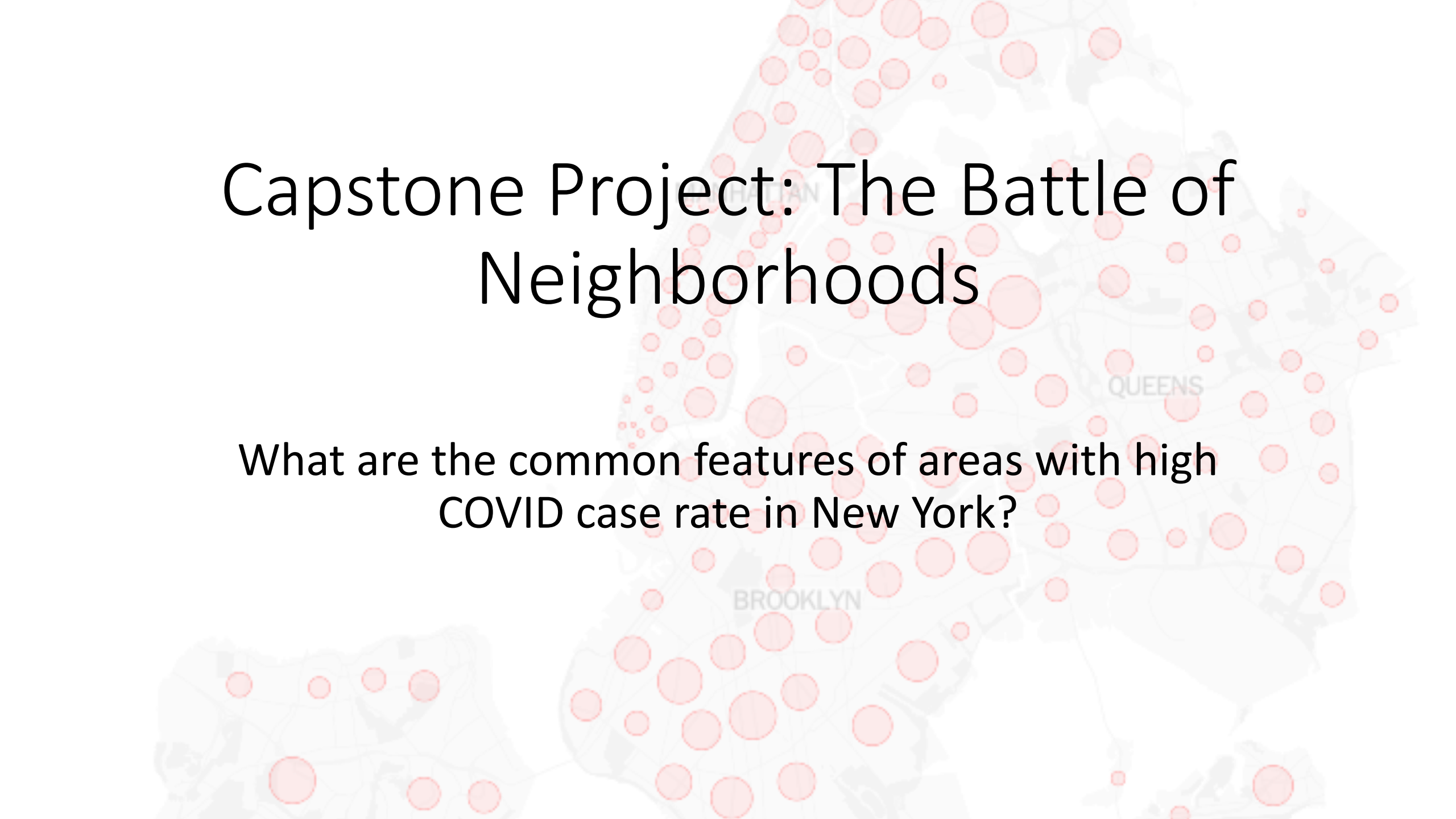


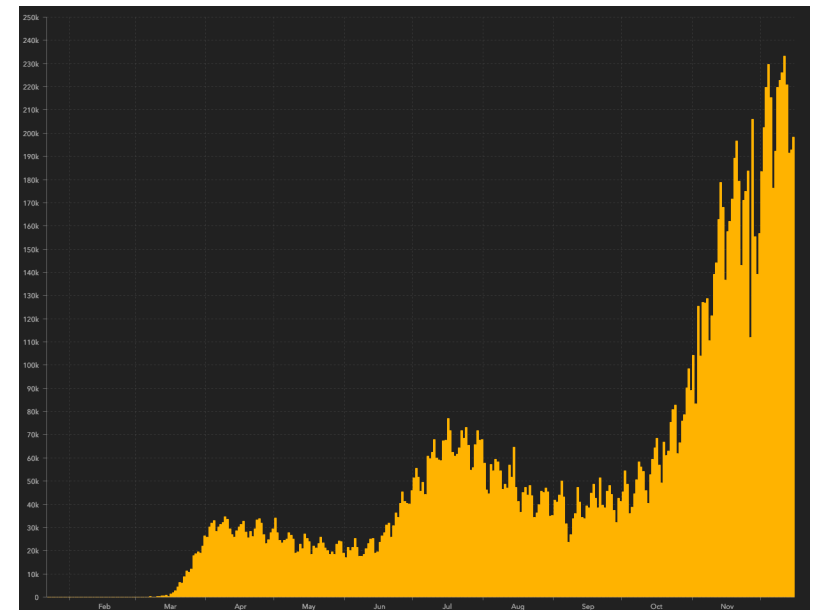
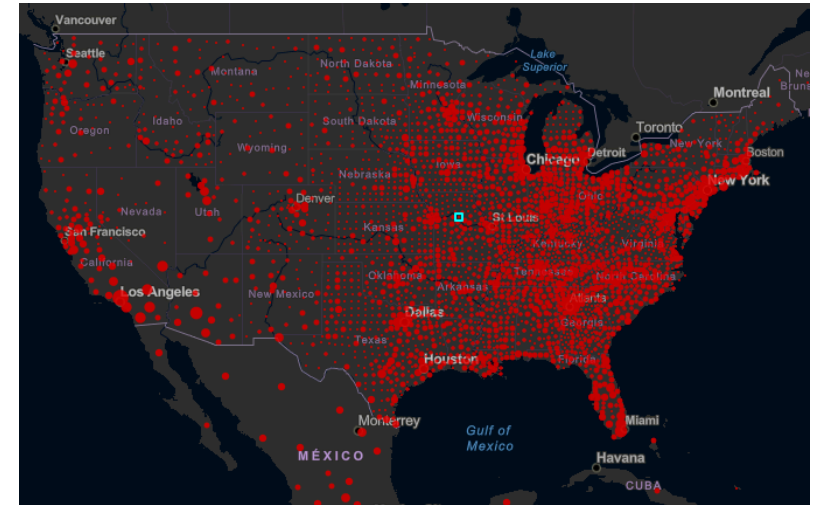
Capstone Project: The Battle of Neighborhoods

A map of New York City is shown in the background, with red circles of varying sizes placed over different neighborhoods. The circles represent COVID-19 case rates, with larger circles indicating higher rates. The map includes labels for 'MANHATTAN', 'QUEENS', and 'BROOKLYN'.

What are the common features of areas with high COVID case rate in New York?

Introduction

- The World Health Organization declared that COVID-19 was a global pandemic
- Widely spread around the world
- US has the highest number of confirmed cases
- During this fall and winter time, situation is getting worse again.



<https://coronavirus.jhu.edu/map.html>

- In this capstone project, I did a tiny study to explore the distribution of COVID cases in New York and tried to understand what were the common features of those neighborhoods with relatively high COVID confirmed cases. With the venues data collected from Foursquare, neighborhoods in New York were clustered into 5 groups. The results showed that 70% of the top 20 areas with the highest confirmed case rate were from the same group. And most venues in these areas with the highest amounts were in food-related categories, such as Pizza Place, Deli/Bodega, Restaurant, Bagel Shop, Ice Cream Shop, Grocery Store, Bakery, and Coffee Shop. The result suggests that we need to take extra caution when we have to visit these kinds of places during the pandemic.

Data

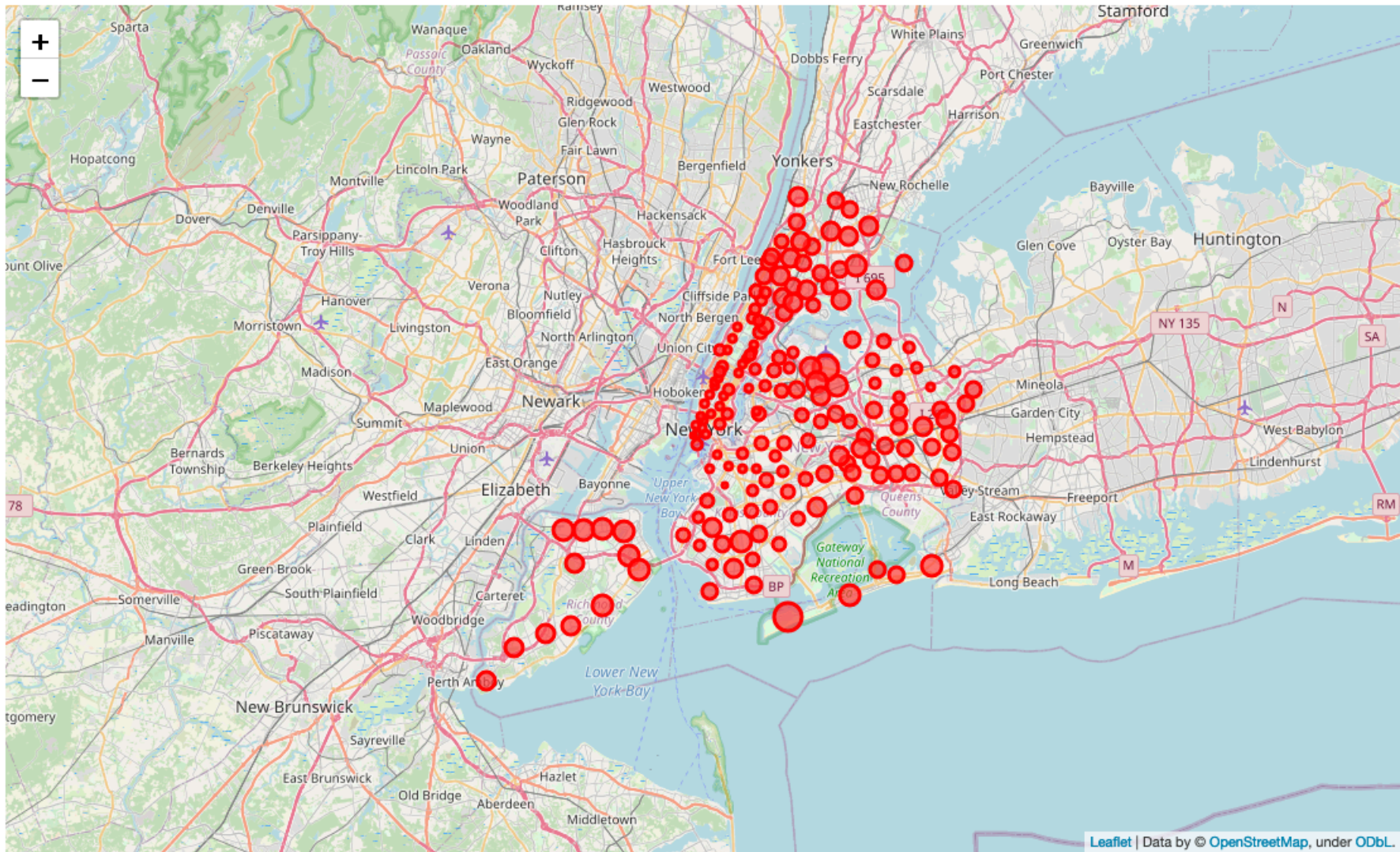
- COVID data
 - The COVID case data of New York come from NYC Health. The data contains cumulative totals since the start of the COVID-19 outbreak in New York City.
 - The data used in this study were grouped by Modified Zip Code Tabulation Areas (MODIFIED_ZCTA).
- Geographical coordinate
 - The latitude and longitude for each MODIFIED_ZCTA are collected from GeoPy using `geocoders.nominatim`.
- Venue dat
 - Venue data are collected from Foursquare. Due to the limitation of requests that can be made, only 100 venues are collected for each MODIFIED_ZCTA with a radius of 1000m.

Data processing

	MODIFIED_ZCTA	NEIGHBORHOOD_NAME	BOROUGH_GROUP	COVID_CASE_COUNT	COVID_CASE_RATE	POP_DENOMINATOR	COVID_DEATH_COUNT	COVID_DEATH_RATE
0	10001	Chelsea/NoMad/West Chelsea	Manhattan	614	2223.58	27613.09	23	83.29
1	10002	Chinatown/Lower East Side	Manhattan	2093	2778.71	75322.71	163	216.40
2	10003	East Village/Gramercy /Greenwich Village	Manhattan	1060	1963.77	53977.81	33	61.14
3	10004	Financial District	Manhattan	93	3129.08	2972.12	1	33.65
4	10005	Financial District	Manhattan	168	1918.42	8757.23	0	0.00
5	10006	Financial District	Manhattan	73	2158.61	3381.80	1	29.57
6	10007	TriBeCa	Manhattan	143	2045.36	6991.45	4	57.21
7	10009	Alphabet City/East Village/Stuyvesant Town-Coo...	Manhattan	1412	2470.64	57151.12	66	115.48
8	10010	Flatiron/Gramercy/Kips Bay	Manhattan	688	2062.78	33353.00	23	68.96
9	10011	Chelsea	Manhattan	1107	2225.31	49745.99	47	94.48

	MODIFIED_ZCTA	NEIGHBORHOOD_NAME	BOROUGH_GROUP	LATITUDE	LONGITUDE	COVID_CASE_RATE
0	10001	Chelsea/NoMad/West Chelsea	Manhattan	40.748418	-73.994114	2223.58
1	10002	Chinatown/Lower East Side	Manhattan	40.717058	-73.989325	2778.71
2	10003	East Village/Gramercy/Greenwich Village	Manhattan	40.731588	-73.988525	1963.77
3	10004	Financial District	Manhattan	40.700769	-74.013464	3129.08
4	10005	Financial District	Manhattan	40.720503	-74.006704	1918.42

Visualization of the COVID data

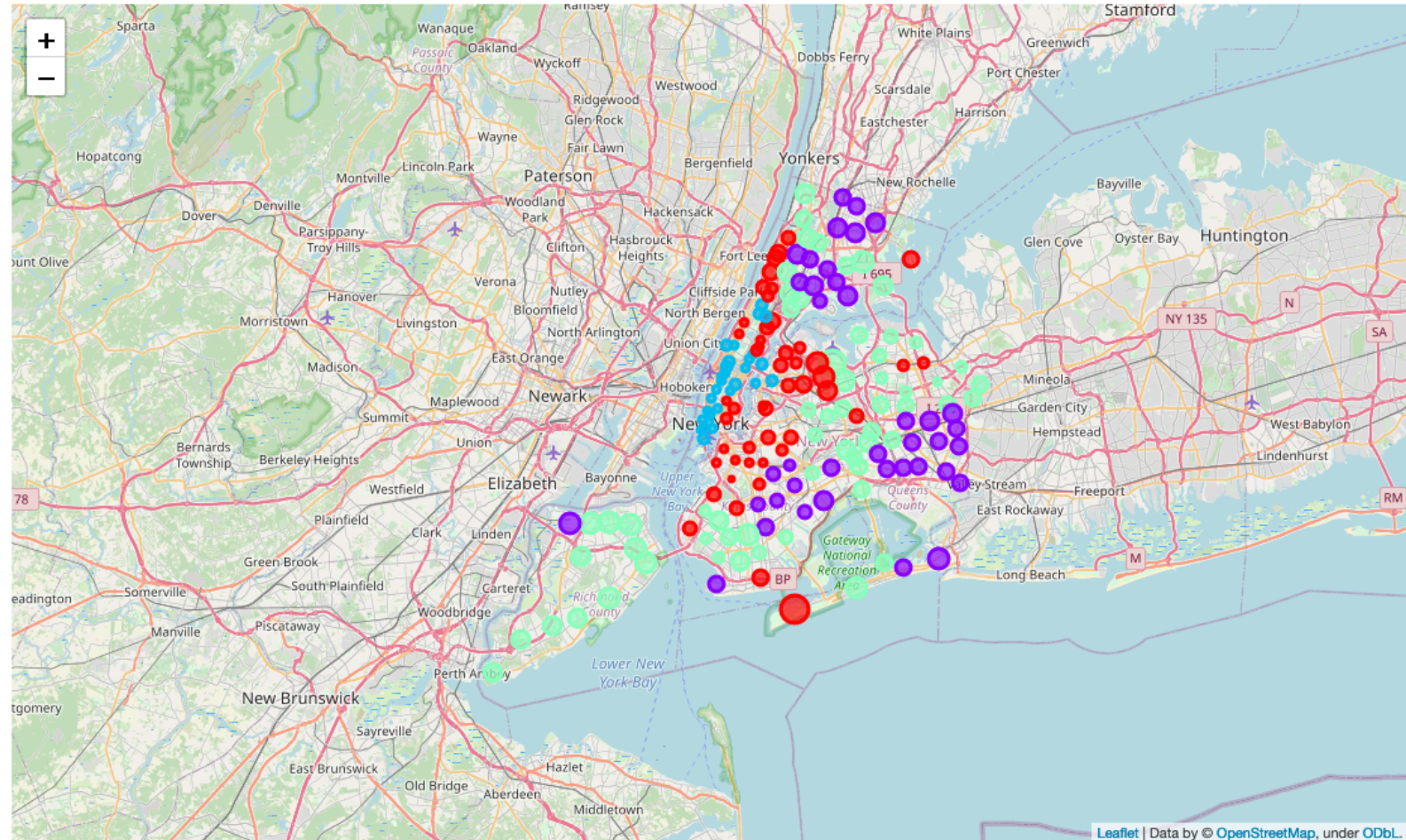


Collect Venue information for each area

- To cluster these 177 neighborhoods, venue information is collected for each MODIFIED_ZCTA from Foursquare.

	MODIFIED_ZCTA	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
0	10001	Hotel	Korean Restaurant	Gym / Fitness Center	Coffee Shop	Italian Restaurant	Theater	Japanese Restaurant	Boxing Gym	Cuban Restaurant	Park
1	10002	Ice Cream Shop	Coffee Shop	French Restaurant	Bakery	Chinese Restaurant	Pizza Place	Bar	Wine Bar	Cocktail Bar	American Restaurant
2	10003	Ice Cream Shop	Coffee Shop	Pizza Place	Wine Shop	Juice Bar	Bar	Bakery	Bagel Shop	Hotel	Chinese Restaurant
3	10004	Coffee Shop	Mexican Restaurant	Bar	Gym	American Restaurant	Hotel	Café	Heliport	Park	Monument / Landmark
4	10005	Café	Clothing Store	Men's Store	Hotel	American Restaurant	Coffee Shop	Sushi Restaurant	Italian Restaurant	Spa	Gym / Fitness Center

Clustering using k-means methods

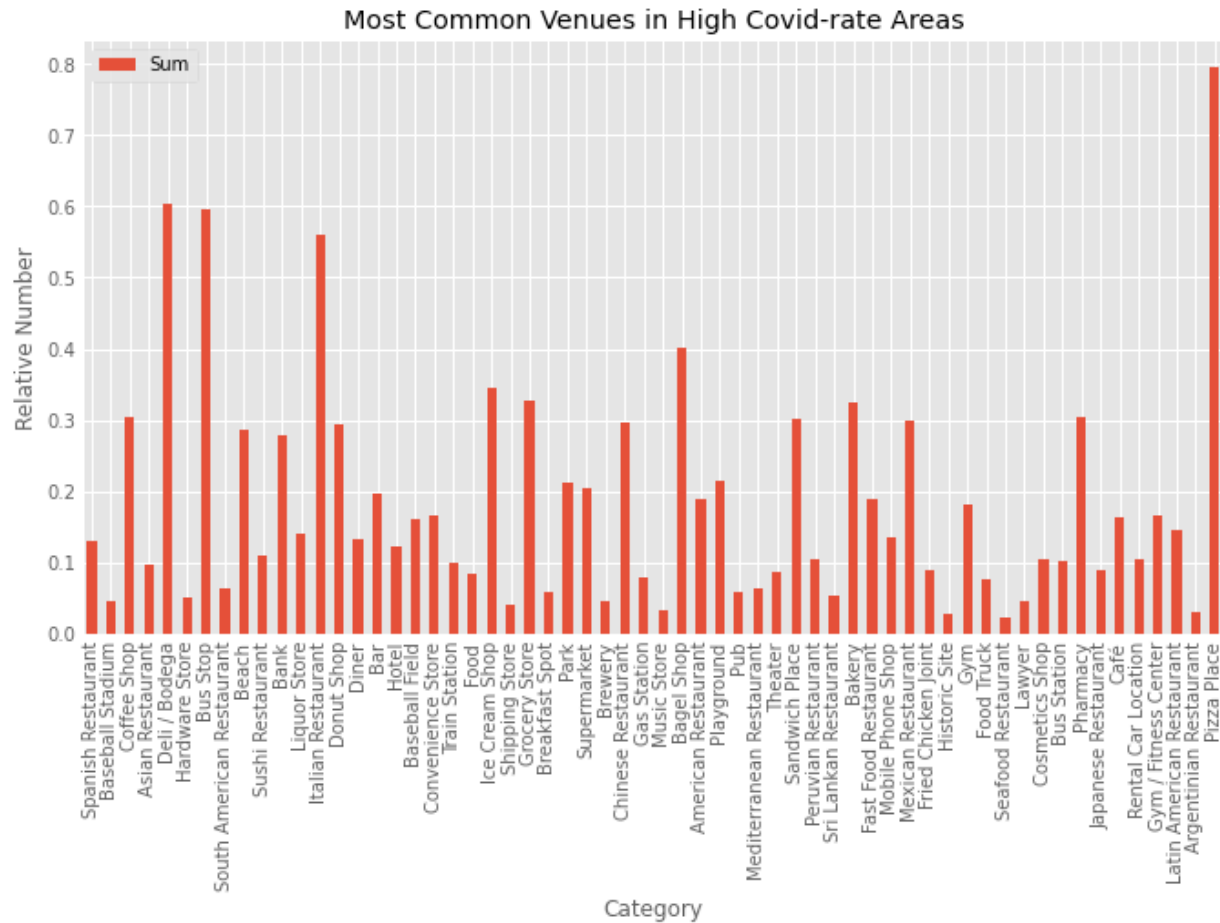


Most common venues in high COVID-rate areas

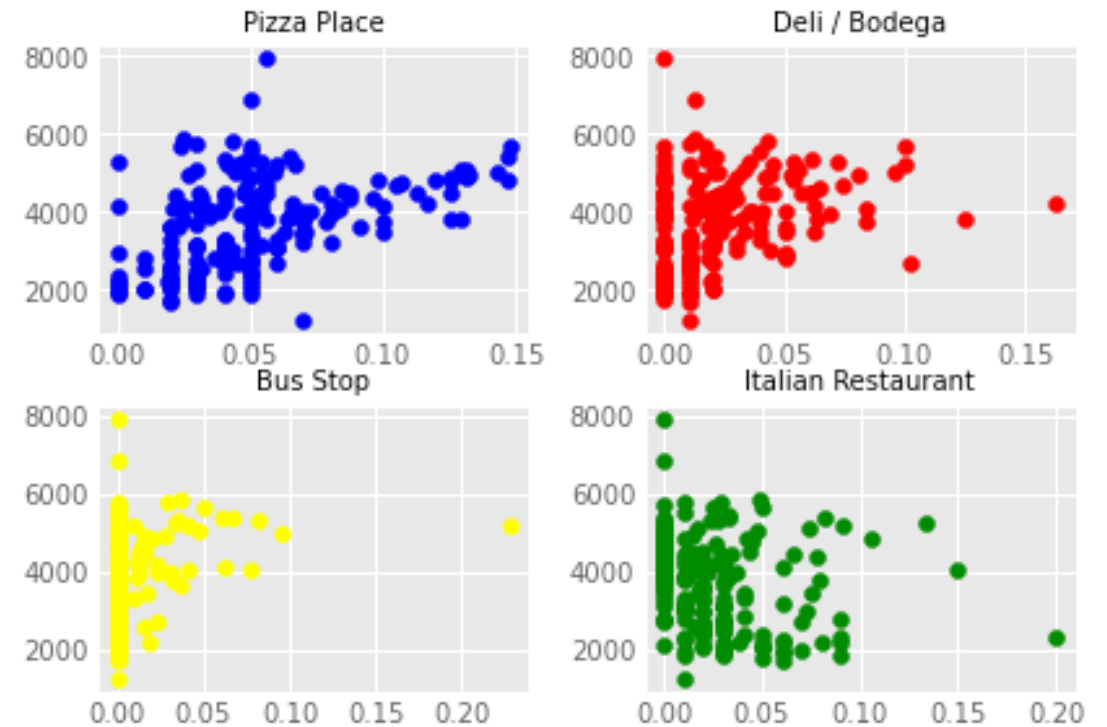
	MODIFIED_ZCTA	NEIGHBORHOOD_NAME	BOROUGH_GROUP	LATITUDE	LONGITUDE	COVID_CASE_RATE	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue
176	11697	Breezy Point	Queens	40.559684	-73.915031	7928.98	0	Bar	Clothing Store	Café
140	11369	Airport/East Elmhurst	Queens	40.762499	-73.872825	6890.14	3	Hotel	Pizza Place	Rental Car Location
49	10306	Lighthouse Hill/Midland Beach/New Dorp/Oakwood	Staten Island	40.569002	-74.116771	5876.14	3	Bank	Mexican Restaurant	Italian Restaurant
45	10302	Elm Park	Staten Island	40.630756	-74.137176	5799.31	3	Chinese Restaurant	Deli / Bodega	Pizza Place
142	11372	Jackson Heights	Queens	40.751377	-73.883138	5777.59	0	Thai Restaurant	Bakery	Mexican Restaurant
116	11230	Midwood	Brooklyn	40.621525	-73.965615	5716.10	3	Pizza Place	Ice Cream Shop	Bagel Shop
47	10304	New Dorp/Todt Hill	Staten Island	40.609770	-74.088140	5674.81	3	Deli / Bodega	Grocery Store	Playground
141	11370	Jackson Heights/Rikers Island	Queens	40.762385	-73.890552	5664.41	0	Bar	Bakery	Latin American Restaurant
139	11368	Corona/North Corona	Queens	40.748072	-73.860616	5554.96	3	Mexican Restaurant	Latin American Restaurant	Pizza Place
66	10461	Morris Park/Pelham Bay/Westchester Square	Bronx	40.845863	-73.841032	5452.38	3	Pizza Place	Sandwich Place	Donut Shop
172	11691	Edgemere/Far Rockaway	Queens	40.601540	-73.757811	5390.67	1	Pizza Place	Beach	Chinese Restaurant
53	10310	Port Richmond/Randall Manor/West Brighton	Staten Island	40.631926	-74.116506	5387.87	3	Bus Stop	Pizza Place	Fast Food Restaurant
48	10305	Arrochar/Midland Beach/Shore Acres/South Beach...	Staten Island	40.598444	-74.076018	5378.45	3	Italian Restaurant	Pharmacy	Deli / Bodega
44	10301	Silver Lake/St. George	Staten Island	40.629516	-74.093853	5318.09	3	Bus Stop	Deli / Bodega	Sri Lankan Restaurant
175	11694	Belle Harbor-Neponsit/Rockaway Park	Queens	40.577426	-73.846705	5303.33	3	Beach	Deli / Bodega	Pizza Place
46	10303	Graniteville/Mariner's Harbor/Port Ivory	Staten Island	40.630273	-74.158773	5295.60	1	Fast Food Restaurant	Discount Store	Spanish Restaurant
50	10307	Tottenville	Staten Island	40.507954	-74.242519	5230.63	3	Italian Restaurant	Deli / Bodega	Grocery Store
55	10314	Bloomfield/Freshkills Park	Staten Island	40.604026	-74.147107	5225.68	3	Bus Stop	Italian Restaurant	Baseball Field
125	11239	East New York	Brooklyn	40.649444	-73.882771	5221.81	1	Department Store	Chinese Restaurant	Pizza Place
73	10468	Fordham/Kingsbridge /University Heights	Bronx	40.865528	-73.900228	5189.47	3	Pizza Place	Spanish Restaurant	Donut Shop

- 70% of the top 20 areas are labeled as cluster 3, which means those areas suffered from high COVID case rates do share some common features.
- Most of these features are related with food.

Most common venues in high COVID-rate areas



Relative Number of Selected Venue vs. COVID Case Rate



Summaries

- most of the MODIFIED_ZCTAs with high COVID case rates are clustered into same groups (Cluster 3)
- 70% of the top 20 most common venues in these 14 areas (cluster 3) are in food-related categories
- Pizza Place, Deli/Bodega, Bus Stop, and Italian Restaurant have much larger relative amount than other categories in these areas.
- that there is a strong positive relationship between Pizza Place and COVID case rate among all 177 areas.

References

- [1] <https://www.who.int/emergencies/diseases/novel-coronavirus-2019>
- [2] <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7205668/>
- [3] <https://www1.nyc.gov/site/doh/covid/covid-19-data.page>
- [4] <https://github.com/nychealth/coronavirus-data>