The Battle of Neighborhoods

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IBM Data Science Professional Certificate – Capstone Project

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Introduction

Business problem

Every city is unique in their own way and give something new. The city of New York is the most populous city in USA. It is diverse and is the financial capital of USA. It is multicultural and rich in heritage and developed enough from a foreign perspective.
Toronto, the capital of Ontario is a major Canadian city. It is the most populous city in Canada and fourth most populous city in North America. Both cities are very diverse and are the financial capitals of their respective countries.

Today Tourism is one of the most essential components of the economy. Most often people would like to visit countries which are having friendly environment. Tourists always eager to travel to different places on the basis of available information. The comparison between two cities always support to choose the specific places according to their choice.

Who would be interested?

Jane is a tourist, and she needs to explore how much these two cities, New York and Toronto are similar or dissimilar in aspects from a tourist point of view regarding food, accommodation, beautiful places etc. and to get more helpful information when making decisions about where to travel.

Data

Description of the data

For this project, Foursquare API will be used to gain the data of two cities, in terms of their neighborhoods. The information we want to focus on are restaurants, hotels, coffee shops, parks, theaters, art galleries, museums around each neighborhood. One Borough from each city will be chosen to analyze their neighborhoods. Therefore, Manhattan from New York and Downtown Toronto from Toronto will be considered.

How data will be used to solve the problem

According to the objectives of this project, Machine Learning technique called “Clustering” will be used to segment the neighborhoods with similar objects on the basis of each neighborhood data. Based on foot traffic

in respective neighborhoods tourist's areas and hubs will be located and that information will be used to decide the similarities or dissimilarities between two cities.

Methodology

Initially we have selected Downtown Toronto and Manhattan to explore their neighborhoods. The data exploration, analysis and visualization for both boroughs are done in the same way but separately.

Downtown Toronto

First Downtown Toronto was considered.

- For Downtown Toronto case, we have extracted table of Toronto's Borough from Wikipedia: http://zims-en.kiwix.campusafrica.gos.orange.com/wikipedia_en_all_nopic/A/List_of_postal_codes_of_Canada:_M
- First the data was arranged according to our requirements.
- In the arrangement phase, which applied multiple steps including but not limited to, eliminating "Not assigned" values,

	Postcode	Borough	Neighbourhood
0	M1A	Not assigned	Not assigned
1	M2A	Not assigned	Not assigned
2	M3A	North York	Parkwoods
3	M4A	North York	Victoria Village
4	M5A	Downtown Toronto	Harbourfront
5	M6A	North York	Lawrence Heights
6	M6A	North York	Lawrence Manor

```
[96]: toronto_df= toronto_df[toronto_df["Borough"] != "Not assigned"]
toronto_df.head()
```

[96]:

	Postcode	Borough	Neighborhood
2	M3A	North York	Parkwoods
3	M4A	North York	Victoria Village
4	M5A	Downtown Toronto	Harbourfront
5	M6A	North York	Lawrence Heights
6	M6A	North York	Lawrence Manor

```
[102]: sum(toronto_df['Neighborhood'] == "Not assigned")
```

[102]: 0

- Since I was not able to get the geographical coordinates of the neighborhoods using the Geocoder package, I have used the csv file that has the geographical coordinates of each postal code.

```
[104]: locations = pd.read_csv("Geospatial_Coordinates.csv")
```

```
[105]: locations.head(5)
```

[105]:

	Postal Code	Latitude	Longitude
0	M1B	43.806686	-79.194353
1	M1C	43.784535	-79.160497
2	M1E	43.763573	-79.188711
3	M1G	43.770992	-79.216917
4	M1H	43.773136	-79.239476

- Combine neighborhoods which have same geographical coordinates at each borough and sorted against the concerned borough.

[110]:

	Postcode	Borough	Neighborhood	Latitude	Longitude
0	M1B	Scarborough	Rouge, Malvern	43.806686	-79.194353
1	M1C	Scarborough	Highland Creek, Rouge Hill, Port Union	43.784535	-79.160497
2	M1E	Scarborough	Guildwood, Morningside, West Hill	43.763573	-79.188711
3	M1G	Scarborough	Woburn	43.770992	-79.216917
4	M1H	Scarborough	Cedarbrae	43.773136	-79.239476

- Set index for only Downtown Toronto and eliminate 'Postcode' column.

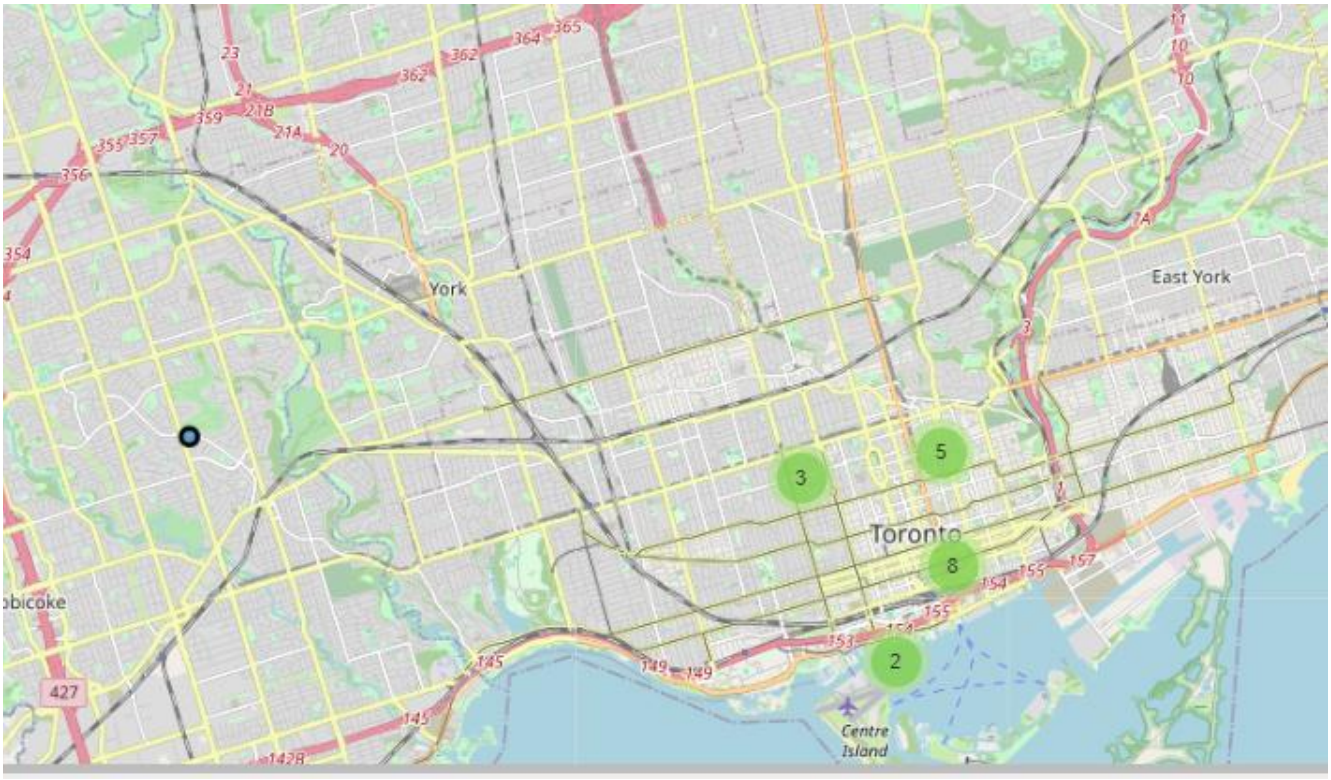
```
[27]: downtown_toronto_data = toronto_df[toronto_df['Borough'] == 'Downtown Toronto'].reset_index(drop=True)
      downtown_toronto_data=downtown_toronto_data.drop(['Postcode'], axis=1)
      downtown_toronto_data
```

[27]:

	Borough	Neighborhood	Latitude	Longitude
0	Downtown Toronto	Rosedale	43.679563	-79.377529
1	Downtown Toronto	Cabbagetown, St. James Town	43.667967	-79.367675
2	Downtown Toronto	Church and Wellesley	43.665860	-79.383160
3	Downtown Toronto	Harbourfront	43.654260	-79.360636
4	Downtown Toronto	Ryerson, Garden District	43.657162	-79.378937
5	Downtown Toronto	St. James Town	43.651494	-79.375418
6	Downtown Toronto	Berczy Park	43.644771	-79.373306
7	Downtown Toronto	Central Bay Street	43.657952	-79.387383
8	Downtown Toronto	Adelaide, King, Richmond	43.650571	-79.384568
9	Downtown Toronto	Harbourfront East, Toronto Islands, Union Station	43.640816	-79.381752
10	Downtown Toronto	Design Exchange, Toronto Dominion Centre	43.647177	-79.381576
11	Downtown Toronto	Commerce Court, Victoria Hotel	43.648198	-79.379817
12	Downtown Toronto	Harbord, University of Toronto	43.662696	-79.400049

For data verification and further exploration, Foursquare API was used to get the coordinates of Downtown Toronto and explore its neighborhoods.

The neighborhoods are further characterized as venues and venue categories. Put blue dots on Bucharest map to see centers of neighborhoods.



Toronto venues

```
# Code to run the above function on each neighborhood and create a new dataframe called toronto_venues.
downtown_toronto_venues = getNearbyVenues(names=downtown_toronto_data['Neighborhood'],
                                          latitudes=downtown_toronto_data['Latitude'],
                                          longitudes=downtown_toronto_data['Longitude'],
                                         )
```

```
Rosedale
Cabbagetown, St. James Town
Church and Wellesley
Harbourfront
Ryerson, Garden District
St. James Town
Berczy Park
Central Bay Street
Adelaide, King, Richmond
Harbourfront East, Toronto Islands, Union Station
Design Exchange, Toronto Dominion Centre
Commerce Court, Victoria Hotel
Harbord, University of Toronto
Chinatown, Grange Park, Kensington Market
CN Tower, Bathurst Quay, Island airport, Harbourfront West, King and Spadina, Railway Lands, South Niagara
Stn A PO Boxes 25 The Esplanade
First Canadian Place, Underground city
Christie
```

- The top 10 venues for each neighborhood were obtained.

	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	Adelaide, King, Richmond	Seafood Restaurant	Coffee Shop	Steakhouse	Café	Plaza	Restaurant	Concert Hall	Asian Restaurant	Smoke Shop	Speakeasy
1	Berczy Park	Seafood Restaurant	Farmers Market	Park	Restaurant	Concert Hall	Beer Bar	Basketball Stadium	Cheese Shop	Bakery	Jazz Club
2	CN Tower, Bathurst Quay, Island airport, Harbo...	Airport Service	Airport Lounge	Airport Terminal	Boat or Ferry	Bar	Airport	Airport Food Court	Airport Gate	Coffee Shop	Harbor / Marina
3	Cabbagetown, St. James Town	Café	Restaurant	Gift Shop	Italian Restaurant	Park	Caribbean Restaurant	Pet Store	General Entertainment	Butcher	Pub
4	Central Bay Street	Coffee Shop	Gastropub	Art Museum	Café	Bubble Tea Shop	Poke Place	Modern European Restaurant	Middle Eastern Restaurant	Sandwich Place	Japanese Restaurant
5	Chinatown, Grange Park, Kensington Market	Café	Vietnamese Restaurant	Bakery	Fish Market	Farmers Market	Dessert Shop	Mexican Restaurant	Organic Grocery	Coffee Shop	Cocktail Bar
6	Christie	Grocery Store	Café	Park	Baby Store	Italian Restaurant	Nightclub	Coffee Shop	Restaurant	Candy Store	Art Gallery
7	Church and Wellesley	Pizza Place	Creperie	Park	Coffee Shop	Mexican Restaurant	Bubble Tea Shop	Breakfast Spot	Bookstore	Pub	Ramen Restaurant
8	Commerce Court, Victoria Hotel	Café	Gastropub	Coffee Shop	Bakery	Gym / Fitness Center	Japanese Restaurant	Deli / Bodega	Museum	Gluten-free Restaurant	Pub

Clustering Neighborhoods - Downtown, Toronto

- A new data frame was created including the cluster labels as well as the top 10 venues for each neighborhood.

[44]:

	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	Con V
0	Downtown Toronto	Rosedale	43.679563	-79.377529	1	Park	Playground	Trail	Dance Studio	Cheese Shop	Chocolate Shop	Clothing Store	Cocktail Bar	Coffee Shop	C
1	Downtown Toronto	Cabbagetown, St. James Town	43.667967	-79.367675	3	Café	Restaurant	Gift Shop	Italian Restaurant	Park	Caribbean Restaurant	Pet Store	General Entertainment	Butcher	
2	Downtown Toronto	Church and Wellesley	43.665860	-79.383160	3	Pizza Place	Creperie	Park	Coffee Shop	Mexican Restaurant	Bubble Tea Shop	Breakfast Spot	Bookstore	Pub	R Resta
3	Downtown Toronto	Harbourfront	43.654260	-79.360636	3	Coffee Shop	Park	Breakfast Spot	Distribution Center	Chocolate Shop	Pub	Restaurant	Performing Arts Venue	Bakery	
4	Downtown Toronto	Ryerson, Garden District	43.657162	-79.378937	0	Café	Burger Joint	Sandwich Place	Electronics Store	Diner	Comic Shop	Middle Eastern Restaurant	Clothing Store	Music Venue	B

Manhattan, New York

- For Manhattan, we used a saved data file which is already explored through foursquare API in which we have extracted all the boroughs of New York and then sorted against the concerned borough.
- Then we explored the Manhattan neighborhoods as venues and venue categories

Access the data

```
[81]: !wget -q -O 'newyork_data.json' https://cf-courses-data.s3.us.cloud-object-storage.appdomain.cloud/IBMDeveloperSkillsNetwork-DS0701EN-S
print('Data downloaded!')
```

```
Data downloaded!
```

examine the resulting dataframe.

```
[57]: neighborhoods.head()
```

[57]:

	Borough	Neighborhood	Latitude	Longitude
0	Bronx	Wakefield	40.894705	-73.847201
1	Bronx	Co-op City	40.874294	-73.829939
2	Bronx	Eastchester	40.887556	-73.827806
3	Bronx	Fieldston	40.895437	-73.905643
4	Bronx	Riverdale	40.890834	-73.912585

Make sure that the dataset has all 5 boroughs and 306 neighborhoods

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

```
The dataframe has 5 boroughs and 306 neighborhoods.
```

Creating new Dataframe manhattan_data

[59]:
```
manhattan_data = neighborhoods[neighborhoods['Borough'] == 'Manhattan'].reset_index(drop=True)
manhattan_data.head()
```

[59]:

	Borough	Neighborhood	Latitude	Longitude
0	Manhattan	Marble Hill	40.876551	-73.910660
1	Manhattan	Chinatown	40.715618	-73.994279
2	Manhattan	Washington Heights	40.851903	-73.936900
3	Manhattan	Inwood	40.867684	-73.921210
4	Manhattan	Hamilton Heights	40.823604	-73.949688

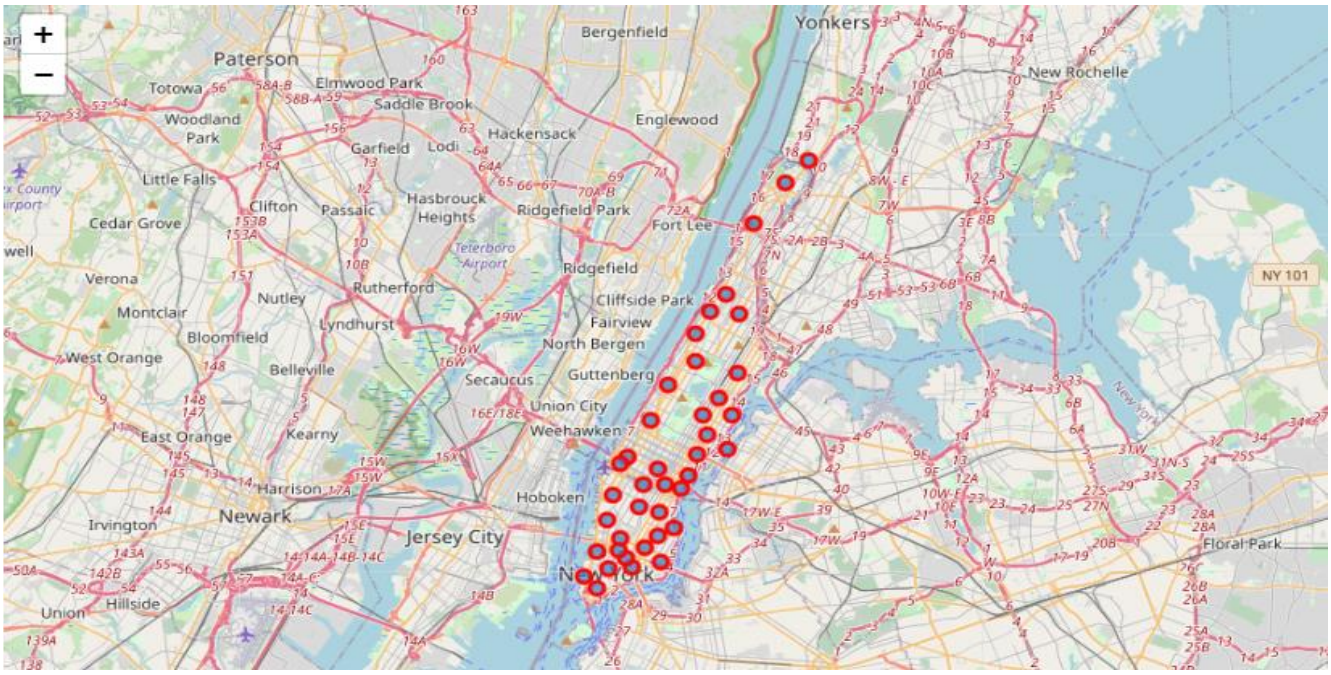
Get the geographical coordinates of Manhattan.

[60]:
```
address = 'Manhattan, NY'

geolocator = Nominatim(user_agent="ny_explorer")
location = geolocator.geocode(address)
latitude = location.latitude
longitude = location.longitude
print('The geograpical coordinate of Manhattan are {}, {}.'.format(latitude, longitude))
```

```
The geograpical coordinate of Manhattan are 40.7896239, -73.9598939.
```

- The neighborhoods are further characterized as venues and venue categories. Put blue dots on Bucharest map to see centers of neighborhoods.



Manhattan venues

[64]:
```
# Run the above function on each neighborhood and create a new dataframe called manhattan_venues
manhattan_venues = getNearbyVenues(names=manhattan_data['Neighborhood'],
                                   latitudes=manhattan_data['Latitude'],
                                   longitudes=manhattan_data['Longitude'],
                                  )
```

```
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
```

[66]:
```
# How many unique categories can be curated from all the returned venues
print('There are {} uniques categories.'.format(len(manhattan_venues['Venue Category'].unique())))
```

```
There are 204 uniques categories.
```

- The top 10 venues for each neighborhood were obtained.

[71]:

	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	Food Court	Memorial Site	Sandwich Place	BBQ Joint	Gym	Coffee Shop	Cooking School	Shopping Mall	Performing Arts Venue
1	Carnegie Hill	Italian Restaurant	Gym	Bookstore	Bagel Shop	Dance Studio	Community Center	Coffee Shop	French Restaurant	Café	Pizza Place
2	Central Harlem	French Restaurant	Jazz Club	Beer Bar	Dessert Shop	Cycle Studio	Ethiopian Restaurant	Music Venue	Cocktail Bar	Spa	Gym / Fitness Center
3	Chelsea	Cupcake Shop	Theater	Indian Restaurant	Hotel	French Restaurant	Fish Market	New American Restaurant	Nightclub	Coffee Shop	Chinese Restaurant
4	Chinatown	Chinese Restaurant	Sandwich Place	Spa	Bakery	New American Restaurant	Furniture / Home Store	Cocktail Bar	Noodle House	Greek Restaurant	Bike Shop
5	Civic Center	Gym / Fitness Center	Falafel Restaurant	French Restaurant	Spa	Yoga Studio	Dance Studio	Park	Monument / Landmark	Molecular Gastronomy Restaurant	Sushi Restaurant

Clustering Neighborhoods – Manhattan, New York

- A new data frame was created including the cluster labels as well as the top 10 venues for each neighborhood.

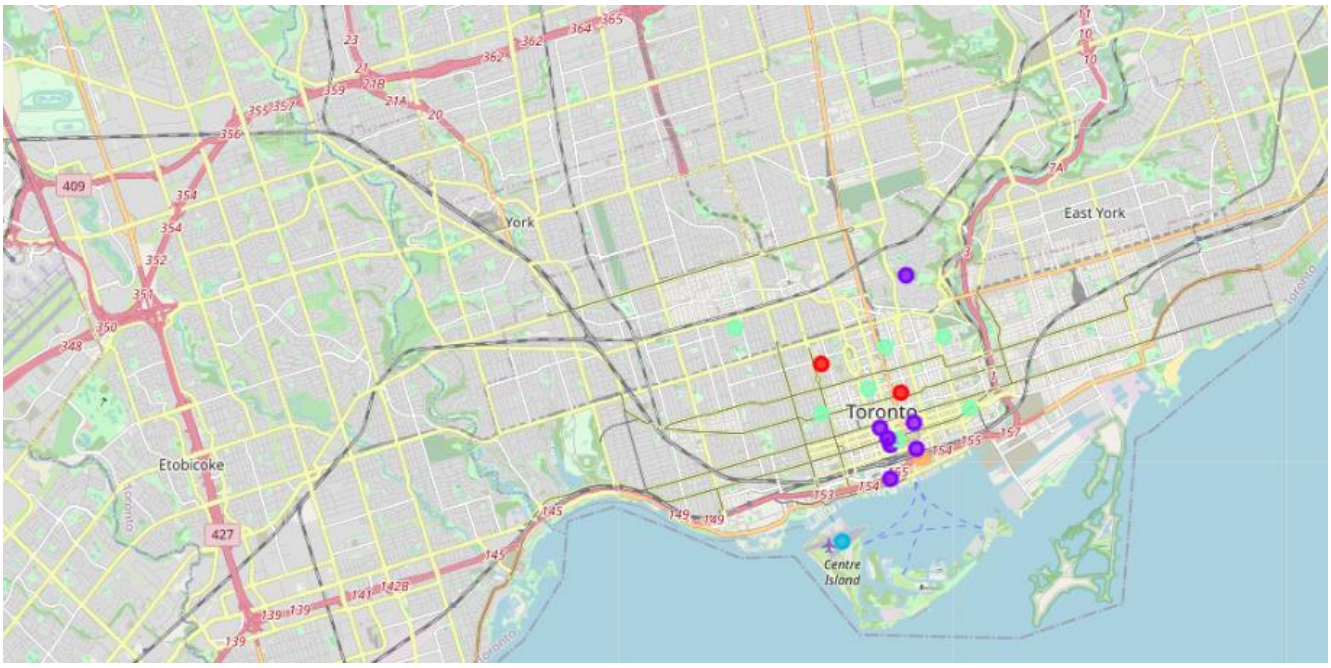
[73]:

	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 M Comm Ve
0	Manhattan	Marble Hill	40.876551	-73.910660	4	Gym	Sandwich Place	Yoga Studio	Discount Store	Pizza Place	Steakhouse	Supplement Shop	Seafood Restaurant	Te Stac
1	Manhattan	Chinatown	40.715618	-73.994279	3	Chinese Restaurant	Sandwich Place	Spa	Bakery	New American Restaurant	Furniture / Home Store	Cocktail Bar	Noodle House	G Restau
2	Manhattan	Washington Heights	40.851903	-73.936900	3	Café	Pizza Place	Wine Shop	Park	Market	Deli / Bodega	Pet Café	Ramen Restaurant	Restau
3	Manhattan	Inwood	40.867684	-73.921210	3	Deli / Bodega	Bakery	Wine Bar	Park	Diner	Pet Store	Farmers Market	Frozen Yogurt Shop	
4	Manhattan	Hamilton Heights	40.823604	-73.949688	1	Yoga Studio	Cocktail Bar	Caribbean Restaurant	Mexican Restaurant	Bakery	Italian Restaurant	Coffee Shop	Smoke Shop	

Results

Downtown Toronto

Cluster Map



Now, we can examine each cluster and determine the discriminating venue categories that distinguish each cluster. Based on the defining categories, we can then assign a name to each cluster.

Cluster 1 (Restaurant, Café, Bar, Gym)

Cluster 1

```
[46]: downtown_toronto_merged.loc[downtown_toronto_merged['Cluster Labels'] == 0, downtown_toronto_merged.columns[[1] + list(range(5, downtown_toronto
```

[46]:

	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
4	Ryerson, Garden District	Café	Burger Joint	Sandwich Place	Electronics Store	Diner	Comic Shop	Middle Eastern Restaurant	Clothing Store	Music Venue	Burrito Place
12	Harbord, University of Toronto	Bakery	Café	Bookstore	Japanese Restaurant	Italian Restaurant	College Gym	Comfort Food Restaurant	Restaurant	Sandwich Place	Beer Bar

Cluster 2 (Park, Shops, Playground, Gym)

Cluster 2

```
[47]: downtown_toronto_merged.loc[downtown_toronto_merged['Cluster Labels'] == 1, downtown_toronto_merged.columns[[1] + list(range(5, downtown_toronto
```

[47]:

	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	Rosedale	Park	Playground	Trail	Dance Studio	Cheese Shop	Chocolate Shop	Clothing Store	Cocktail Bar	Coffee Shop	College Gym
5	St. James Town	Gastropub	Café	Coffee Shop	BBQ Joint	Food Truck	Hotel	Italian Restaurant	Japanese Restaurant	Creperie	Cosmetics Shop
8	Adelaide, King, Richmond	Seafood Restaurant	Coffee Shop	Steakhouse	Café	Plaza	Restaurant	Concert Hall	Asian Restaurant	Smoke Shop	Speakeasy
9	Harbourfront East, Toronto Islands, Union Station	Park	Plaza	Skating Rink	Deli / Bodega	Performing Arts Venue	Café	Bubble Tea Shop	Bistro	Salad Place	Lake
10	Design Exchange, Toronto Dominion Centre	Café	Coffee Shop	Gym	Steakhouse	Museum	Pub	Restaurant	Sandwich Place	Beer Bar	Bakery
15	Stn A PO Boxes 25 The Esplanade	Beer Bar	Cocktail Bar	Farmers Market	Café	French Restaurant	Fountain	Food Truck	Thai Restaurant	Concert Hall	Tailor Shop
16	First Canadian Place, Underground city	Café	Coffee Shop	Restaurant	Gym	Steakhouse	Gastropub	Gym / Fitness Center	Pizza Place	Pub	Seafood Restaurant

Cluster 3 (Airport, Harbor)

Cluster 3

```
[48]: downtown_toronto_merged.loc[downtown_toronto_merged['Cluster Labels'] == 2, downtown_toronto_merged.columns[[1] + list(range(5, downtow
```

[48]:

	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
14	CN Tower, Bathurst Quay, Island airport, Harbo...	Airport Service	Airport Lounge	Airport Terminal	Boat or Ferry	Bar	Airport	Airport Food Court	Airport Gate	Coffee Shop	Harbor / Marina

Cluster 4 (Restaurant, Spa, Pub, Museum, Night Club, Park)

Cluster 4

```
[49]: downtown_toronto_merged.loc[downtown_toronto_merged['Cluster Labels'] == 3, downtown_toronto_merged.columns[[1] + list(range(5, downtow
```

[49]:

	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	Cabbagetown, St. James Town	Café	Restaurant	Gift Shop	Italian Restaurant	Park	Caribbean Restaurant	Pet Store	General Entertainment	Butcher	Pub
2	Church and Wellesley	Pizza Place	Creperie	Park	Coffee Shop	Mexican Restaurant	Bubble Tea Shop	Breakfast Spot	Bookstore	Pub	Ramen Restaurant
3	Harbourfront	Coffee Shop	Park	Breakfast Spot	Distribution Center	Chocolate Shop	Pub	Restaurant	Performing Arts Venue	Bakery	Spa
7	Central Bay Street	Coffee Shop	Gastropub	Art Museum	Café	Bubble Tea Shop	Poke Place	Modern European Restaurant	Middle Eastern Restaurant	Sandwich Place	Japanese Restaurant
11	Commerce Court, Victoria Hotel	Café	Gastropub	Coffee Shop	Bakery	Gym / Fitness Center	Japanese Restaurant	Deli / Bodega	Museum	Gluten-free Restaurant	Pub
13	Chinatown, Grange Park, Kensington Market	Café	Vietnamese Restaurant	Bakery	Fish Market	Farmers Market	Dessert Shop	Mexican Restaurant	Organic Grocery	Coffee Shop	Cocktail Bar
17	Christie	Grocery Store	Café	Park	Baby Store	Italian Restaurant	Nightclub	Coffee Shop	Restaurant	Candy Store	Art Gallery

Cluster 5 (Basketball Stadium, Market, Bar, Seafood)

Cluster 5

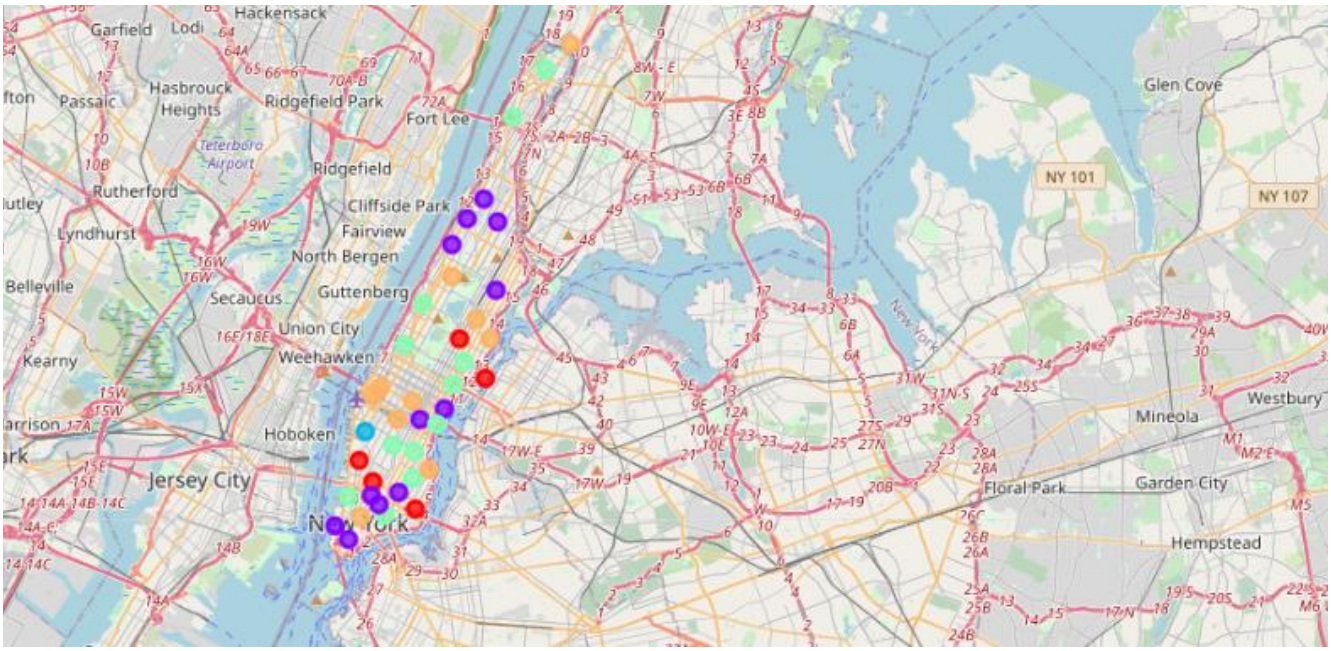
```
[50]: downtown_toronto_merged.loc[downtown_toronto_merged['Cluster Labels'] == 4, downtown_toronto_merged.columns[[1] + list(range(5, downtow
```

[50]:

	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
6	Berczy Park	Seafood Restaurant	Farmers Market	Park	Restaurant	Concert Hall	Beer Bar	Basketball Stadium	Cheese Shop	Bakery	Jazz Club

Manhattan New York

Cluster map



Cluster 1 (Restaurant, Café, Theater, Gym, Bar, Coffee Shop)

Cluster 1

```
[76]: manhattan_merged.loc[manhattan_merged['Cluster Labels'] == 0, manhattan_merged.columns[[1] + list(range(5, manhattan_merged.shape[1]))]]
```

[76]:

	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
8	Upper East Side	Hotel	Jazz Club	Bookstore	Hotel Bar	Gym / Fitness Center	Optical Shop	Falafel Restaurant	Pizza Place	Italian Restaurant	Cosmetics Shop
11	Roosevelt Island	Indie Theater	Gym	Playground	Deli / Bodega	Residential Building (Apartment / Condo)	Park	Outdoors & Recreation	Sandwich Place	School	Coffee Shop
18	Greenwich Village	Italian Restaurant	Sushi Restaurant	Yoga Studio	Bagel Shop	Bakery	Beer Bar	Café	Caribbean Restaurant	Clothing Store	Coffee Shop
20	Lower East Side	Chinese Restaurant	Coffee Shop	Art Gallery	Yoga Studio	Performing Arts Venue	Café	French Restaurant	Cocktail Bar	Mediterranean Restaurant	Community Center
24	West Village	Italian Restaurant	Cocktail Bar	Coffee Shop	Chinese Restaurant	Board Shop	Speakeasy	Sandwich Place	Park	Bakery	Accessories Store

Cluster 2 (Restaurant, Seafood, Bar, Gym, Spa, Park, Museum)

Cluster 2

```
[77]: manhattan_merged.loc[manhattan_merged['Cluster Labels'] == 1, manhattan_merged.columns[[1] + list(range(5, manhattan_merged.shape[1]))]]
```

[77]:

	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
4	Hamilton Heights	Yoga Studio	Cocktail Bar	Caribbean Restaurant	Mexican Restaurant	Bakery	Italian Restaurant	Coffee Shop	Smoke Shop	Café	Pizza Place
5	Manhattanville	Coffee Shop	Italian Restaurant	Bar	Climbing Gym	Café	Gastropub	Mexican Restaurant	Supermarket	Seafood Restaurant	Bike Trail
6	Central Harlem	French Restaurant	Jazz Club	Beer Bar	Dessert Shop	Cycle Studio	Ethiopian Restaurant	Music Venue	Cocktail Bar	Spa	Gym / Fitness Center
7	East Harlem	Mexican Restaurant	Thai Restaurant	Latin American Restaurant	Food Truck	Steakhouse	New American Restaurant	Taco Place	Gym	Beer Bar	Sandwich Place
16	Murray Hill	Japanese Restaurant	Burger Joint	Coffee Shop	Museum	Sushi Restaurant	Gym	Tea Room	Sandwich Place	Hawaiian Restaurant	Bar
22	Little Italy	Wine Bar	Ice Cream Shop	Sandwich Place	Café	Asian Restaurant	Gourmet Shop	Salon / Barbershop	Salad Place	Thai Restaurant	Optical Shop
23	Soho	Boutique	Salon / Barbershop	Shoe Store	Cupcake Shop	Bakery	Dance Studio	Clothing Store	Music Store	Miscellaneous Shop	Dessert Shop
26	Morningside Heights	Coffee Shop	Bookstore	American Restaurant	Park	Pub	Mexican Restaurant	Greek Restaurant	Outdoor Sculpture	Sandwich Place	Salad Place
28	Battery Park City	Park	Food Court	Memorial Site	Sandwich Place	BBQ Joint	Gym	Coffee Shop	Cooking School	Shopping Mall	Performing Arts Venue
29	Financial District	Coffee Shop	Jewelry Store	Gym / Fitness Center	Event Space	Monument / Landmark	Salad Place	Steakhouse	New American Restaurant	Mediterranean Restaurant	Gym
31	Noho	Wine Shop	French Restaurant	Coffee Shop	Cocktail Bar	Italian Restaurant	Boutique	Gourmet Shop	Southern / Soul Food Restaurant	Sandwich Place	Himalayan Restaurant
35	Turtle Bay	Tennis Court	Duty-free Shop	Café	Museum	Seafood Restaurant	Boxing Gym	Cocktail Bar	Coffee Shop	Grocery Store	Sushi Restaurant

Cluster 3 (Restaurant, Night Club)

Cluster 3

```
[78]: manhattan_merged.loc[manhattan_merged['Cluster Labels'] == 2, manhattan_merged.columns[[1] + list(range(5, manhattan_merged.shape[1]))]]
```

[78]:

	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
17	Chelsea	Cupcake Shop	Theater	Indian Restaurant	Hotel	French Restaurant	Fish Market	New American Restaurant	Nightclub	Coffee Shop	Chinese Restaurant

Cluster 4 (Restaurant, Café, Bar, Gym, Spa)

Cluster 4

[79]:
```
manhattan_merged.loc[manhattan_merged['Cluster Labels'] == 3, manhattan_merged.columns[[1] + list(range(5, manhattan_merged.shape[1]))]
```

[79]:

	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	Chinese Restaurant	Sandwich Place	Spa	Bakery	New American Restaurant	Furniture / Home Store	Cocktail Bar	Noodle House	Greek Restaurant	Bike Shop
2	Washington Heights	Café	Pizza Place	Wine Shop	Park	Market	Deli / Bodega	Pet Café	Ramen Restaurant	Restaurant	Coffee Shop
3	Inwood	Deli / Bodega	Bakery	Wine Bar	Park	Diner	Pet Store	Farmers Market	Frozen Yogurt Shop	Café	Mexican Restaurant
10	Lenox Hill	Taco Place	Thai Restaurant	Liquor Store	Health Food Store	Burger Joint	Middle Eastern Restaurant	Cocktail Bar	College Academic Building	Gourmet Shop	Gym
12	Upper West Side	Italian Restaurant	American Restaurant	Cupcake Shop	Tiki Bar	Southern / Soul Food Restaurant	Movie Theater	Seafood Restaurant	Mediterranean Restaurant	Greek Restaurant	Bookstore
13	Lincoln Square	Theater	Indie Movie Theater	Performing Arts Venue	Concert Hall	Plaza	Library	Gift Shop	Circus	Opera House	College Arts Building
19	East Village	Vietnamese Restaurant	Korean Restaurant	Dessert Shop	Pet Café	Coffee Shop	Beer Store	Moroccan Restaurant	Beer Bar	Bar	Dog Run
21	Tribeca	Wine Shop	American Restaurant	Park	Poke Place	Sushi Restaurant	Italian Restaurant	Hotel	New American Restaurant	Cycle Studio	Playground
27	Gramercy	Pizza Place	Coffee Shop	Thrift / Vintage Store	Playground	Dim Sum Restaurant	Irish Pub	Cocktail Bar	Spa	Mexican Restaurant	Gourmet Shop
34	Sutton Place	Grocery Store	Gym	Beer Garden	Yoga Studio	Bakery	Food Court	Coffee Shop	Greek Restaurant	Steakhouse	Gym / Fitness Center
36	Tudor City	Park	Yoga Studio	Hawaiian Restaurant	Convenience Store	Salad Place	Seafood Restaurant	Café	Spanish Restaurant	Deli / Bodega	Boxing Gym
38	Flatiron	Japanese Restaurant	Furniture / Home Store	Yoga Studio	Thai Restaurant	Women's Store	Gym / Fitness Center	Gym	Miscellaneous Shop	Donut Shop	Salad Place

Cluster 5 (Market, Park, Gym, Coffee)

Cluster 5

[80]:
```
manhattan_merged.loc[manhattan_merged['Cluster Labels'] == 4, manhattan_merged.columns[[1] + list(range(5, manhattan_merged.shape[1]))]]
```

[80]:

	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	Yoga Studio	Discount Store	Pizza Place	Steakhouse	Supplement Shop	Seafood Restaurant	Tennis Stadium	Donut Shop
9	Yorkville	Deli / Bodega	Wine Shop	Italian Restaurant	Hobby Shop	Diner	Dog Run	Park	Coffee Shop	Café	Gym
14	Clinton	Gym / Fitness Center	Theater	Sports Bar	Park	Sporting Goods Shop	Building	Cocktail Bar	Mediterranean Restaurant	Gym	Comedy Club
15	Midtown	Hotel	Cuban Restaurant	Grocery Store	Plaza	Park	Salad Place	Coffee Shop	Clothing Store	Smoke Shop	French Restaurant
25	Manhattan Valley	Mexican Restaurant	Bar	Yoga Studio	Cosmetics Shop	Furniture / Home Store	Pizza Place	Coffee Shop	Grocery Store	Hawaiian Restaurant	Bike Shop
30	Carnegie Hill	Italian Restaurant	Gym	Bookstore	Bagel Shop	Dance Studio	Community Center	Coffee Shop	French Restaurant	Café	Pizza Place
32	Civic Center	Gym / Fitness Center	Falafel Restaurant	French Restaurant	Spa	Yoga Studio	Dance Studio	Park	Monument / Landmark	Molecular Gastronomy Restaurant	Sushi Restaurant
33	Midtown South	Korean Restaurant	Dessert Shop	Coffee Shop	Fried Chicken Joint	Scenic Lookout	Grocery Store	Hotel	Wine Bar	Cosmetics Shop	Lingerie Store
37	Stuyvesant Town	Boat or Ferry	Park	Bar	Coffee Shop	Gym / Fitness Center	Heliport	Harbor / Marina	Baseball Field	Farmers Market	Bistro
39	Hudson Yards	American Restaurant	Hotel	Gym / Fitness Center	Park	Public Art	Theater	Roof Deck	Pedestrian Plaza	Residential Building (Apartment / Condo)	Supermarket

Discussion

- After clustering the data of the respective neighborhoods, in Downtown and Manhattan, It can be seen that there are venues which can attract the Tourists.

- The neighborhoods are much similar in features like Theaters, Gyms, Parks, food places, Clubs, museums, Spas etc.

- As far as concern to dissimilarity, it differs in terms of some unique places like historical places, Airports and Harbors.

- When comparing the tourist places, it can be observed that the historical place is only situated in Downtown Toronto and the Monument or landmark venue is in Manhattan neighborhoods.

- Similarly, Airport facility, Harbor, Sculpture garden and Boat or ferry services are also available in Downtown Toronto while venues like Nightlife, climbing gym and Museums are present in Manhattan.

- As far as concern to recommendations, we recommend Downtown Toronto Neighborhoods will be considered first to visit. The tourists have an easily travelling access due to Airport facility, which not only saves time but also helps to save money. This saved money can be utilized to explore more, the attracting venues.

Conclusion

- The downtown Toronto and Manhattan neighborhoods have more like similar venues.

- As we know that every place is unique in its own way, so that’s argument is present in both neighborhoods.

- The dissimilarity exists in terms of some different venues and facilities but not on a larger extent.