Comparison between New York City and London Specifically, Manhattan and Westminster

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Capstone_Project

Background

❑ London is comparable to New York City (NYC) with the population of totaling around 8.9 million compared to NYC's 8.4 million.

❑ London area covers around 607 square miles which is about twice as big as NYC's 302.6 square mile area

❑ There are 32 boroughs in London and 5 boroughs in New York

❑ Manhattan of New York City is one of the best areas of New York

❑ Westminster is the best-performing borough in 2019

Business Problem

❑ which is the top 5 most common venues in Manhattan and Westminster?

❑ what is the top 10 venues for each neighborhood in Manhattan and Westminster?

Interest

❑ Solving this problem may help the person who wants to choose to live between Manhattan and

   Westminster in the future by considering the venues around the neighborhoods
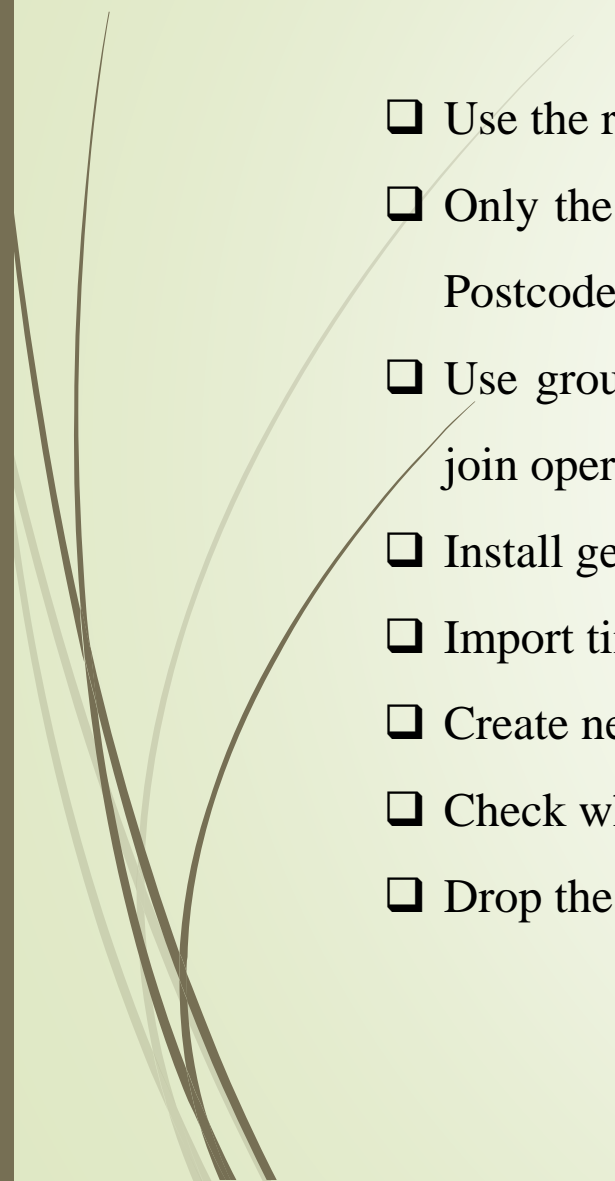
Data sources

❑ The data source from IBM Lab course "Segmenting and Clustering Neighborhoods in New York City"

❑ The Wikipedia data source for London

Data cleaning

❑ Import libraries and download New York City data

❑ Using open function to check NY Jason data, make a new dataframe named "neighborhood" Defining the data frame columns and instantiate the dataframe.

❑ Re-arrange the data frame format like "Borough, Neighborhood, Latitude, Longitude" in order.

❑ Check whether the dataframe has how many boroughs and neighborhoods.

❑ IBM lab course data provided with neighborhoods exist in each borough as well as the latitude and longitude coordinates of each neighborhood.

❑ Web scrapping from the URL using BeautifulSoup for London Data.

❑ Extract Location data, Borough data, Post town data, Post code district data, Dial code data and OS grid ref data from the URL

❑ Use the regex function to remove the brackets and numbers in Borough columns.

❑ Only the Post code district data, Borough data and Location data needed so renamed the columns as Postcode and Neighbourhood

❑ Use groupby operation to arrange the dataframe to the Postcode followed by Borough and apply a join operation of the neighbourhoods with the same Postcode and Borough.

❑ Install geocoder and import it

❑ Import time and use get latlng()arcgis geocoder to get latitude and longitude

❑ Create new dataframe and combine with the result coordinates

❑ Check whether the dataframe has how many boroughs and neighbourhoods

❑ Drop the Postcode column and check whether the dataframe looks like the New York dataframe order

Data selection and Methodology

❑ According to my business problem, I checked the number of boroughs and neighborhoods of New York and Manhattan

❑ Using geolocator to get the coordinates of New York and Manhattan

❑ Creating the maps of them using latitude and longitude values

❑ Using my Foursquare Credentials to create API request URL, make the GET request and return only relevant information for each nearby venue

❑ Creating Manhattan venues group by Neighborhood

❑ Checking the unique categories of Manhattan venues

❑ Using explore function to get each neighborhood along with the top 5 most common venues and top 10 venues

❑ Setting number of clusters and used k-means clustering algorithm

❑ Creating a map using Folium to show clusters

❑ Examining the clusters

❑ Repeating whole process for London and Westminster

Results

❑ From the map of New York, there are 5 boroughs and 306 neighborhoods (**Figure 1**).

❑ I created a map to check the Neighborhoods of Manhattan (**Figure 2**).

❑ I chose Manhattan from New York and checked the Manhattan venues.

The results are;

(1) Marble Hill, (2) Chinatown, (3) Washington Heights,
(4) Inwood, (5) Hamilton Heights, (6) Manhattanville,
(7) Central Harlem, (8) East Harlem, (9) Upper East Side,
(10) Yorkville, (11) Lenox Hill, (12) Roosevelt Island,
(13) Upper West Side, (14) Lincoln Square, (15) Clinton,
(16) Midtown, (17) Murray Hill, (18) Chelsea,
(19) Greenwich Village, (20) East Village, (21) Lower East Side,
(22) Tribeca, (23) Little Italy, (24) Soho,
(25) West Village, (26) Manhattan Valley, (27) Morningside Heights,
(28) Gramercy, (29) Battery Park City, (30) Financial District,
(31) Carnegie Hill, (32) Noho, (33) Civic Center,
(34) Midtown South, (35) Sutton Place, (36) Turtle Bay,
(37) Tudor City, (38) Stuyvesant Town, (39) Flatiron, (40) Hudson Yards

❑ There are 324 unique categories
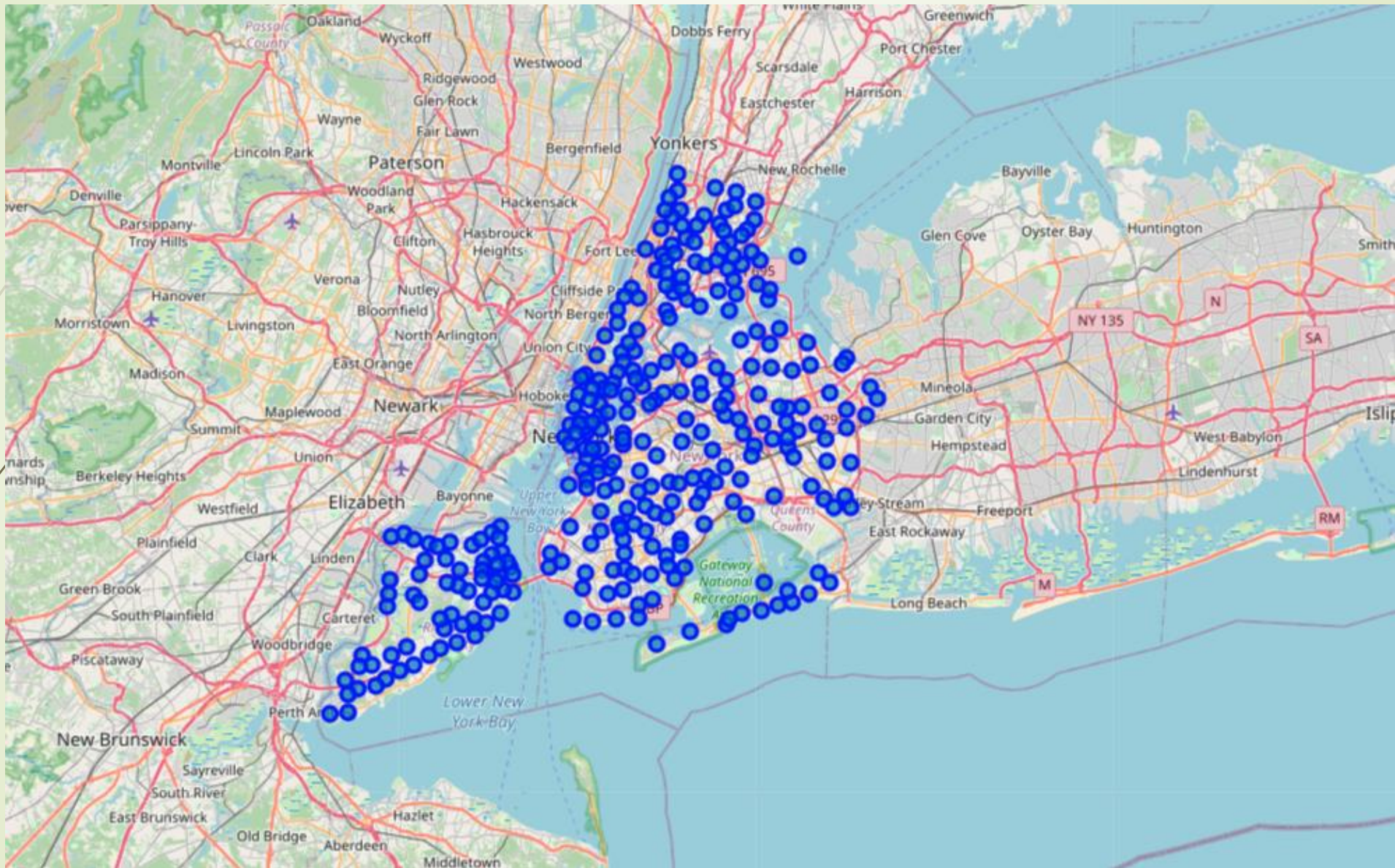
Figure 1. Map of New York showing 5 Boroughs and 306 Neighborhoods
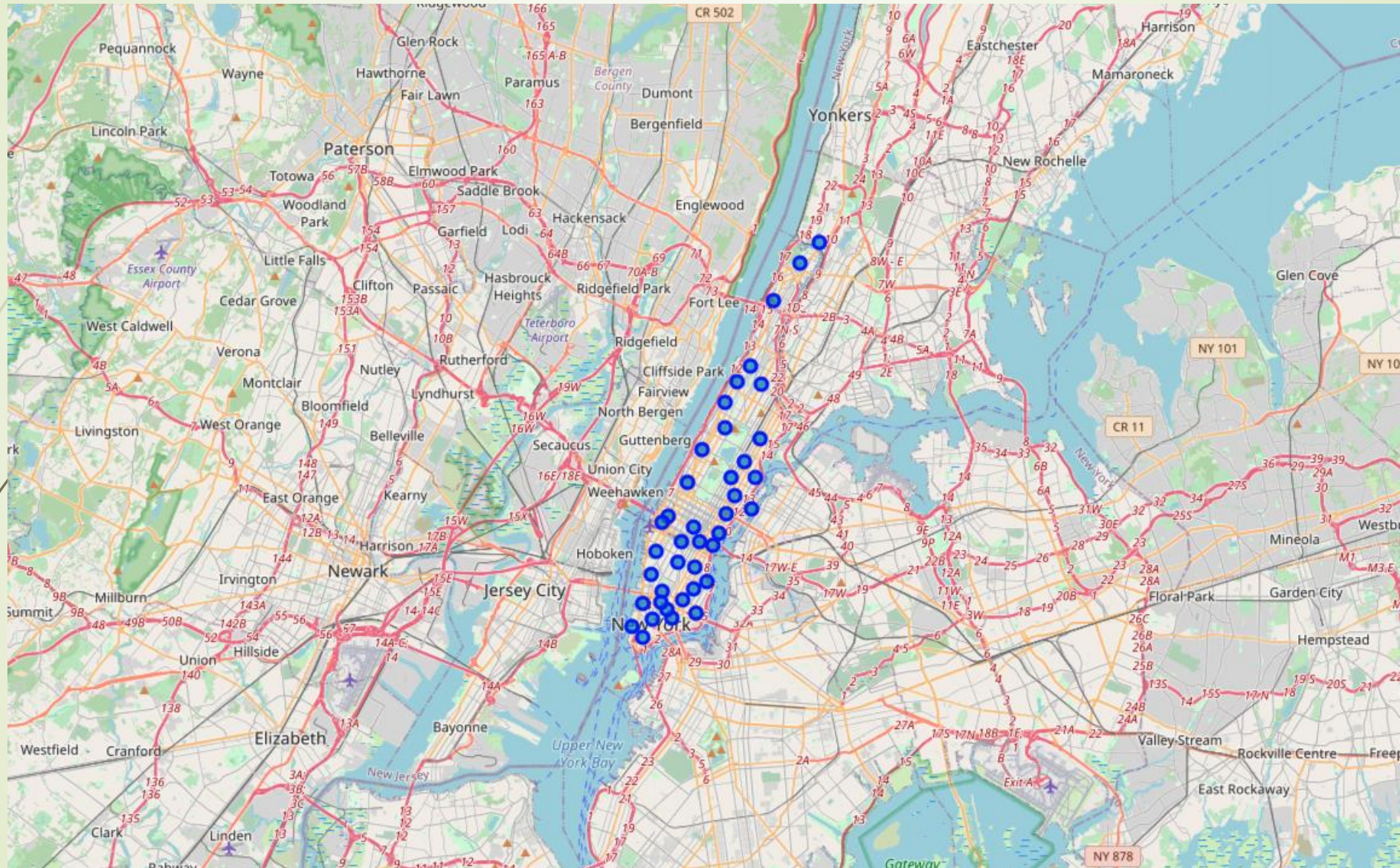
Figure 2. Map of Manhattan showing neighborhoods

❑ From the map of London, there are 63 boroughs and 322 neighborhoods (**Figure 3**)

❑ I created a map to check the Neighborhoods of Westminster (**Figure 4**)

❑ I chose Westminster from London and checked the Westminster venues

The results are;

(1) Lisson Grove, (2) St John's Wood, (3) Belgravia,

(4) Knightsbridge, (5) Millbank, (6) Pimlico,

(7) St James's, (8) Westminster, (9) Chinatown,

(10) Marylebone (also St Marylebone), (11) Mayfair, (12) Soho,

(13) Bayswater, (14) Paddington, (15) Maida Vale,

(16) Little Venice, (17) Aldwych, (18) Charing Cross, (19) Covent Garden

❑ There are 126 unique categories

Figure 3. Map of London showing 63 Boroughs and 306 Neighborhoods

Figure 4. Map of Westminster showing neighborhoods
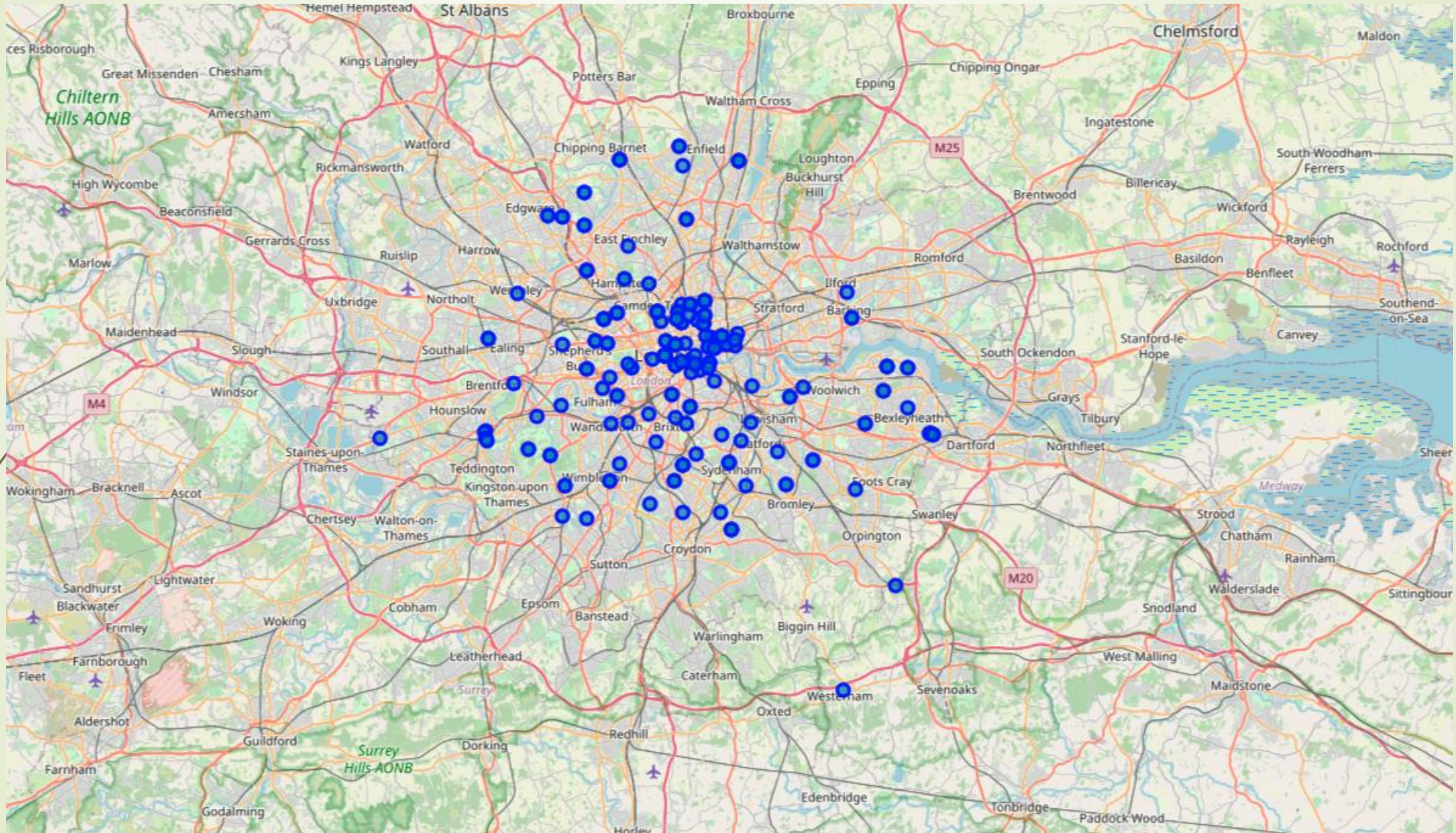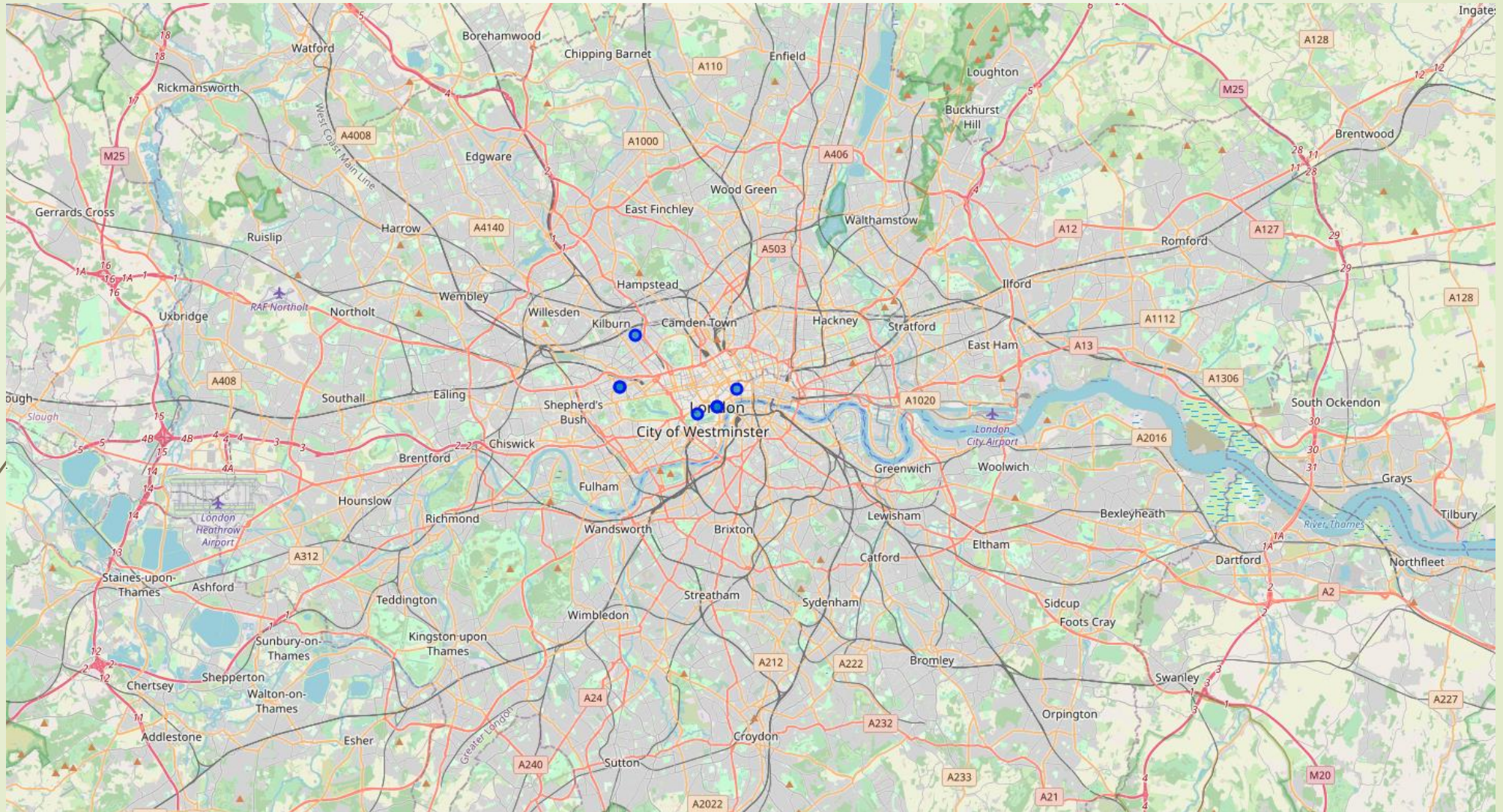
❏ I created tables and checked the neighborhood along with the top 5 most common venues and top 10 venues of Manhattan in addition of adding cluster labels (**Table 1,2**)

	Neighborhood	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	Battery Park City	Park	Hotel	Memorial Site	Gym	Coffee Shop	Boat or Ferry	Sandwich Place	Chinese Restaurant	Gourmet Shop	Pizza Place
1	Carnegie Hill	Coffee Shop	Pizza Place	Wine Shop	Gym	Café	Cosmetics Shop	Bookstore	Japanese Restaurant	Gym / Fitness Center	Bakery
2	Central Harlem	African Restaurant	Fried Chicken Joint	Bar	American Restaurant	Gym / Fitness Center	Sandwich Place	Seafood Restaurant	French Restaurant	Juice Bar	Gym
3	Chelsea	Art Gallery	Bakery	Coffee Shop	French Restaurant	American Restaurant	Ice Cream Shop	Italian Restaurant	Hotel	Cycle Studio	Cupcake Shop
4	Chinatown	Bakery	Chinese Restaurant	Cocktail Bar	Ice Cream Shop	Salon / Barbershop	American Restaurant	Dessert Shop	Optical Shop	Spa	Noodle House

Table 1. Top 10 venues of Manhattan showing along with the neighborhood

	Borough	Neighborhood	Latitude	Longitude	Cluster Labels	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	Manhattan	Marble Hill	40.876551	-73.910660	4	Sandwich Place	Yoga Studio	Clothing Store	Tennis Stadium	Pizza Place	Storage Facility	Miscellaneous Shop	Ice Cream Shop	Coffee Shop	Bank
1	Manhattan	Chinatown	40.715618	-73.994279	1	Bakery	Chinese Restaurant	Cocktail Bar	Ice Cream Shop	Salon / Barbershop	American Restaurant	Dessert Shop	Optical Shop	Spa	Noodle House
2	Manhattan	Washington Heights	40.851903	-73.936900	0	Café	Pizza Place	Grocery Store	Chinese Restaurant	Mobile Phone Shop	Spanish Restaurant	Bank	Bakery	Sandwich Place	Park
3	Manhattan	Inwood	40.867684	-73.921210	2	Café	Mexican Restaurant	Lounge	Deli / Bodega	Pizza Place	Bank	Bakery	Park	Restaurant	Wine Bar
4	Manhattan	Hamilton Heights	40.823604	-73.949688	0	Pizza Place	Sandwich Place	Mexican Restaurant	Café	Juice Bar	Bakery	Latin American Restaurant	Indian Restaurant	Cocktail Bar	Caribbean Restaurant

Table 2. Top 10 venues of Manhattan showing along with neighborhood including cluster labels

❑ I created tables and checked the neighborhood along with the top 5 most common venues and top 10 venues of Westminster in addition of adding cluster labels (**Table 3,4**)

	Neighbourhood	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	Aldwych, Charing Cross, Covent Garden	Pub	Coffee Shop	Sandwich Place	Restaurant	Hotel	French Restaurant	Bar	History Museum	Japanese Restaurant	Grocery Store
1	Bayswater, Paddington	Pub	Café	Persian Restaurant	Hotel	Pizza Place	Indian Restaurant	Coffee Shop	Gym / Fitness Center	Greek Restaurant	Garden
2	Belgravia, Knightsbridge, Millbank, Pimlico, S...	Lounge	Hotel	French Restaurant	Palace	Tea Room	Seafood Restaurant	Men's Store	Park	Cocktail Bar	Clothing Store
3	Chinatown, Marylebone (also St Marylebone), Ma...	Theater	Plaza	Hotel	Bakery	Chinese Restaurant	Sandwich Place	Cocktail Bar	Garden	Japanese Restaurant	Ice Cream Shop
4	Lisson Grove, St John's Wood	Café	Thai Restaurant	Pizza Place	Caucasian Restaurant	Garden	Middle Eastern Restaurant	Yoga Studio	Pub	Deli / Bodega	Persian Restaurant

Table 3. Top 10 venues of Westminster showing along with the neighborhood

	Borough	Neighbourhood	Latitude	Longitude	Cluster Labels	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	Westminster	Lisson Grove, St John's Wood	51.537125	-0.181958	0	Café	Thai Restaurant	Pizza Place	Caucasian Restaurant	Garden	Middle Eastern Restaurant	Yoga Studio	Pub	Deli / Bodega	Persian Restaurant
1	Westminster	Belgravia, Knightsbridge, Millbank, Pimlico, S...	51.504456	-0.140785	4	Lounge	Hotel	French Restaurant	Palace	Tea Room	Seafood Restaurant	Men's Store	Park	Cocktail Bar	Clothing Store
2	Westminster	Chinatown, Marylebone (also St Marylebone), Ma...	51.507408	-0.127699	1	Theater	Plaza	Hotel	Bakery	Chinese Restaurant	Sandwich Place	Cocktail Bar	Garden	Japanese Restaurant	Ice Cream Shop
3	Westminster	Bayswater, Paddington	51.515390	-0.192100	2	Pub	Café	Persian Restaurant	Hotel	Pizza Place	Indian Restaurant	Coffee Shop	Gym / Fitness Center	Greek Restaurant	Garden
4	Westminster	Maida Vale	51.507408	-0.127699	1	Theater	Plaza	Hotel	Bakery	Chinese Restaurant	Sandwich Place	Cocktail Bar	Garden	Japanese Restaurant	Ice Cream Shop

Table 4. Top 10 venues of Westminster showing along with neighborhood including cluster labels

❑ To Examine each cluster and determine the discriminating venue categories that distinguish each cluster, I made 5 clusters for Manhattan (**Table 5-9**) and 5 clusters of Westminster (**Table 10-14**)

	Neighborhood	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
2	Washington Heights	Café	Pizza Place	Grocery Store	Chinese Restaurant	Mobile Phone Shop	Spanish Restaurant	Bank	Bakery	Sandwich Place	Park
4	Hamilton Heights	Pizza Place	Sandwich Place	Mexican Restaurant	Café	Juice Bar	Bakery	Latin American Restaurant	Indian Restaurant	Cocktail Bar	Caribbean Restaurant
7	East Harlem	Bakery	Mexican Restaurant	Pizza Place	Bank	Deli / Bodega	Sandwich Place	Steakhouse	New American Restaurant	Thai Restaurant	French Restaurant
20	Lower East Side	Chinese Restaurant	Bakery	Art Gallery	Sandwich Place	Pizza Place	Pharmacy	Café	Latin American Restaurant	Cocktail Bar	Dance Studio

Table 5. Cluster 1 of Manhattan

	Neighborhood	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
1	Chinatown	Bakery	Chinese Restaurant	Cocktail Bar	Ice Cream Shop	Salon / Barbershop	American Restaurant	Dessert Shop	Optical Shop	Spa	Noodle House
8	Upper East Side	Italian Restaurant	Exhibit	Bakery	Spa	Juice Bar	Wine Shop	Hotel	Coffee Shop	Yoga Studio	American Restaurant
9	Yorkville	Italian Restaurant	Coffee Shop	Sushi Restaurant	Japanese Restaurant	Gym	Deli / Bodega	Bar	Diner	Wine Shop	Spa
10	Lenox Hill	Italian Restaurant	Café	Pizza Place	Sushi Restaurant	Bank	Gym	Cocktail Bar	Coffee Shop	Deli / Bodega	Gym / Fitness Center
12	Upper West Side	Italian Restaurant	Bakery	Coffee Shop	Wine Bar	Café	American Restaurant	Cosmetics Shop	Vegetarian / Vegan Restaurant	Mediterranean Restaurant	Middle Eastern Restaurant
13	Lincoln Square	Concert Hall	Café	Plaza	Theater	Performing Arts Venue	Bakery	Gym / Fitness Center	Indie Movie Theater	Clothing Store	Hotel
14	Clinton	Coffee Shop	Theater	Sandwich Place	American Restaurant	Italian Restaurant	Gym / Fitness Center	Gym	Spa	Steakhouse	Cocktail Bar
15	Midtown	Hotel	Clothing Store	Coffee Shop	Theater	Spa	Bakery	Sushi Restaurant	Bookstore	Food Truck	Cuban Restaurant
16	Murray Hill	Coffee Shop	Japanese Restaurant	Hotel	Gym / Fitness Center	Taco Place	American Restaurant	Pizza Place	Sandwich Place	Spa	Sushi Restaurant
17	Chelsea	Art Gallery	Bakery	Coffee Shop	French Restaurant	American Restaurant	Ice Cream Shop	Italian Restaurant	Hotel	Cycle Studio	Cupcake Shop
18	Greenwich Village	Italian Restaurant	Clothing Store	Dessert Shop	Sushi Restaurant	Indian Restaurant	Coffee Shop	Café	Seafood Restaurant	Gym	Boutique
19	East Village	Bar	Wine Bar	Vegetarian / Vegan Restaurant	Juice Bar	Ice Cream Shop	Pizza Place	Coffee Shop	Mexican Restaurant	Vietnamese Restaurant	Korean Restaurant
21	Tribeca	Spa	Italian Restaurant	Park	Café	Scenic Lookout	Cocktail Bar	Greek Restaurant	Basketball Court	Hotel	Steakhouse
22	Little Italy	Bakery	Italian Restaurant	Café	Tea Room	Hotel	Coffee Shop	Pizza Place	Spa	Salon / Barbershop	Ice Cream Shop
23	Soho	Clothing Store	Italian Restaurant	Shoe Store	Bakery	Women's Store	Boutique	Café	Dessert Shop	Mediterranean Restaurant	Coffee Shop
24	West Village	Italian Restaurant	Cocktail Bar	New American Restaurant	Park	Wine Bar	Seafood Restaurant	Coffee Shop	Jazz Club	American Restaurant	Food & Drink Shop
25	Manhattan Valley	Yoga Studio	Playground	Mexican Restaurant	Indian Restaurant	Coffee Shop	Bar	Vietnamese Restaurant	Pizza Place	Café	Sushi Restaurant
27	Gramercy	Pizza Place	Sandwich Place	Coffee Shop	Italian Restaurant	Diner	Park	Bagel Shop	Ice Cream Shop	Mexican Restaurant	Spa
29	Financial District	Coffee Shop	Pizza Place	Gym / Fitness Center	Cocktail Bar	American Restaurant	Steakhouse	Café	Falafel Restaurant	Plaza	Wine Shop
30	Carnegie Hill	Coffee Shop	Pizza Place	Wine Shop	Gym	Café	Cosmetics Shop	Bookstore	Japanese Restaurant	Gym / Fitness Center	Bakery
31	Noho	Cocktail Bar	Italian Restaurant	Pizza Place	Grocery Store	Mexican Restaurant	Bookstore	Coffee Shop	Hotel	Sushi Restaurant	Japanese Restaurant
32	Civic Center	Coffee Shop	Spa	Gym / Fitness Center	Cocktail Bar	French Restaurant	Hotel	Yoga Studio	Italian Restaurant	Falafel Restaurant	Gym
33	Midtown South	Korean Restaurant	Hotel	Bakery	Hotel Bar	Gym / Fitness Center	Café	Japanese Restaurant	Dessert Shop	Coffee Shop	Cosmetics Shop
34	Sutton Place	Italian Restaurant	Gym	Steakhouse	Spa	Mexican Restaurant	Pizza Place	Hotel	Park	Gym / Fitness Center	Juice Bar
38	Flatiron	Italian Restaurant	American Restaurant	Spa	Japanese Restaurant	New American Restaurant	Gym / Fitness Center	Wine Shop	Coffee Shop	Yoga Studio	Dessert Shop

Table 6. Cluster 2 of Manhattan

	Neighborhood	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
3	Inwood	Café	Mexican Restaurant	Lounge	Deli / Bodega	Pizza Place	Bank	Bakery	Park	Restaurant	Wine Bar
5	Manhattanville	Bank	Deli / Bodega	Chinese Restaurant	Coffee Shop	Italian Restaurant	Mexican Restaurant	Shipping Store	Indian Restaurant	Ice Cream Shop	Climbing Gym
6	Central Harlem	African Restaurant	Fried Chicken Joint	Bar	American Restaurant	Gym / Fitness Center	Sandwich Place	Seafood Restaurant	French Restaurant	Juice Bar	Gym
11	Roosevelt Island	Deli / Bodega	Park	Coffee Shop	Restaurant	Café	Outdoors & Recreation	Bus Line	Gym	Gym / Fitness Center	Bubble Tea Shop
26	Morningside Heights	Bookstore	Café	Sandwich Place	Deli / Bodega	American Restaurant	Park	Coffee Shop	Burger Joint	Bubble Tea Shop	Pharmacy
28	Battery Park City	Park	Hotel	Memorial Site	Gym	Coffee Shop	Boat or Ferry	Sandwich Place	Chinese Restaurant	Gourmet Shop	Pizza Place
35	Turtle Bay	Italian Restaurant	Park	Steakhouse	Deli / Bodega	Sushi Restaurant	Coffee Shop	French Restaurant	Seafood Restaurant	Turkish Restaurant	Sandwich Place
36	Tudor City	Park	Café	Deli / Bodega	Mexican Restaurant	Bank	Greek Restaurant	Gym / Fitness Center	Sushi Restaurant	Pizza Place	Thai Restaurant
39	Hudson Yards	Gym / Fitness Center	American Restaurant	Park	Restaurant	Gym	Coffee Shop	Hotel	Burger Joint	Italian Restaurant	Bus Line

Table 7. Cluster 3 of Manhattan

	Neighborhood	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
37	Stuyvesant Town	Boat or Ferry	Park	Yoga Studio	Pet Service	Bar	Coffee Shop	Bistro	Cocktail Bar	Farmers Market	Heliport

Table 8. Cluster 4 of Manhattan

	Neighborhood	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	Marble Hill	Sandwich Place	Yoga Studio	Clothing Store	Tennis Stadium	Pizza Place	Storage Facility	Miscellaneous Shop	Ice Cream Shop	Coffee Shop	Bank

Table 9. Cluster 5 of Manhattan

	Neighbourhood	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	Lisson Grove, St John's Wood	Café	Thai Restaurant	Pizza Place	Caucasian Restaurant	Garden	Middle Eastern Restaurant	Yoga Studio	Pub	Deli / Bodega	Persian Restaurant

Table 10. Cluster 1 of Westminster

	Neighbourhood	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
2	Chinatown, Marylebone (also St Marylebone), Ma...	Theater	Plaza	Hotel	Bakery	Chinese Restaurant	Sandwich Place	Cocktail Bar	Garden	Japanese Restaurant	Ice Cream Shop
4	Maida Vale	Theater	Plaza	Hotel	Bakery	Chinese Restaurant	Sandwich Place	Cocktail Bar	Garden	Japanese Restaurant	Ice Cream Shop

Table 11. Cluster 2 of Westminster

	Neighbourhood	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
3	Bayswater, Paddington	Pub	Café	Persian Restaurant	Hotel	Pizza Place	Indian Restaurant	Coffee Shop	Gym / Fitness Center	Greek Restaurant	Garden
5	Little Venice	Pub	Café	Persian Restaurant	Hotel	Pizza Place	Indian Restaurant	Coffee Shop	Gym / Fitness Center	Greek Restaurant	Garden

Table 12. Cluster 3 of Westminster

	Neighbourhood	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
6	Aldwych, Charing Cross, Covent Garden	Pub	Coffee Shop	Sandwich Place	Restaurant	Hotel	French Restaurant	Bar	History Museum	Japanese Restaurant	Grocery Store

Table 13. Cluster 4 of Westminster

	Neighbourhood	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
1	Belgravia, Knightsbridge, Millbank, Pimlico, S...	Lounge	Hotel	French Restaurant	Palace	Tea Room	Seafood Restaurant	Men's Store	Park	Cocktail Bar	Clothing Store

Table 14. Cluster 5 of Westminster

Conclusion

❑ Based on my results, top 10 venues for each neighborhood in Manhattan has a lot of difference than Westminster
❑ The number of unique categories of Manhattan is higher than Westminster
❑ The person can choose a lot more choices in Manhattan than Westminster

Future Directions

❑ From this calculation and data, the person can consider not only living but also opening a business depending on the unique categories of which he or she wants to live in corresponding neighborhood
❑ To open business in Westminster or Manhattan City, this geographical dataset can provide as the tips to consider