

# Capstone Project

## The Battle of Neighborhoods

### **New York City versus Toronto as location for a future Headquarter**

### (Week 2)

### Final Report

#### **1. Introduction**

The “business problem” to be solved by this project and who may be interested

#### **2. Data / Methodology**

Describe Data requirements and Sources needed to solve the problem

#### **3. Analysis / Results**

Discussion of the results and finding of answer

#### **4. Discussion / Conclusion**

Answer chosen and conclusions

## 1. Introduction/Business Problem

*“For most businesses, the issue of location choice now is driven by labor: Will we be able to attract the white collar skills we need?”*

*– Peter Cappell*

As mentioned by Peter Cappell, to get the best and most appropriate associates is one of the most important business factors for companies, not only for Amazon. They want a labor force that is young and educated – which generally means millennials.

But what do millennials want? They want everything!

- They want a city with all the cultural amenities – theaters, museums, fairs, concerts, live music, all forms of entertainment.
- They do not want to be in the middle of nowhere; they do not like suburbs or exurbs.
- They want a lot of bars and restaurants so they can have fun in addition to work.

Companies know that and pay a lot of attention to that, so cities that have those features have a huge advantage.

In our case a new and emerging company needs to decide on the location of its future headquarter - Toronto, Canada or New York City, US.

Therefore, differences of neighborhoods between the two Cities are required and explored in this project. What and how many venues are there in the different neighborhoods and how are they clustered.

## 2. Data - A description of the data and how it will be used to solve the problem

a) Data used for the project are as following:

- New York City dataset:  
[https://geo.nyu.edu/catalog/nyu\\_2451\\_34572](https://geo.nyu.edu/catalog/nyu_2451_34572)
- New York City latitude and longitude:  
Geolibrary
- Toronto Dataset (Toronto's zip codes, boroughs and neighborhood names):  
[https://en.wikipedia.org/wiki/List\\_of\\_postal\\_codes\\_of\\_Canada:\\_M](https://en.wikipedia.org/wiki/List_of_postal_codes_of_Canada:_M).
- Toronto latitude and longitude information:  
[http://cocl.us/Geospatial\\_data](http://cocl.us/Geospatial_data)
- Explore neighborhoods in Toronto and New York City:  
Foursquare API

b) The following tools were used:

- Pandas: Data Analysis
- NumPy: Data handling (vectors)
- JSON: Handling of JSON files
- Geopy: Retrieving location data
- Matplotlib: Data Visualization/Plotting
- Sklearn: Machine Learning; k-Mean calculation
- Folium: Map Rendering

c) Methodology used:

1. Data download
2. Data transformation
3. Adding latitude/longitude
4. Segmentation and Explore specific neighborhoods
5. Data analyzing
6. Clustering using k-means

### 3. Analysis & Results

As stated in the first section of this report, our main goal is to create a reliable profile of the neighborhoods in New York City with focus on Manhattan and Toronto. Afterwards compare those profiles and decide which City would be more attractive for millennials to work and live in based on available number and type of venues, like bars, restaurants, museums, dancing studios ...

The Analysis section is divided by city.

#### 3.1. Analysis of New York City

##### 3.1.1 New York City neighborhoods

New York City has 5 boroughs and 306 neighborhoods.

```
print('The dataframe has {} boroughs and {} neighborhoods.'.format(
    len(neighborhoods['Borough'].unique()),
    neighborhood.shape[0]
))
```

The dataframe has 5 boroughs and 306 neighborhoods.

As companies would like to set their headquarter in the center of the city we will focus in the next steps on Manhattan only.

##### 3.1.2 Manhattan Neighborhoods and venues

As a result of the queries we got

- Manhattan has 40 different Neighborhoods (see list below)
- There are 3197 individual venues in those neighborhoods
- Those venues can be grouped in 334 unique categories

---

Marble Hill  
Chinatown  
Washington Heights  
Inwood  
Hamilton Heights  
Manhattanville  
Central Harlem  
East Harlem  
Upper East Side  
Yorkville  
Lenox Hill  
Roosevelt Island  
Upper West Side  
Lincoln Square  
Clinton  
Midtown  
Murray Hill  
Chelsea  
Greenwich Village  
East Village  
Lower East Side  
Tribeca  
Little Italy  
Soho  
West Village  
Manhattan Valley  
Morningside Heights  
Gramercy  
Battery Park City  
Financial District  
Carnegie Hill  
Noho  
Civic Center  
Midtown South  
Sutton Place  
Turtle Bay  
Tudor City  
Stuyvesant Town  
Flatiron  
Hudson Yards

```
print(manhattan_venues.shape)  
manhattan_venues.head()
```

```
(3197, 7)
```

```
print('There are {} unique categories.'.format(len(manhattan_venues['Venue Category'].unique())))
```

```
There are 334 unique categories.
```

```
▶ manhattan_grouped.shape
```

```
t[31]: (40, 335)
```

### 3.1.3 Manhattan Top Venues

From Foursquare we retrieved the top 10 venues for each of the 40 neighborhoods:

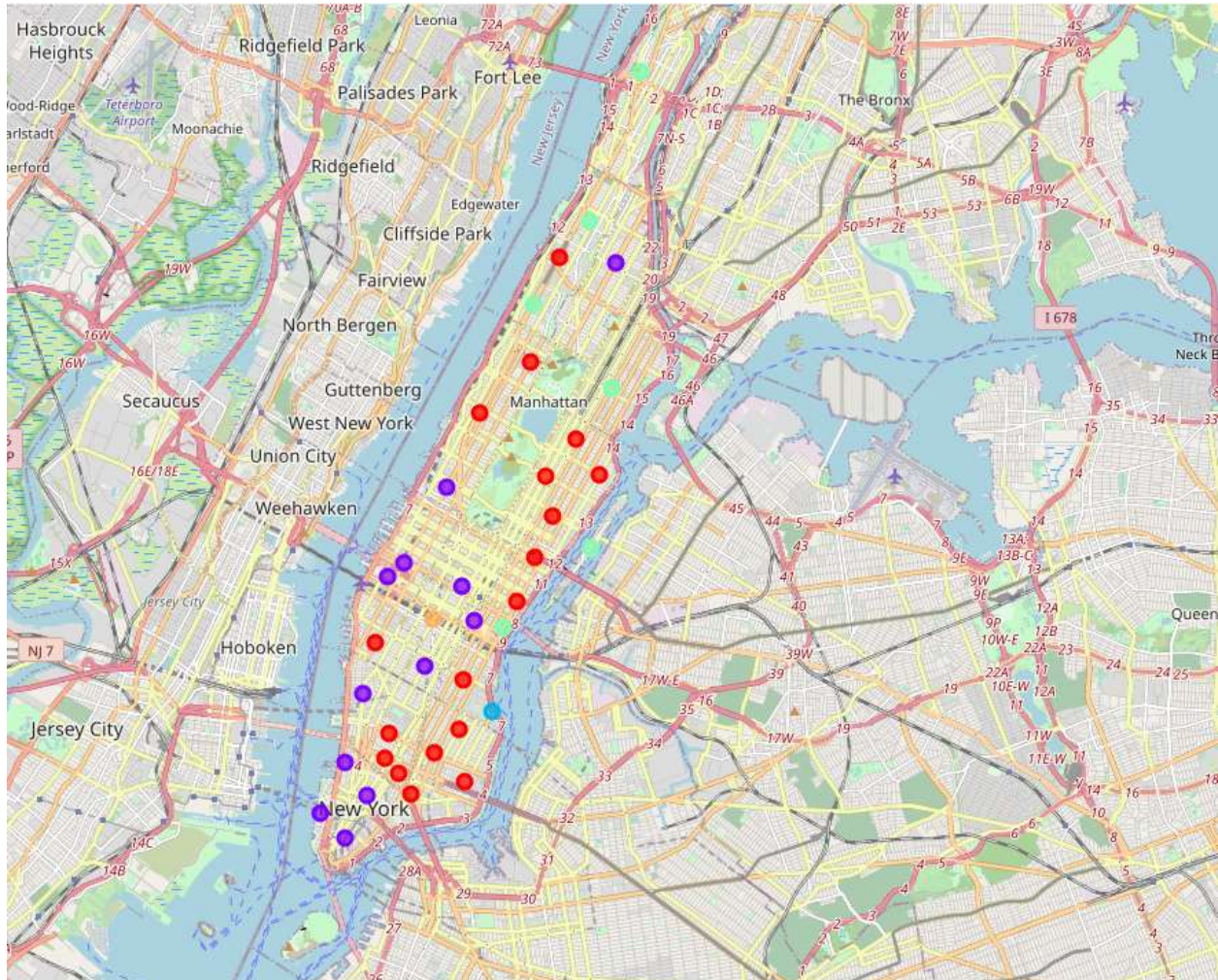
	Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
0	Battery Park City	Coffee Shop	Hotel	Park	Clothing Store	Gym	Memorial Site	Plaza	Gourmet Shop	Shopping Mall	Playground
1	Carnegie Hill	Coffee Shop	Café	Yoga Studio	French Restaurant	Pizza Place	Cosmetics Shop	Bookstore	Bar	Wine Shop	Gym / Fitness Center
2	Central Harlem	African Restaurant	French Restaurant	Bar	American Restaurant	Chinese Restaurant	Art Gallery	Cosmetics Shop	Seafood Restaurant	Library	Bookstore
3	Chelsea	Coffee Shop	Art Gallery	Bakery	French Restaurant	American Restaurant	Wine Shop	Ice Cream Shop	Café	Park	Market
4	Chinatown	Bakery	Chinese Restaurant	Cocktail Bar	Spa	Ice Cream Shop	American Restaurant	Optical Shop	Vietnamese Restaurant	Salon / Barbershop	Dessert Shop
5	Civic Center	Coffee Shop	Cocktail Bar	Spa	Gym / Fitness Center	French Restaurant	Hotel	Park	Sushi Restaurant	Men's Store	Korean Restaurant
6	Clinton	Gym / Fitness Center	Theater	Italian Restaurant	Cocktail Bar	Coffee Shop	Gym	American Restaurant	Sandwich Place	Spa	Hotel
7	East Harlem	Mexican Restaurant	Deli / Bodega	Bakery	Thai Restaurant	Latin American Restaurant	Sandwich Place	Spa	French Restaurant	Spanish Restaurant	Liquor Store
8	East Village	Bar	Mexican Restaurant	Pizza Place	Vietnamese Restaurant	Korean Restaurant	Coffee Shop	Vegetarian / Vegan Restaurant	Salon / Barbershop	Cocktail Bar	Wine Bar
9	Financial District	Coffee Shop	Pizza Place	Italian Restaurant	Café	Gym	Mexican Restaurant	Park	Cocktail Bar	Hotel	Bar
10	Flatiron	Italian Restaurant	Japanese Restaurant	American Restaurant	Wine Shop	Coffee Shop	New American Restaurant	Furniture / Home Store	Gym / Fitness Center	Mediterranean Restaurant	Mexican Restaurant
11	Gramercy	Bar	Bagel Shop	Pizza Place	American Restaurant	Coffee Shop	Cocktail Bar	Mexican Restaurant	Italian Restaurant	Playground	Wine Shop
12	Greenwich Village	Italian Restaurant	Sushi Restaurant	Café	Clothing Store	American Restaurant	Dessert Shop	Boutique	Gym	Gourmet Shop	French Restaurant
13	Hamilton Heights	Pizza Place	Coffee Shop	Café	Mexican Restaurant	Deli / Bodega	Yoga Studio	Latin American Restaurant	Liquor Store	Sushi Restaurant	Park
14	Hudson Yards	Gym / Fitness Center	American Restaurant	Café	Italian Restaurant	Hotel	Park	Gym	Dog Run	Bar	Coffee Shop
15	Inwood	Lounge	Mexican Restaurant	Restaurant	Café	Wine Bar	Pizza Place	Park	Bakery	Chinese Restaurant	Spanish Restaurant
16	Lenox Hill	Sushi Restaurant	Italian Restaurant	Pizza Place	Coffee Shop	Cocktail Bar	Café	Gym / Fitness Center	Gym	Burger Joint	Mexican Restaurant
17	Lincoln Square	Plaza	Café	Theater	Concert Hall	Performing Arts Venue	Wine Shop	French Restaurant	Bakery	Indie Movie Theater	Gym / Fitness Center
18	Little Italy	Café	Bakery	Italian Restaurant	Cocktail Bar	Chinese Restaurant	Coffee Shop	Clothing Store	Bubble Tea Shop	Mediterranean Restaurant	Salon / Barbershop
19	Lower East Side	Chinese Restaurant	Art Gallery	Café	Bakery	Park	Coffee Shop	Japanese Restaurant	Yoga Studio	Cocktail Bar	Bubble Tea Shop
20	Manhattan Valley	Coffee Shop	Bar	Yoga Studio	Mexican Restaurant	Thai Restaurant	Indian Restaurant	French Restaurant	Pizza Place	Clothing Store	Hill
21	Manhattanville	Coffee Shop	Italian Restaurant	Mexican Restaurant	Chinese Restaurant	Seafood Restaurant	Cuban Restaurant	Boutique	Supermarket	Burger Joint	Spanish Restaurant
22	Marble Hill	Gym	Sandwich Place	Coffee Shop	Discount Store	Yoga Studio	Diner	Seafood Restaurant	Tennis Stadium	Supplement Shop	Donut Shop
23	Midtown	Hotel	Clothing Store	Theater	Sporting Goods Shop	Coffee Shop	Café	Bookstore	Bakery	Steakhouse	Turkish Restaurant
24	Midtown South	Korean Restaurant	Hotel	American Restaurant	Japanese Restaurant	Coffee Shop	Gym / Fitness Center	Burger Joint	Dessert Shop	Gym	Gastropub
25	Morningside Heights	Park	Bookstore	American Restaurant	Coffee Shop	Burger Joint	Deli / Bodega	Café	Farmers Market	Mediterranean Restaurant	Supermarket
26	Murray Hill	Coffee Shop	Sandwich Place	Bar	Japanese Restaurant	Burger Joint	Pizza Place	Hotel	Gym / Fitness Center	American Restaurant	Steakhouse
27	Noho	Italian Restaurant	Coffee Shop	Pizza Place	Cocktail Bar	Bookstore	French Restaurant	Grocery Store	Mexican Restaurant	Yoga Studio	Wine Bar
28	Roosevelt Island	Park	Greek Restaurant	Coffee Shop	Sandwich Place	Gym / Fitness Center	Gym	Food & Drink Shop	Liquor Store	Bubble Tea Shop	Dry Cleaner
29	Soho	Clothing Store	Italian Restaurant	Coffee Shop	Boutique	Salon / Barbershop	Sporting Goods Shop	Women's Store	Bakery	Mediterranean Restaurant	Furniture / Home Store
30	Stuyvesant Town	Boat or Ferry	Park	Bar	Coffee Shop	Baseball Field	Harbor / Marina	Fountain	Cocktail Bar	Heliport	Skating Rink
31	Sutton Place	Italian Restaurant	Pizza Place	Gym / Fitness Center	Park	Coffee Shop	Bagel Shop	Gym	Furniture / Home Store	Burger Joint	Bakery
32	Tribeca	Italian Restaurant	Park	American Restaurant	Wine Bar	Men's Store	Bakery	Coffee Shop	Café	Spa	Gym / Fitness Center
33	Tudor City	Park	Café	Greek Restaurant	Sushi Restaurant	Deli / Bodega	Mexican Restaurant	Coffee Shop	Dog Run	Diner	Gym
34	Turtle Bay	Italian Restaurant	Coffee Shop	Sushi Restaurant	Park	Deli / Bodega	Seafood Restaurant	Japanese Restaurant	Ramen Restaurant	Pharmacy	Turkish Restaurant
35	Upper East Side	Italian Restaurant	Exhibit	Coffee Shop	Bakery	American Restaurant	Gym / Fitness Center	Spa	French Restaurant	Hotel	Juice Bar
36	Upper West Side	Italian Restaurant	Bar	Wine Bar	Bakery	Indian Restaurant	Café	Coffee Shop	Dessert Shop	French Restaurant	Gym / Fitness Center
37	Washington Heights	Café	Bakery	Bank	Grocery Store	Mobile Phone Shop	Latin American Restaurant	Chinese Restaurant	New American Restaurant	Park	Gym
38	West Village	Italian Restaurant	Cocktail Bar	American Restaurant	New American Restaurant	Park	Wine Bar	Cosmetics Shop	Jazz Club	Coffee Shop	Theater
39	Yorkville	Italian Restaurant	Gym	Coffee Shop	Bar	Deli / Bodega	Wine Shop	Diner	Sushi Restaurant	Japanese Restaurant	Bagel Shop



### 3.1.4 Cluster of Manhattan Neighborhoods

All 40 neighborhoods were clustered using k\_mean methodology into 5 clusters.

Those 5 clusters of neighborhoods are represented by 5 different colors in the map below.



All 5 clusters are listed below with included Neighborhoods and top 10 venues

# Cluster 1 with 18 Neighborhoods

Cluster 1

manhattan\_merged.loc[manhattan\_merged['Cluster\_Labels'] == 0, manhattan\_merged.columns[[1] + list(range(5, manhattan\_merged.shape[1]))]]

10]:

	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	Spa	Ice Cream Shop	American Restaurant	Optical Shop	Vietnamese Restaurant	Salon / Barbershop	Dessert Shop
5	Manhattanville	Coffee Shop	Italian Restaurant	Mexican Restaurant	Chinese Restaurant	Seafood Restaurant	Cuban Restaurant	Boutique	Supermarket	Burger Joint	Spanish Restaurant
8	Upper East Side	Italian Restaurant	Exhibit	Coffee Shop	Bakery	American Restaurant	Gym / Fitness Center	Spa	French Restaurant	Hotel	Juice Bar
9	Yorkville	Italian Restaurant	Gym	Coffee Shop	Bar	Deli / Bodega	Wine Shop	Diner	Sushi Restaurant	Japanese Restaurant	Bagel Shop
10	Lenox Hill	Sushi Restaurant	Italian Restaurant	Pizza Place	Coffee Shop	Cocktail Bar	Café	Gym / Fitness Center	Gym	Burger Joint	Mexican Restaurant
12	Upper West Side	Italian Restaurant	Bar	Wine Bar	Bakery	Indian Restaurant	Café	Coffee Shop	Dessert Shop	French Restaurant	Gym / Fitness Center
17	Chelsea	Coffee Shop	Art Gallery	Bakery	French Restaurant	American Restaurant	Wine Shop	Ice Cream Shop	Café	Park	Market
18	Greenwich Village	Italian Restaurant	Sushi Restaurant	Café	Clothing Store	American Restaurant	Dessert Shop	Boutique	Gym	Gourmet Shop	French Restaurant
19	East Village	Bar	Mexican Restaurant	Pizza Place	Vietnamese Restaurant	Korean Restaurant	Coffee Shop	Vegetarian / Vegan Restaurant	Salon / Barbershop	Cocktail Bar	Wine Bar
20	Lower East Side	Chinese Restaurant	Art Gallery	Café	Bakery	Park	Coffee Shop	Japanese Restaurant	Yoga Studio	Cocktail Bar	Bubble Tea Shop
21	Little Italy	Café	Bakery	Italian Restaurant	Cocktail Bar	Chinese Restaurant	Coffee Shop	Clothing Store	Bubble Tea Shop	Mediterranean Restaurant	Salon / Barbershop
23	Soho	Clothing Store	Italian Restaurant	Coffee Shop	Boutique	Salon / Barbershop	Sporting Goods Shop	Women's Store	Bakery	Mediterranean Restaurant	Furniture / Home Store
25	Manhattan Valley	Coffee Shop	Bar	Yoga Studio	Mexican Restaurant	Thai Restaurant	Indian Restaurant	French Restaurant	Pizza Place	Clothing Store	Hill
27	Gramercy	Bar	Bagel Shop	Pizza Place	American Restaurant	Coffee Shop	Cocktail Bar	Mexican Restaurant	Italian Restaurant	Playground	Wine Shop
30	Carnegie Hill	Coffee Shop	Café	Yoga Studio	French Restaurant	Pizza Place	Cosmetics Shop	Bookstore	Bar	Wine Shop	Gym / Fitness Center
31	Noho	Italian Restaurant	Coffee Shop	Pizza Place	Cocktail Bar	Bookstore	French Restaurant	Grocery Store	Mexican Restaurant	Yoga Studio	Wine Bar
34	Sutton Place	Italian Restaurant	Pizza Place	Gym / Fitness Center	Park	Coffee Shop	Bagel Shop	Gym	Furniture / Home Store	Burger Joint	Bakery
35	Turtle Bay	Italian Restaurant	Coffee Shop	Sushi Restaurant	Park	Deli / Bodega	Seafood Restaurant	Japanese Restaurant	Ramen Restaurant	Pharmacy	Turkish Restaurant

# Cluster 2 with 10 Neighborhoods

Cluster 2

manhattan\_merged.loc[manhattan\_merged['Cluster\_Labels'] == 1, manhattan\_merged.columns[[1] + list(range(5, manhattan\_merged.shape[1]))]]

145]:

	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	Gym	Sandwich Place	Coffee Shop	Discount Store	Yoga Studio	Diner	Seafood Restaurant	Tennis Stadium	Supplement Shop	Donut Shop
6	Central Harlem	African Restaurant	French Restaurant	Bar	American Restaurant	Chinese Restaurant	Art Gallery	Cosmetics Shop	Seafood Restaurant	Library	Bookstore
13	Lincoln Square	Pizza	Café	Theater	Concert Hall	Performing Arts Venue	Wine Shop	French Restaurant	Bakery	Indie Movie Theater	Gym / Fitness Center
14	Clinton	Gym / Fitness Center	Theater	Italian Restaurant	Cocktail Bar	Coffee Shop	Gym	American Restaurant	Sandwich Place	Spa	Hotel
15	Midtown	Hotel	Clothing Store	Theater	Sporting Goods Shop	Coffee Shop	Café	Bookstore	Bakery	Steakhouse	Turkish Restaurant
16	Murray Hill	Coffee Shop	Sandwich Place	Bar	Japanese Restaurant	Burger Joint	Pizza Place	Hotel	Gym / Fitness Center	American Restaurant	Steakhouse
21	Tribeca	Italian Restaurant	Park	American Restaurant	Wine Bar	Men's Store	Bakery	Coffee Shop	Café	Spa	Gym / Fitness Center
24	West Village	Italian Restaurant	Cocktail Bar	American Restaurant	New American Restaurant	Park	Wine Bar	Cosmetics Shop	Jazz Club	Coffee Shop	Theater
28	Battery Park City	Coffee Shop	Hotel	Park	Clothing Store	Gym	Memorial Site	Pizza	Gourmet Shop	Shopping Mall	Playground
29	Financial District	Coffee Shop	Pizza Place	Italian Restaurant	Café	Gym	Mexican Restaurant	Park	Cocktail Bar	Hotel	Bar

# Cluster 3 with 1 Neighborhoods

Cluster 3

manhattan\_merged.loc[manhattan\_merged['Cluster\_Labels'] == 2, manhattan\_merged.columns[[1] + list(range(5, manhattan\_merged.shape[1]))]]

6]:

	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	Bar	Coffee Shop	Baseball Field	Harbor / Marina	Fountain	Cocktail Bar	Heliprot	Skating Rink

# Cluster 4 with 7 Neighborhoods

Cluster 4

manhattan\_merged.loc[manhattan\_merged['Cluster\_Labels'] == 3, manhattan\_merged.columns[[1] + list(range(5, manhattan\_merged.shape[1]))]]

17]:

	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	Bakery	Bank	Grocery Store	Mobile Phone Shop	Latin American Restaurant	Chinese Restaurant	New American Restaurant	Park	Gym
3	Inwood	Lounge	Mexican Restaurant	Restaurant	Café	Wine Bar	Pizza Place	Park	Bakery	Chinese Restaurant	Spanish Restaurant
4	Hamilton Heights	Pizza Place	Coffee Shop	Café	Mexican Restaurant	Deli / Bodega	Yoga Studio	Latin American Restaurant	Liquor Store	Sushi Restaurant	Park
7	East Harlem	Mexican Restaurant	Deli / Bodega	Bakery	Thai Restaurant	Latin American Restaurant	Sandwich Place	Spa	French Restaurant	Spanish Restaurant	Liquor Store
11	Roosevelt Island	Park	Greek Restaurant	Coffee Shop	Sandwich Place	Gym / Fitness Center	Gym	Food & Drink Shop	Liquor Store	Bubble Tea Shop	Dry Cleaner
26	Morningside Heights	Park	Bookstore	American Restaurant	Coffee Shop	Burger Joint	Deli / Bodega	Café	Farmers Market	Mediterranean Restaurant	Supermarket
36	Tudor City	Park	Café	Greek Restaurant	Sushi Restaurant	Deli / Bodega	Mexican Restaurant	Coffee Shop	Dog Run	Diner	Gym

# Cluster 5 with 1 Neighborhood

Cluster 5

manhattan\_merged.loc[manhattan\_merged['Cluster\_Labels'] == 4, manhattan\_merged.columns[[1] + list(range(5, manhattan\_merged.shape[1]))]]

18]:

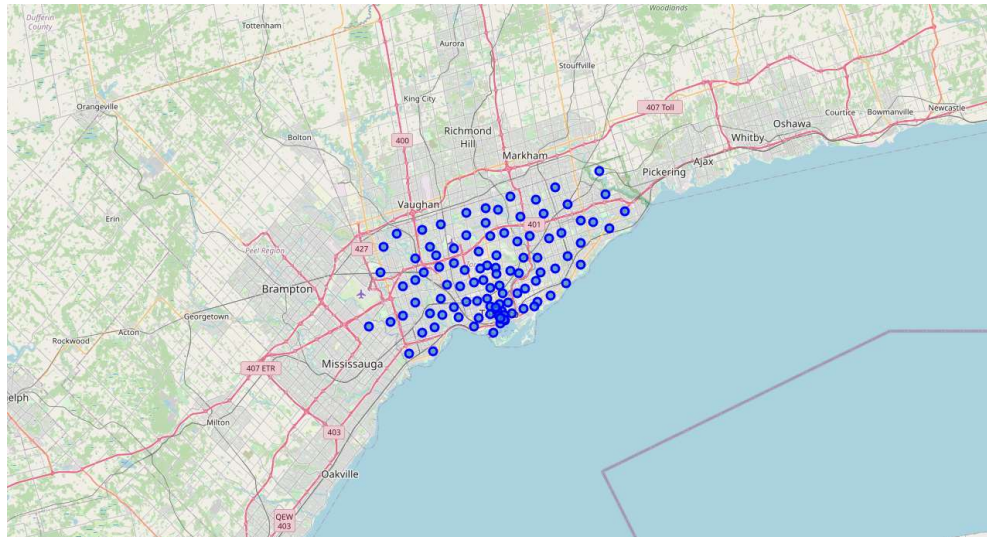
	Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
33	Midtown South	Korean Restaurant	Hotel	American Restaurant	Japanese Restaurant	Coffee Shop	Gym / Fitness Center	Burger Joint	Dessert Shop	Gym	Gastropub



### 3.2. Analysis of Toronto

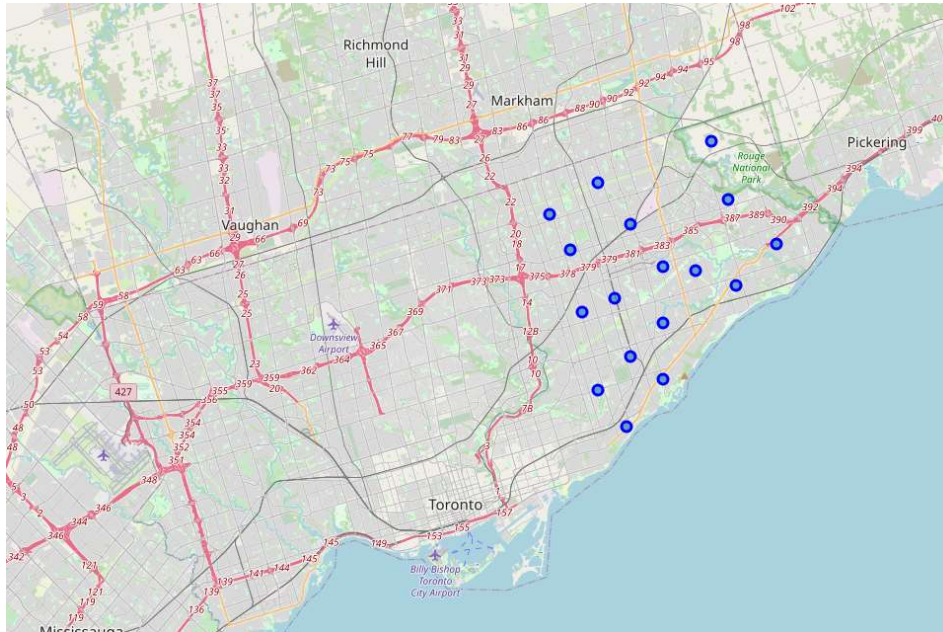
From Wikipedia page it was retrieved there are 103 different postal codes in Toronto.

For each postal code, the corresponding neighborhoods were mapped and are shown on the map below.



### 3.2.1 Toronto / Scarborough Neighborhoods

Due to the large dataset, we focus in the next steps on one of the most important boroughs, Scarborough. After retrieving the latitude and longitude of the neighborhoods of Scarborough, the 17 Neighborhoods are plotted below.



Rouge, Malvern  
Highland Creek, Rouge Hill, Port Union  
Guildwood, Morningside, West Hill  
Woburn  
Cedarbrae  
Scarborough Village  
East Birchmount Park, Ionview, Kennedy Park  
Clairlea, Golden Mile, Oakridge  
Cliffcrest, Cliffside, Scarborough Village West  
Birch Cliff, Cliffside West  
Dorset Park, Scarborough Town Centre, Wexford Heights  
Maryvale, Wexford  
Agincourt  
Clarks Corners, Sullivan, Tam O'Shanter  
Agincourt North, L'Amoreaux East, Milliken, Steeles East  
L'Amoreaux West  
Upper Rouge

### 3.2.2 Venues for each Neighborhoods in Scarborough

Using Foursquare the top 100 venues with a radius of 500m were downloaded.

There venues were in 53 unique categories like American Restaurant, Asian Restaurant, bakery, bar, Bank, Bus stop, shopping Mall, Rental Car and many more.

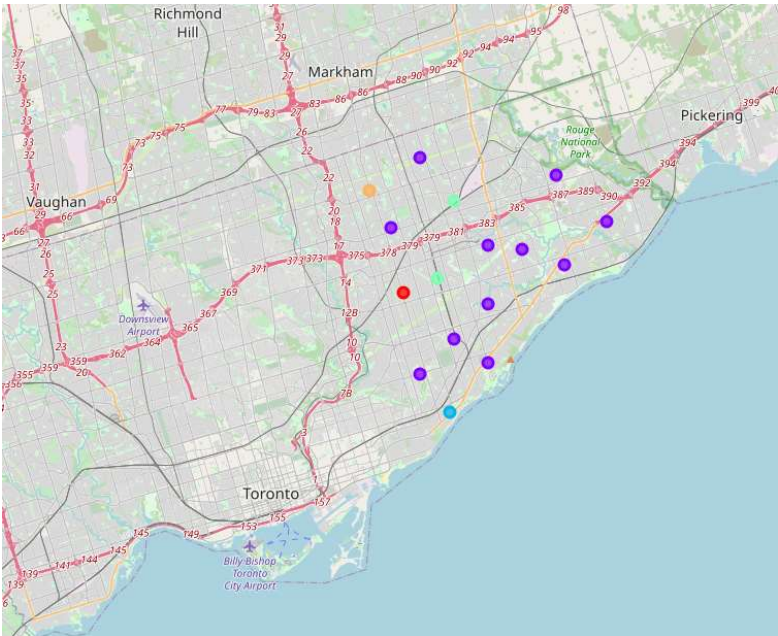
In a next step the top 10 venues per Neighborhood were listed, see below:

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	Scarborough	Malvern, Rouge	43.806686 -79.194353	1	Fast Food Restaurant	Vietnamese Restaurant	Coffee Shop	Hobby Shop	Haikka Restaurant	General Entertainment	Gas Station	Furniture / Home Store	Fried Chicken Joint	Electronics Store
1	Scarborough	Rouge Hill, Port Union, Highland Creek	43.784535 -79.160497	1	Bar	Vietnamese Restaurant	Coffee Shop	Hobby Shop	Haikka Restaurant	General Entertainment	Gas Station	Furniture / Home Store	Fried Chicken Joint	Fast Food Restaurant
2	Scarborough	Guildwood, Morningside, West Hill	43.763573 -79.188711	1	Rental Car Location	Restaurant	Medical Center	Electronics Store	Breakfast Spot	Mexican Restaurant	Bank	Intersection	Fried Chicken Joint	College Stadium
3	Scarborough	Woburn	43.770992 -79.216917	1	Coffee Shop	Korean BBQ Restaurant	Vietnamese Restaurant	Haikka Restaurant	General Entertainment	Gas Station	Furniture / Home Store	Fried Chicken Joint	Fast Food Restaurant	Electronics Store
4	Scarborough	Cedarbrae	43.773136 -79.239476	1	Gas Station	Thai Restaurant	Athletics & Sports	Haikka Restaurant	Bakery	Bank	Caribbean Restaurant	Fried Chicken Joint	Electronics Store	Department Store
5	Scarborough	Scarborough Village	43.744734 -79.239476	1	Jewelry Store	Playground	Vietnamese Restaurant	Coffee Shop	Haikka Restaurant	General Entertainment	Gas Station	Furniture / Home Store	Fried Chicken Joint	Fast Food Restaurant
6	Scarborough	Kennedy Park, Ionview, East Birchmount Park	43.727929 -79.262029	1	Discount Store	Coffee Shop	Hobby Shop	Bus Station	Department Store	Vietnamese Restaurant	Haikka Restaurant	General Entertainment	Gas Station	Furniture / Home Store
7	Scarborough	Gorden Mlie, Cnairnea, Oakridge	43.711112 -79.284577	1	Bakery	Ice Cream Shop	Bus Line	Metro Station	Soccer Field	Intersection	Park	Department Store	Discount Store	Electronics Store
8	Scarborough	Cliffside, Cliffcrest, Scarborough Village West	43.716316 -79.239476	1	American Restaurant	Motel	Movie Theater	Ice Cream Shop	Haikka Restaurant	General Entertainment	Gas Station	Furniture / Home Store	Fried Chicken Joint	Fast Food Restaurant
9	Scarborough	Birch Cliff, Cliffside West	43.692657 -79.264848	2	General Entertainment	Skating Rink	Café	College Stadium	Vietnamese Restaurant	Coffee Shop	Haikka Restaurant	Gas Station	Furniture / Home Store	Fried Chicken Joint
10	Scarborough	Dorset Park, Wexford Heights, Scarborough Town...	43.757410 -79.273304	3	Indian Restaurant	Pet Store	Brewery	Chinese Restaurant	Furniture / Home Store	Light Rail Station	Vietnamese Restaurant	Restaurant	Soccer Field	Smoke Shop
11	Scarborough	Wexford, Maryvale	43.750072 -79.295849	0	Middle Eastern Restaurant	Auto Garage	Smoke Shop	Bakery	Sandwich Place	Electronics Store	College Stadium	Cosmetics Shop	Department Store	Discount Store
12	Scarborough	Agincourt	43.794200 -79.262029	3	Clothing Store	Skating Rink	Latin American Restaurant	Breakfast Spot	Lounge	Coffee Shop	General Entertainment	Gas Station	Furniture / Home Store	Fried Chicken Joint
13	Scarborough	Clarks Corners, Tam O'Shanter, Sullivan	43.781638 -79.304302	1	Pizza Place	Fast Food Restaurant	Noodle House	Thai Restaurant	Gas Station	Chinese Restaurant	Intersection	Bank	Italian Restaurant	Fried Chicken Joint
14	Scarborough	Milliken, Agincourt North, Steeles East, L'Amo...	43.815252 -79.284577	1	Intersection	Playground	Park	Vietnamese Restaurant	Clothing Store	General Entertainment	Gas Station	Furniture / Home Store	Fried Chicken Joint	Fast Food Restaurant
15	Scarborough	Steeles West, L'Amoreaux West	43.799525 -79.318389	4	Fast Food Restaurant	Coffee Shop	Indian Restaurant	Pizza Place	Thrift / Vintage Store	Furniture / Home Store	Discount Store	Cosmetics Shop	Chinese Restaurant	Pharmacy

3.2.3 Cluster of Scarborough Neighborhoods

All 17 neighborhoods were clustered using k\_mean methodology into 5 clusters.

Those 5 clusters of neighborhoods are represented by 5 different colors in the map below.



All 5 clusters are listed below with included Neighborhoods and top 10 venues

	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
11	Wexford, Maryvale	Middle Eastern Restaurant	Auto Garage	Smoke Shop	Bakery	Sandwich Place	Electronics Store	College Stadium	Cosmetics Shop	Department Store	Discount Store

	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	Malvern, Rouge	Fast Food Restaurant	Vietnamese Restaurant	Coffee Shop	Hobby Shop	Hakka Restaurant	General Entertainment	Gas Station	Furniture / Home Store	Fried Chicken Joint	Electronics Store
1	Rouge Hill, Port Union, Highland Creek	Bar	Vietnamese Restaurant	Coffee Shop	Hobby Shop	Hakka Restaurant	General Entertainment	Gas Station	Furniture / Home Store	Fried Chicken Joint	Fast Food Restaurant
2	Guildwood, Morningside, West Hill	Rental Car Location	Restaurant	Medical Center	Electronics Store	Breakfast Spot	Mexican Restaurant	Bank	Intersection	Fried Chicken Joint	College Stadium
3	Woburn	Coffee Shop	Korean BBQ Restaurant	Vietnamese Restaurant	Hakka Restaurant	General Entertainment	Gas Station	Furniture / Home Store	Fried Chicken Joint	Fast Food Restaurant	Electronics Store
4	Cedarbrae	Gas Station	Thai Restaurant	Athletics & Sports	Hakka Restaurant	Bakery	Bank	Caribbean Restaurant	Fried Chicken Joint	Electronics Store	Department Store
5	Scarborough Village	Jewelry Store	Playground	Vietnamese Restaurant	Coffee Shop	Hakka Restaurant	General Entertainment	Gas Station	Furniture / Home Store	Fried Chicken Joint	Fast Food Restaurant
6	Kennedy Park, Ionview, East Birchmount Park	Discount Store	Coffee Shop	Hobby Shop	Bus Station	Department Store	Vietnamese Restaurant	Hakka Restaurant	General Entertainment	Gas Station	Furniture / Home Store
7	Golden Mile, Clairlea, Oakridge	Bakery	Ice Cream Shop	Bus Line	Metro Station	Soccer Field	Intersection	Park	Department Store	Discount Store	Electronics Store
8	Cliffside, Cliffcrest, Scarborough Village West	American Restaurant	Motel	Movie Theater	Ice Cream Shop	Hakka Restaurant	General Entertainment	Gas Station	Furniture / Home Store	Fried Chicken Joint	Fast Food Restaurant
13	Clarks Corners, Tam O'Shanter, Sullivan	Pizza Place	Fast Food Restaurant	Noodle House	Thai Restaurant	Gas Station	Chinese Restaurant	Intersection	Bank	Italian Restaurant	Fried Chicken Joint
14	Milliken, Agincourt North, Steeles East, L'Amoreaux	Intersection	Playground	Park	Vietnamese Restaurant	Clothing Store	General Entertainment	Gas Station	Furniture / Home Store	Fried Chicken Joint	Fast Food Restaurant

	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
9	Birch Cliff, Cliffside West	General Entertainment	Skating Rink	Café	College Stadium	Vietnamese Restaurant	Coffee Shop	Hakka Restaurant	Gas Station	Furniture / Home Store	Fried Chicken Joint

	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
10	Dorset Park, Wexford Heights, Scarborough Town...	Indian Restaurant	Pet Store	Brewery	Chinese Restaurant	Furniture / Home Store	Light Rail Station	Vietnamese Restaurant	Restaurant	Soccer Field	Smoke Shop
12	Agincourt	Clothing Store	Skating Rink	Latin American Restaurant	Breakfast Spot	Lounge	Coffee Shop	General Entertainment	Gas Station	Furniture / Home Store	Fried Chicken Joint

	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
15	Steeles West, L'Amoreaux West	Fast Food Restaurant	Coffee Shop	Indian Restaurant	Pizza Place	Thrift / Vintage Store	Furniture / Home Store	Discount Store	Cosmetics Shop	Chinese Restaurant	Pharmacy

#### **4. Discussion / Conclusion**

Answer chosen and conclusions

In Manhattan, there are 40 different Neighborhoods with 334 different categories of venues, whereas in Scarborough there are only 17 with 39 different type of venues. Thus, New York City shows a much higher variety of venues.

In addition, the total number of venues is in Manhattan higher than in Scarborough.

Based on the results retrieved from the data analyses, visualizations and clustering we conclude, New York City would be the better choice for a location of an headquarter, if the number and type of venues are the main criteria.

Nevertheless, it needs to be concluded the done analysis is only one criteria out of several to finally decide on the location of an headquarter.

In a next step, it would be needed to compare e.g. prices to rent an office (USD/qm) in the respective neighborhoods as well as check availability of apartments to rent.