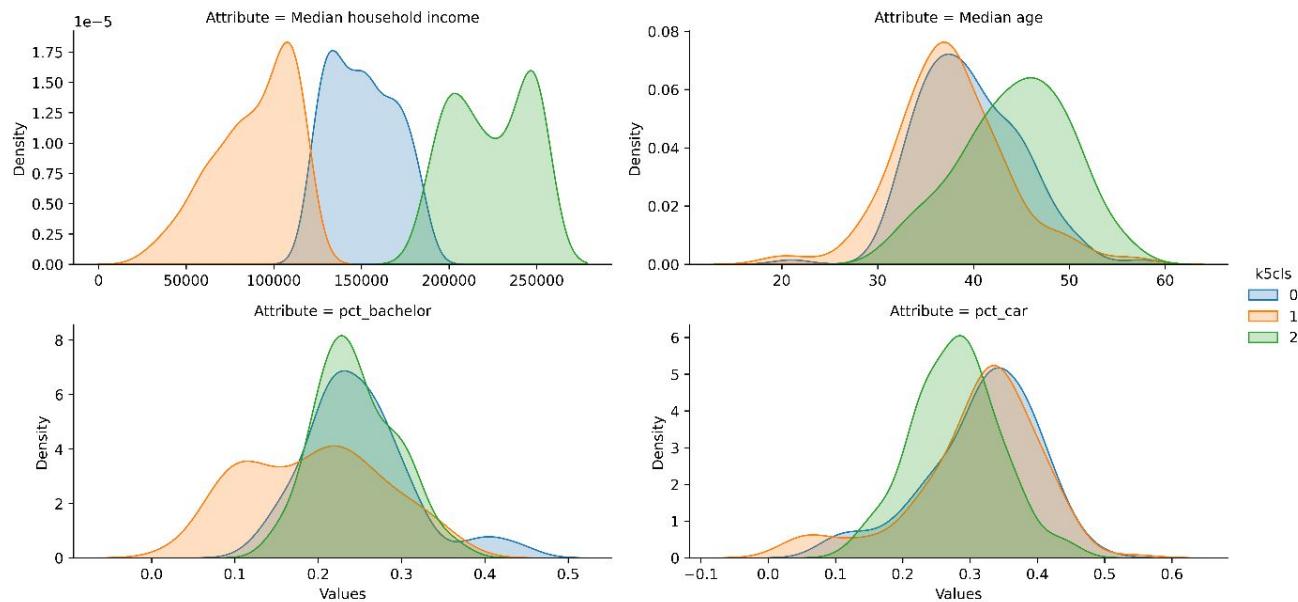
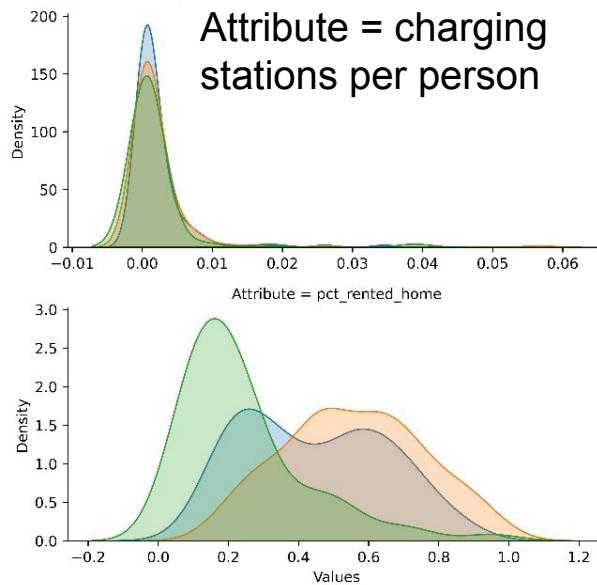
K-means Clustering



K-means clustering map



K-means Clustering

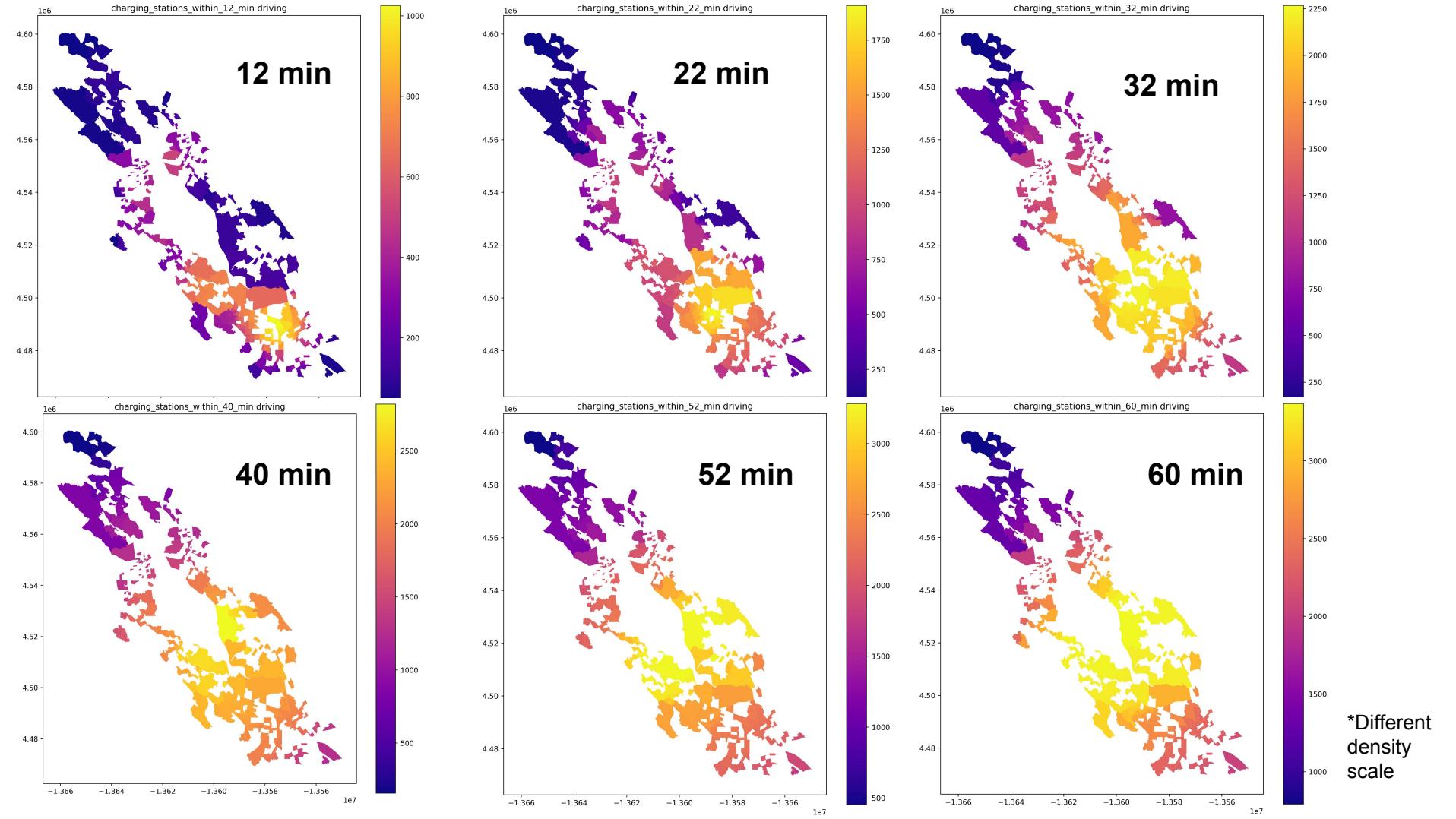


We don't have to charge our EV inside
our community(census tracts)

Consider mobility!

Quantify reachable stations within driving time frame

- Calculate distance from the centroid of each tract to each charging station.
 - Driving speed ~ 40 mph constant (considering the traffic condition and a combination of local streets and highways)
 - People who commute to work by driving cars within various timeframes (0-10 mins, 10-14 mins, ..., 45-59 mins).
 - Estimate #reachable stations on people's way to work.
-
- Overestimation because charging stations from all directions of the centroid of a tract were considered.



Findings:

- Minimal correlations between charging stations and demographics
- Large differences of station count between tracts
- 1 additional minute of driving → 4.8% increase of charging stations

Limitations and Future studies:

- Find suitable indicators for modeling charging station network
- More precise method for estimating reachable stations
- Census tract for SFO should be avoided