

# **Similarities and Dissimilarities between Toronto and New York City on Food, Arts & Entertainment and Nightlife**

Deshraj Singh Kiran

June 28, 2019

**TABLE OF CONTENTS**

1. Introduction .....3

2. Data Acquisition & Cleaning .....4

3. Methodology .....5

    3.1 Data Preparation .....5

    3.2 Exploratory Data Analysis .....6

        3.2.1 Food .....6

        3.2.2 Arts & Entertainment .....16

        3.2.3 Nightlife Spot .....26

    3.3 Clustering of Neighborhoods .....37

4. Results .....42

5. Discussions .....45

6. Conclusion .....47

7. Future Directions .....47

## 1. Introduction

This project seeks to identify the similarities or differences in Arts & Entertainment, Food and Nightlife between New York City (NYC) and Toronto.

### 1.1 Business Problem

New York City, USA and Toronto, CA are two of the most visited places by tourists. Moreover, they also offer various work opportunities, and are thus the cities where people from all around the world move to for a better life.

Both tourists and those who plan to move to another city often look for places of enjoyment, social activities and entertainment before considering a city. Although, Google and Question & Answer platforms such as [Quora](#) give you many options to explore and learn about a city, most of information is based on subjective knowledge of individuals who have travelled or moved to such places.

While that is a good option to learn about a place, data driven information is a better way to inform yourself and also is more reliable. Keeping in mind that individuals who wish to travel or move to NYC or Toronto are unsure of which is the better place from enjoyment perspective, this project compares three categories between the two cities. These categories include Arts & Entertainment, Food and Nightlife.

Example of some of the questions the project seeks to answer:

1. How frequent Japanese Restaurants are in the neighborhoods of Toronto as compared to New York City?
2. If Museums play an important role in deciding which place to tour, then should you choose Toronto or New York City?
3. If Art Galleries are your favourite place to explore in your free time, then would it matter much if you choose to visit New York City rather than Toronto?

### 1.2 Target Audience

The target audience of this project is tourists and also the people who want to decide between the New York City and Toronto based on Food, Arts & Entertainment and Nightlife venues in the neighborhoods of the two cities.

## 2. Data Acquisition & Cleaning

This section describes the data sourced for this project, as well as data cleaning and preparation for subsequent exploration.

### 2.1. New York City Neighborhood Location Dataset

The data is freely available and is taken from [NYU Spatial Data Repository](#). The original format of this dataset is a GeoJson file, which is then converted to a CSV. The raw data can be found [here](#).

The CSV File has the following features:

1. Borough
2. Neighborhood
3. Latitude
4. Longitude

There are a total of 307 records available (including header row) in this dataset. The cleaned dataset is found [here](#).

### 2.2. Toronto Neighborhood Location Dataset

The dataset of PostalCode, Borough and Neighborhood is scraped from [this](#) Wikipedia page.

Unlike the New York City data I had to clean the Toronto data by dropping the data points where the Borough was *Not assigned*. I then transformed the cells that had a Borough but a *Not assigned* Neighborhood. Each of those neighborhoods was assigned the same value as Borough.

After cleaning, the dataset was merged with the geospatial coordinates of each PostalCode by creating an inner join on *PostalCode*. The geospatial coordinates of each PostalCode of Toronto could be found [here](#). The *PostalCode* column was then dropped as it was not needed for exploratory data analysis. There are a total of 211 records available (including header row) in this dataset.

The [final CSV file](#) will have the following features:

1. Borough
2. Neighborhood
3. Latitude
4. Longitude

### 2.3. Places API of Foursquare

The above mentioned New York City and Toronto datasets will be used in conjunction with the [Foursquare Developer API](#) for this project.

Using the Places API Endpoints of Foursquare Developer API for different categories like Food, Arts & Entertainment and Nightlife Spot, we find the frequency of the venues of each of these categories and the similarities or differences in them for both the cities.

For example, by using the *explore* API endpoint along with the *categoryId* of the *Food* venue category we get the nearby venues of the provided location filtered by the *Food* venue category.

Following is a sample (first 5 rows) of the filtered data showing different *Food* venues in New York City nearby the *Wakefield* neighborhood:

Table 1 Sample New York City venues filtered by Food Venue Category

	Neighborhood	Neighborhood Latitude	Neighborhood Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
0	Wakefield	40.894705	-73.847201	Ripe Kitchen & Bar	40.898152	-73.838875	Caribbean Restaurant
1	Wakefield	40.894705	-73.847201	Ali's Roti Shop	40.894036	-73.856935	Caribbean Restaurant
2	Wakefield	40.894705	-73.847201	Jackie's West Indian Bakery	40.889283	-73.843310	Caribbean Restaurant
3	Wakefield	40.894705	-73.847201	Jimbo's	40.891740	-73.858226	Burger Joint
4	Wakefield	40.894705	-73.847201	Cooler Runnings Jamaican Restaurant Inc	40.898276	-73.850381	Caribbean Restaurant

I've used datasets such as above for exploratory data analysis to identify the similarities or differences on Arts & Entertainment, Food and Nightlife between New York City and Toronto.

### 3. Methodology

This section describes the data preparation, exploratory data analysis, and machine learnings that were conducted to find how they relate to the original business problem of identifying the similarities and dissimilarities between the New York City and Toronto on Food, Arts & Entertainment, and Nightlife.

#### 3.1 Data Preparation

The datasets used in this section were collected mainly from two sources namely, Wikipedia and [NYU Spatial Data Repository](#).

After cleaning and transforming the gathered data, the final neighbourhood datasets for both New York City and Toronto include 'Borough', 'Neighborhood', 'Latitude' and 'Longitude' columns. The total number of boroughs and neighborhoods in Toronto were found to be 11 and 210, while the New York City had 5 boroughs and 306 neighborhoods.

The *explore* endpoint of the Foursquare Places API used to retrieve nearby venues of all the neighborhoods in New York City and Toronto were limited to 1000 meters of radius and 100 returned results. The returned json result of the *explore* query had most of the relevant information in the *items* variable, out of which I extracted the data for 'Neighborhood', 'Neighborhood Latitude', 'Neighborhood Longitude', 'Venue', 'Venue Latitude',

‘Venue Longitude’, ‘Venue Category’ columns that I needed to use for subsequent data analysis and exploration.

Please refer to the Data Acquisition and Cleaning section to find more information about the data used in the project.

## 3.2 Exploratory Data Analysis

The project does the exploratory data analysis of 3 different *Venue Categories*: ‘Food’, ‘Arts & Entertainment’ and ‘Nightlife Spot’. So I broke them down into 3 sub-headings accordingly.

### 3.2.1 Food

Using Foursquare Places API, the number of food venues in Toronto were 6984, while New York City had 17971 food venues. The number of unique Food Venue Categories in Toronto was 109, while in New York City it was 142.

#### 3.2.1.A. Neighborhoods Without Any Food Venues

##### 3.2.1.A.t Neighborhoods Without Any Food Venues in Toronto

Number of unique neighborhoods in Toronto before being filtered by Food venue categories was 209 but after filtering it come down to 207. So we had 2 neighborhoods that did not have any Food venues within a circle of 1000 meters of radius, namely ‘Northwest’ and ‘Upper Rouge’.

##### 3.2.1.A.n Neighborhoods Without Any Food Venues in New York City

Unlike Toronto, number of unique neighborhoods in NYC that did not have any Food venues was 0. Number of unique neighborhoods in NYC before and after being filtered by Food venue categories was both 302. It is 302 not 306 because 4 of them have duplicate names.

#### 3.2.1.B. Count of Food Venues in each Borough

##### 3.2.1.B.t Count of Food Venues in each Borough of Toronto

The maximum count of Food venues was found in Downtown Toronto with a value of 1093. Mississauga on the other hand had the minimum count with only 24 food venues.

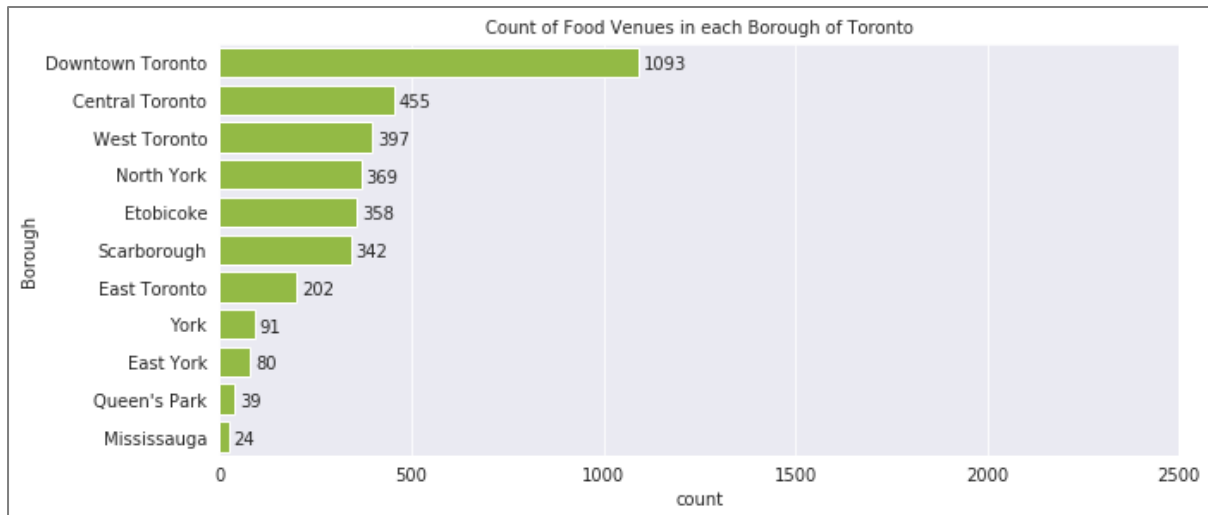


Figure 1 Count of Food venues in each Borough of Toronto

### 3.2.1.B.n Count of Food Venues in each Borough of New York City

The maximum number of food venues was found in Brooklyn. The count was 1939. Staten Island on the other hand had the minimum number of food venues. It had only 978 food venues.

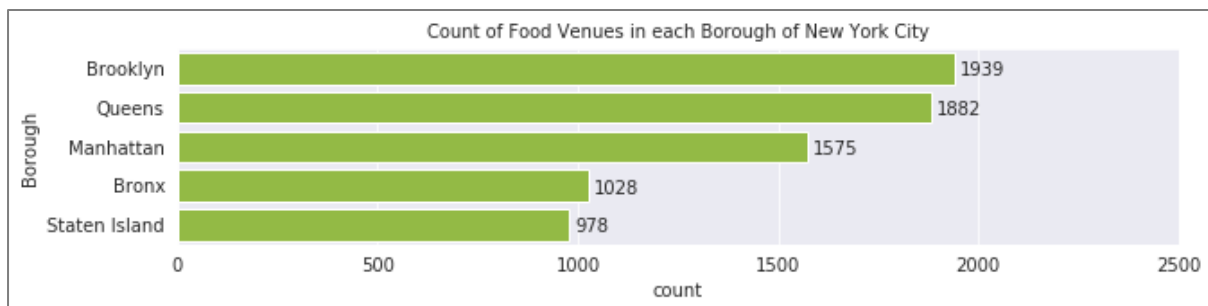


Figure 2 Count of Food venues in each Borough of New York City

### 3.2.1.C. Count of Food Venues in Each Neighborhood

#### 3.2.1.C.t Count of Food Venues in Each Neighborhood of Toronto

Figure 3 below shows the first 5 of 209 neighbourhoods of Toronto by the count of Food venues. All of them have a count of 100, while 'Silver Hills' and 'York Mills' in Figure 4 have a count of 2 each.

The maximum number of venues returned by Foursquare API is 100. So if a neighborhood has more than 100 Food venues within 1000 meters then it will not be included in the result. As Figure 3 below shows, the first 5 of 207 neighborhoods in Toronto seems to have more than 100 Food venues within 1000 meters of radius.

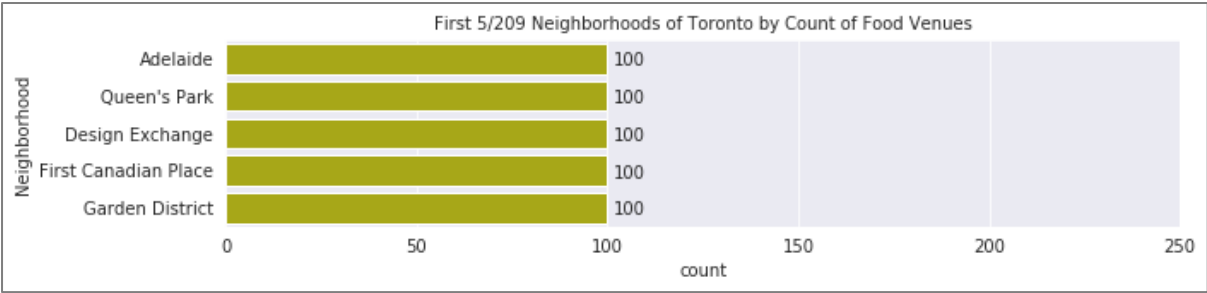


Figure 3 First 5/209 Neighborhoods of Toronto by Count of Food Venues

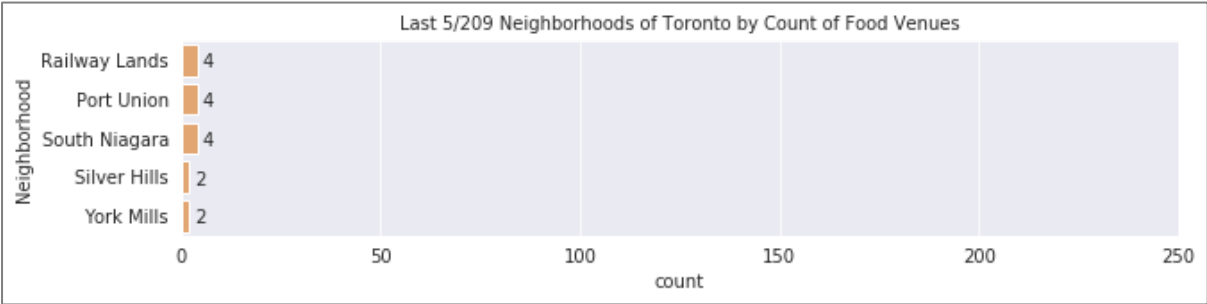


Figure 4 Last 5/209 Neighborhoods of Toronto by Count of Food Venues

3.2.1.C.n Count of Food Venues in Each Neighborhood of New York City

Following Figure 5 shows the first 5 of 306 neighbourhoods of New York City by the count of Food venues. ‘Murray Hill’ had the highest count of 200. Figure 6 shows that ‘Todt Hill’ has a lowest count of just 1.

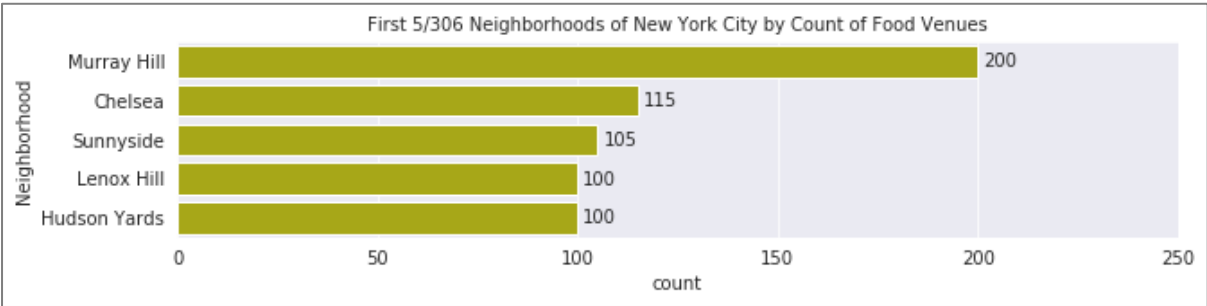


Figure 5 First 5/306 Neighborhoods of New York City by Count of Food Venues

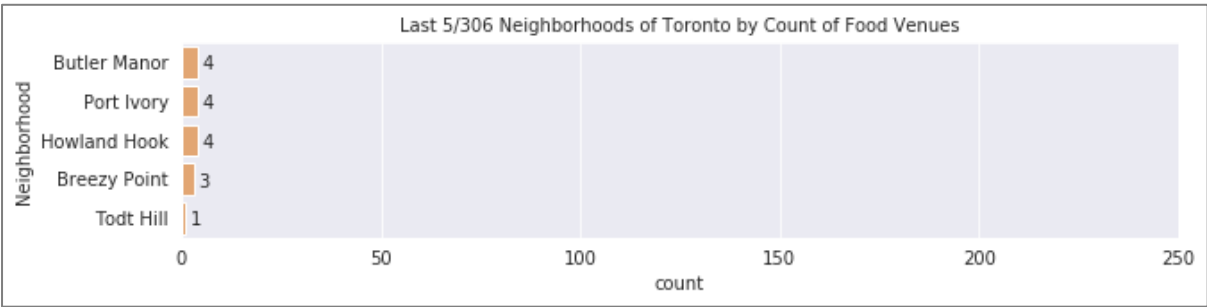


Figure 6 Last 5/306 Neighborhoods of New York City by Count of Food Venues



### 3.2.1.D. Count of Food Venues of Each Food Venue Category

#### 3.2.1.D.t Count of Food Venues of Each Food Venue Category in Toronto

Figure 7 shows the first 10 out the 109 unique Food venue categories of Toronto. Café turns out to be the first food venue category of Toronto by count. It has a count of 602 in all the neighborhoods of Toronto. Figure 8 shows the last 10 out the 109 unique Food venue categories of Toronto. As we could see that 'Pide Place' and many other Food venue categories have just 1 venue in all the neighborhoods of Toronto.

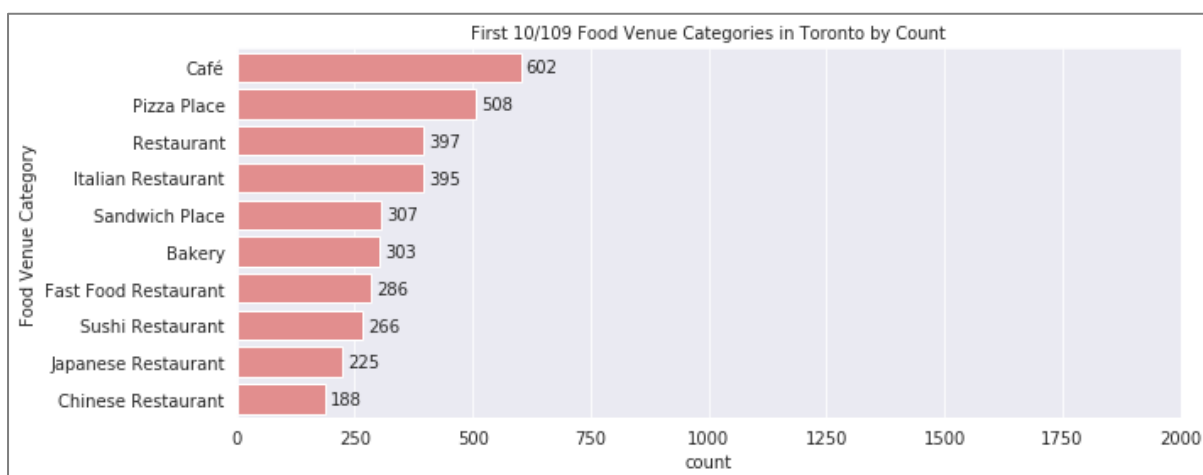


Figure 7 First 10/109 Food venue categories in Toronto by Count

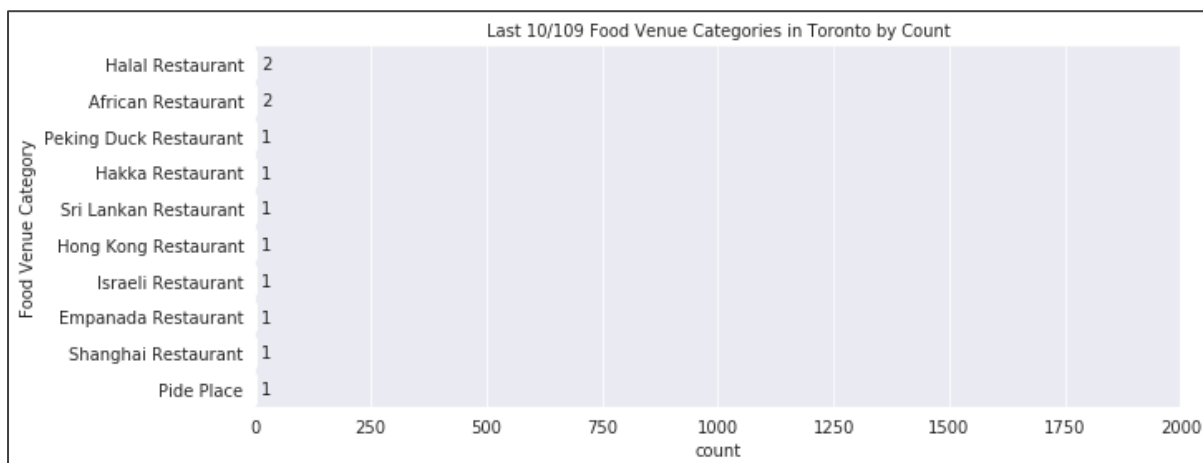


Figure 8 Last 10/109 Food venue categories in Toronto by Count

#### 3.2.1.D.n Count of Food Venues of Each Food Venue Category in New York City

Figure 9 shows the first 10 out the 142 unique Food venue categories of New York City. 'Pizza Place' turns out to be the first food venue category of New York City by count. It has a count of 1772 in all the neighborhoods of New York City. Figure 10 shows the last 10 out the 142 unique Food venue categories of New York City. As we could see that 'Burmese Restaurant' and many other Food venue categories have just 1 venue in all the neighborhoods of New York City.

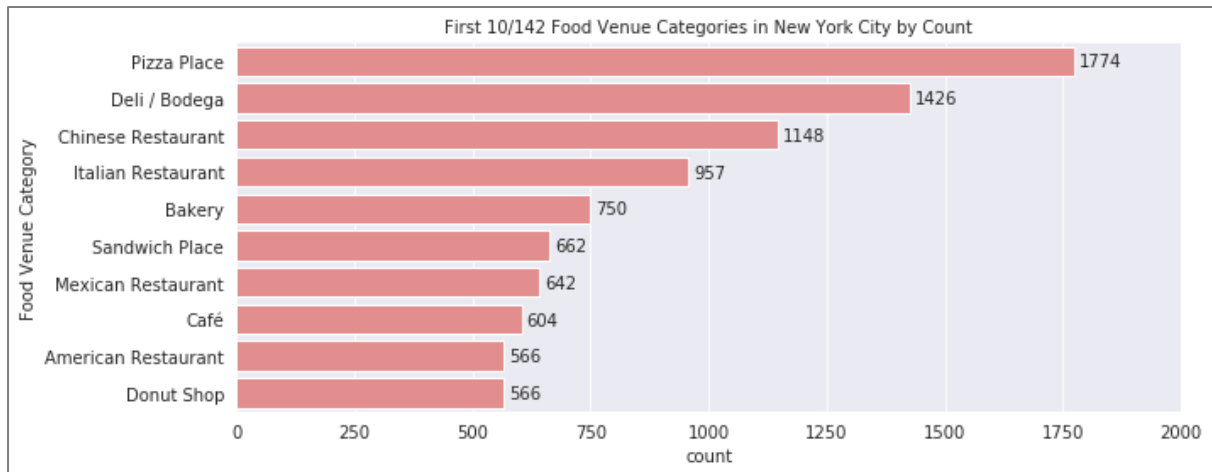


Figure 9 First 10/142 Food venue categories in New York City by Count

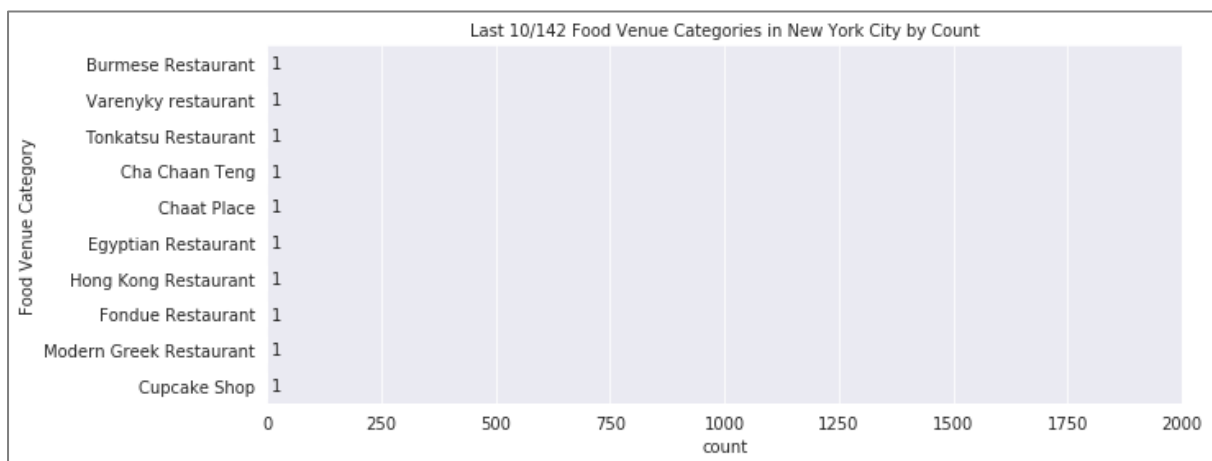


Figure 10 Last 10/142 Food venue categories in New York City by Count

The total count of 'Japanese Restaurant' in Toronto is 225 in 209 neighborhoods, while its count in the New York City is 322 in 306 neighborhoods. We could see it in Figure 9.1 below.

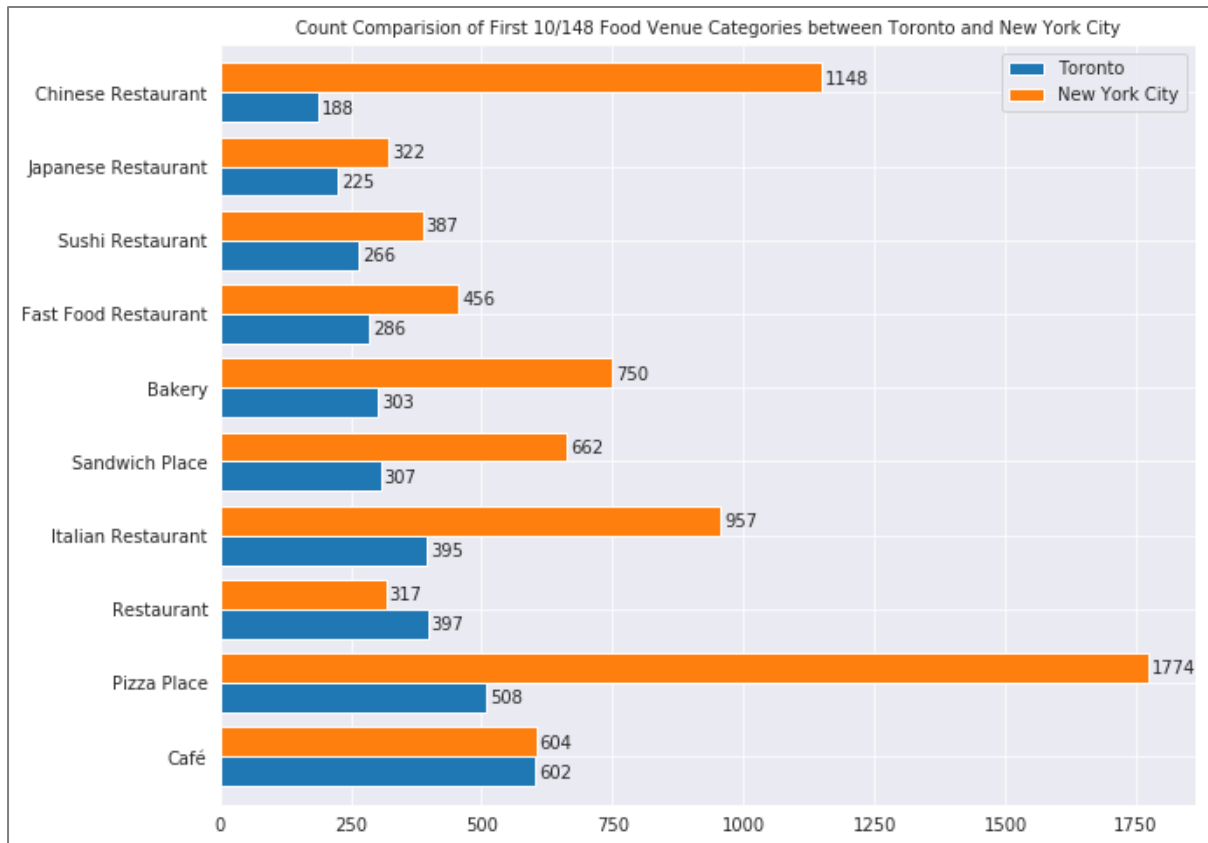


Figure 9.1 Comparison of total count of First 10/148 Food venue categories between Toronto and New York City

### 3.2.1.E. Food Venue Categories found in X, but not in Y

#### 3.2.1.E.t Food Venue Categories found in Toronto, but not in New York City

A total of 6 food venue categories were found in the neighborhoods of Toronto, but not in New York City. Figure 11 shows these 6 food venue categories along with their counts.

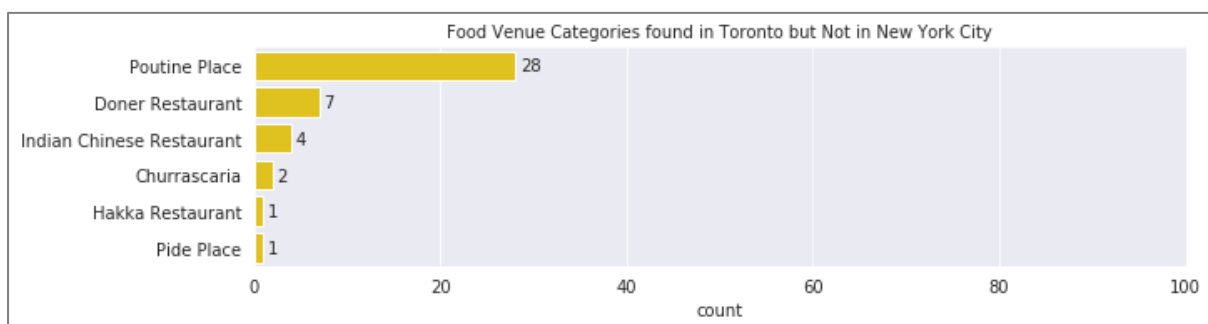


Figure 11 Food venue categories found in Toronto, but not in New York City

#### 3.2.1.E.n Food Venue Categories found in New York City, but not in Toronto

A total of 39 food venue categories were found in the neighborhoods of New York City, but not in Toronto. Figure 11 shows these 39 food venue categories along with their counts.

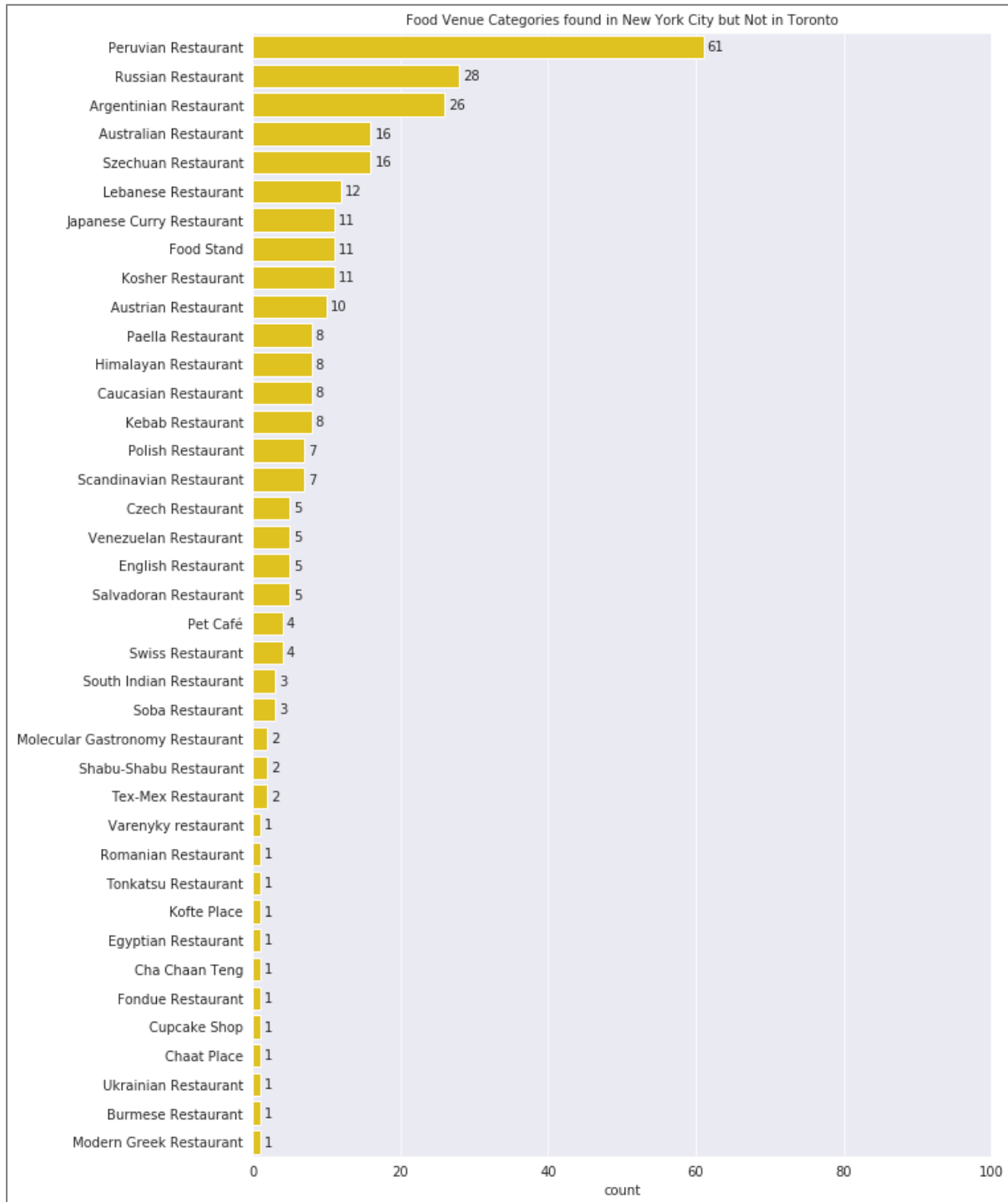


Figure 12 Food venue categories found in New York City, but not in Toronto

### 3.2.1.F. Food Venue Categories by Count in Each Borough

#### 3.2.1.F.t First 4 Food Venue Categories by Count in Each Borough of Toronto

Earlier in 3.2.1.D.t we found that ‘Café’, ‘Pizza Place’, ‘Restaurant’ and ‘Italian Restaurant’ were the first 4 Food venue categories in Toronto by count. The count of these 4 Food venue categories in each Borough of the Toronto is shown in the Figure 13 below. As we could in the Figure 13 that ‘Downtown Toronto’ has the highest number Food venues of each of these 4 Food Venue Category, while ‘Mississauga’ has the lowest.

The 3<sup>rd</sup> Food Venue Category by count in Toronto is ‘Restaurant’. It seems to be the kind of restaurant where all the different kinds of cuisines are served.

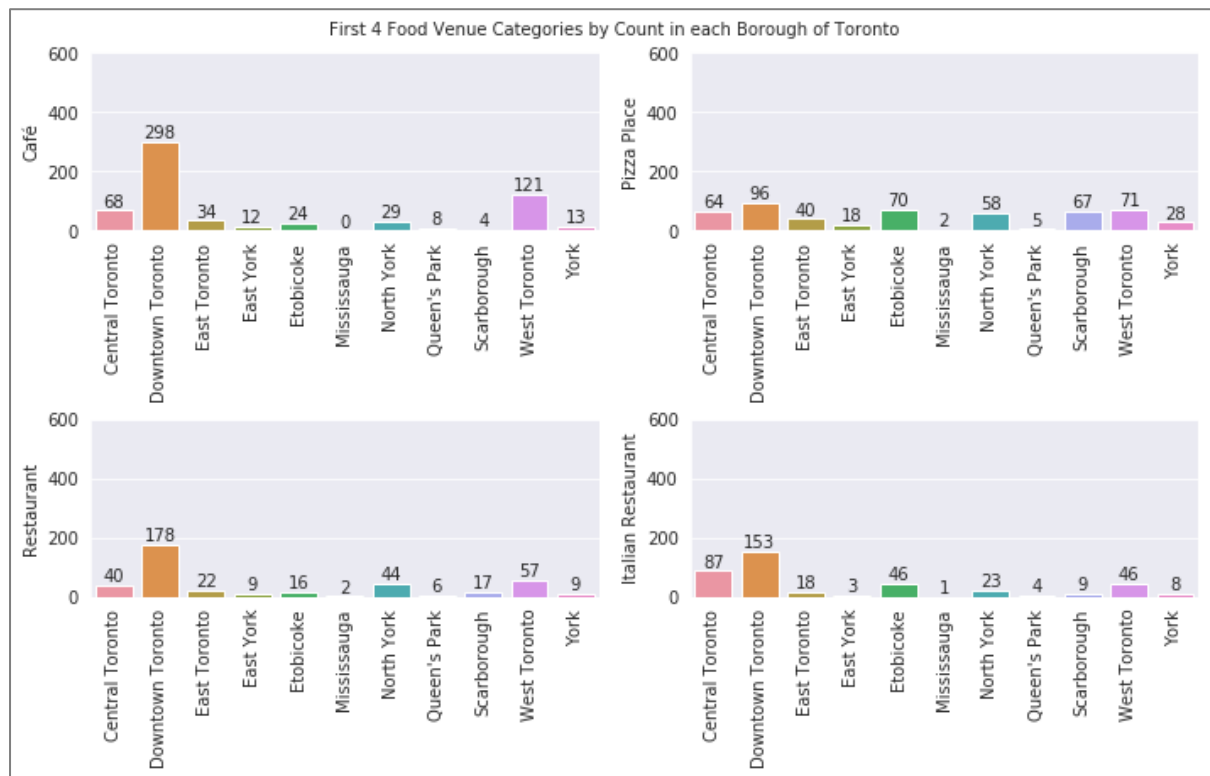


Figure 13 First 4 Food venue categories by Count in each Borough of Toronto

### 3.2.1.F.t First 4 Food Venue Categories by Count in Each Borough of New York City

Earlier in 3.2.1.D.n we found that ‘Pizza Place’, ‘Deli / Bodega’, ‘Chinese Restaurant’ and ‘Italian Restaurant’ were the first 4 Food venue categories in New York City. The count of these 4 Food venue categories in each Borough of the Toronto is shown in the Figure 14 below. As we could in the Figure 14 that ‘Brooklyn’ has the highest number of ‘Pizza Place’ Food venues, while ‘Manhattan’ has the highest count for ‘Italian Restaurant’.

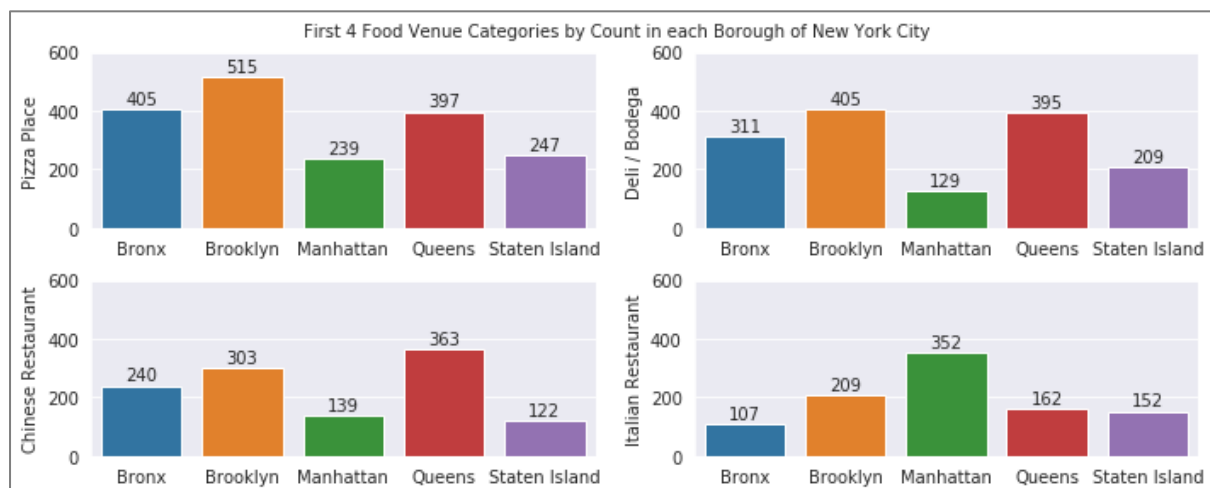


Figure 14 First 4 Food venue categories by Count in each Borough of New York City

### 3.2.1.G. 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> Most Common Food Venues in Neighborhoods

#### 3.2.1.G.t 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> Most Common Food Venues in the Neighborhoods of Toronto

Figure 15 shows 'Pizza Place' beats 'Café' by a very narrow margin to be the 1<sup>st</sup> most common Food venue in the neighborhoods of Toronto.

We could see that 'Japanese Restaurant' also falls in the 5<sup>th</sup> place in the 2<sup>nd</sup> most commonly found Food venues in Toronto.

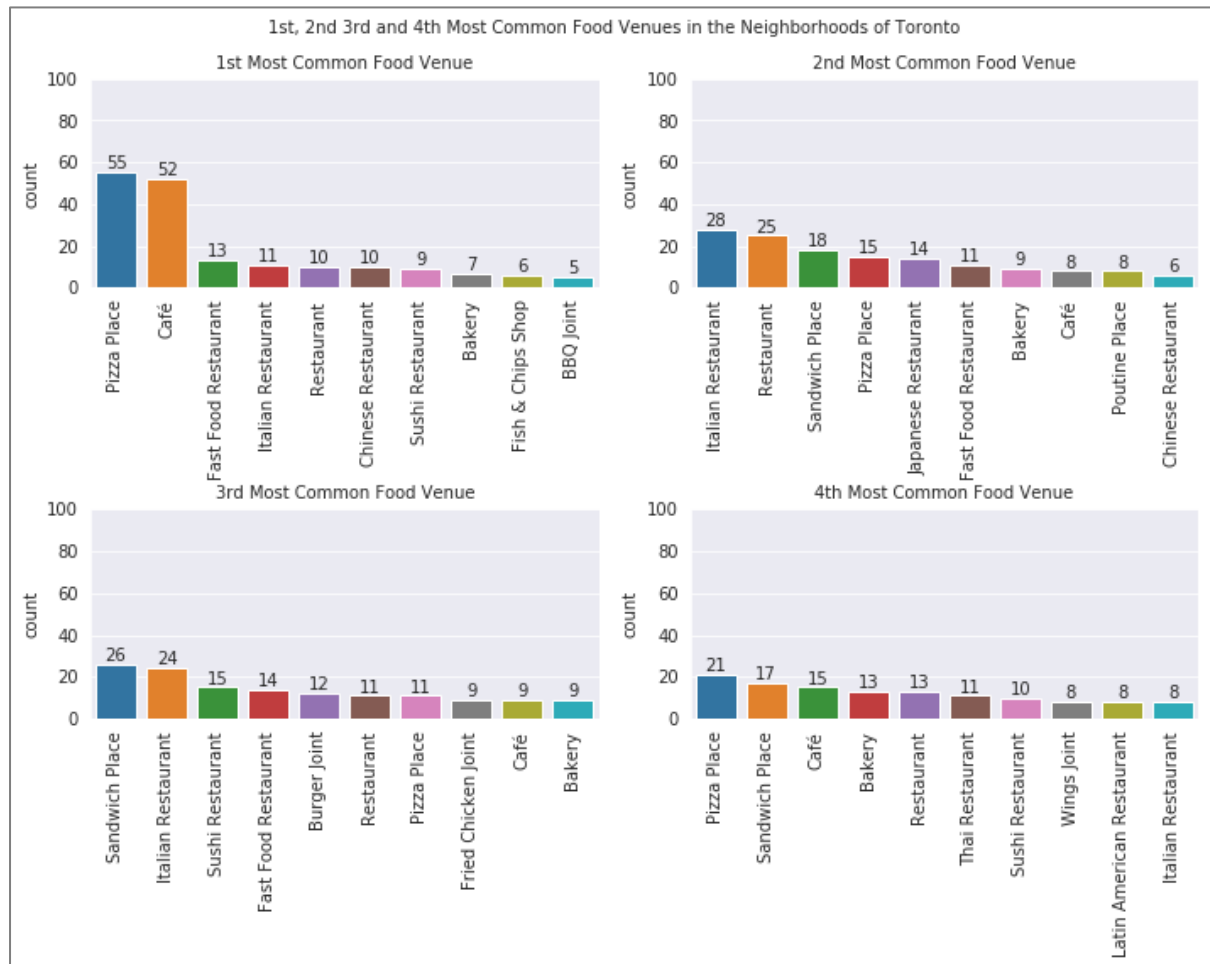
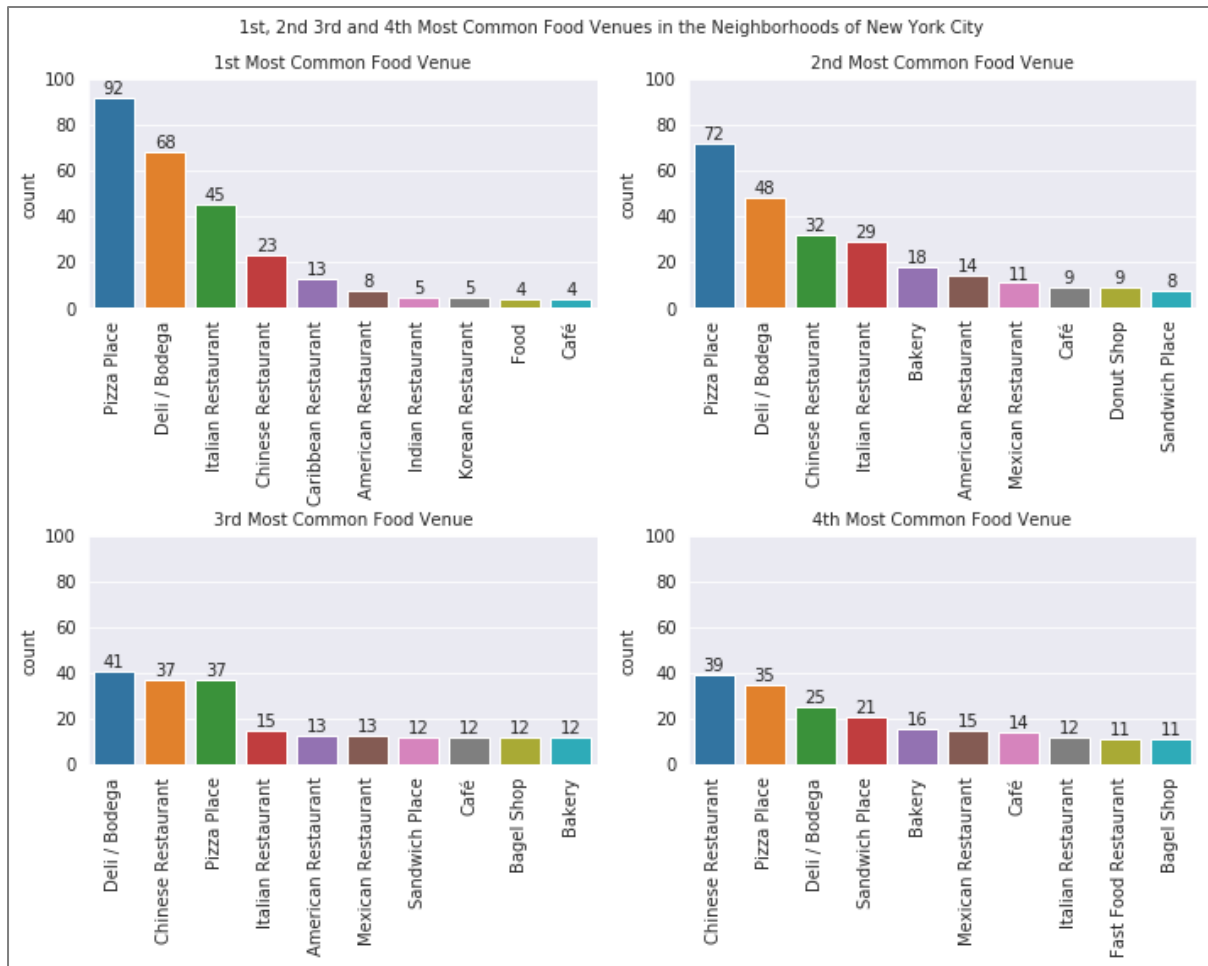


Figure 15 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> most common Food venues in neighborhoods of Toronto

#### 3.2.1.G.n 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> Most Common Food Venues in the Neighborhoods of NYC

Figure 16 shows 'Pizza Place' to be not just the 1<sup>st</sup>, but 2<sup>nd</sup> most common Food venue as well in the neighborhoods of New York City.

While Toronto had 'Japanese Restaurant' found in the 5<sup>th</sup> place of the 2<sup>nd</sup> most commonly found Food venues in Toronto, it is nowhere to be found in the first 4 most commonly found Food venues.

Figure 16 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> most common Food venues in neighborhoods of New York City

### 3.2.1.H Highly Disproportionate Food Venue Categories in Toronto and NYC

There were some important statistics about the counts of various Food venue categories that were found in both Toronto and NYC but were disproportionate by a huge margin (less than 5%). These are shown in the following Table 3.2.1.H.

Table 3.2.1.H Count Comparison of highly disproportionate Food Venue between NYC and Toronto

Food Venue Category	New York City (NYC)	Toronto
Southern / Soul Food Restaurant	88	2
Spanish Restaurant	233	3
South American Restaurant	73	3
Donut Shop	566	21
Deli / Bodega	1426	128

### 3.2.1 Arts & Entertainment

Using Foursquare Places API, the number of Arts & Entertainment venues in Toronto were 2083, while New York City had 4984 food venues. The number of unique Arts & Entertainment Venue Categories in Toronto was 30, while in New York City it was 37.

#### 3.2.2.A. Neighborhoods Without Any Arts & Entertainment Venues

##### 3.2.2.A.t Neighborhoods Without Any Arts & Entertainment Venues in Toronto

Number of unique neighborhoods in Toronto before being filtered by Arts & Entertainment venue categories was 209 but after filtering it come down to 207. So we had 20 neighborhoods that did not have any Arts & Entertainment venues within a circle of 1000 meters of radius. Table 2 below shows these 20 neighborhoods in the Toronto dataset used in the project.

Table 2 Toronto neighborhoods without any Arts & Entertainment venues

	Borough	Neighborhood	Latitude	Longitude
8	Scarborough	Rouge	43.806686	-79.194353
9	Scarborough	Malvern	43.806686	-79.194353
32	Scarborough	Guildwood	43.763573	-79.188711
33	Scarborough	Morningside	43.763573	-79.188711
34	Scarborough	West Hill	43.763573	-79.188711
37	York	Caledonia-Fairbanks	43.689026	-79.453512
38	Scarborough	Woburn	43.770992	-79.216917
53	Scarborough	Scarborough Village	43.744734	-79.239476
83	North York	Downsview West	43.739015	-79.506944
97	North York	Downsview Central	43.728496	-79.495697
105	North York	Emery	43.724766	-79.532242
106	North York	Humberlea	43.724766	-79.532242
110	North York	Downsview Northwest	43.761631	-79.520999
125	Etobicoke	Westmount	43.696319	-79.532242
128	North York	Willowdale West	43.782736	-79.442259
146	Scarborough	Clarks Corners	43.781638	-79.304302
147	Scarborough	Sullivan	43.781638	-79.304302
148	Scarborough	Tam O'Shanter	43.781638	-79.304302
186	Etobicoke	Northwest	43.706748	-79.594054
187	Scarborough	Upper Rouge	43.836125	-79.205636

##### 3.2.2.A.n Neighborhoods Without Any Arts & Entertainment Venues in New York City

Number of unique neighborhoods in New York City before being filtered by Arts & Entertainment venue categories was 302 but after filtering it come down to 292. So we had 10 neighborhoods that did not have any Arts & Entertainment venues within a circle of 1000 meters of radius. Table 3 below shows these 10 neighborhoods in the New York City dataset used in the project.



Table 3 New York City neighborhoods without any Arts &amp; Entertainment venues

	Borough	Neighborhood	Latitude	Longitude
76	Brooklyn	Mill Island	40.606336	-73.908186
172	Queens	Breezy Point	40.557401	-73.925512
177	Queens	Arverne	40.589144	-73.791992
179	Queens	Neponsit	40.572037	-73.857547
203	Staten Island	Todt Hill	40.597069	-74.111329
207	Staten Island	Port Ivory	40.639683	-74.174645
227	Staten Island	Arlington	40.635325	-74.165104
245	Staten Island	Bloomfield	40.605779	-74.187256
257	Staten Island	Howland Hook	40.638433	-74.186223
303	Queens	Bayswater	40.611322	-73.765968

### 3.2.2.B. Count of Arts & Entertainment Venues in each Borough

#### 3.2.2.B.t Count of Arts & Entertainment Venues in each Borough of Toronto

The maximum number of Arts & Entertainment venues was found in Downtown Toronto. The count was 381. Mississauga on the other hand had the minimum number of Arts & Entertainment venues. It had only 4 Arts & Entertainment venues.

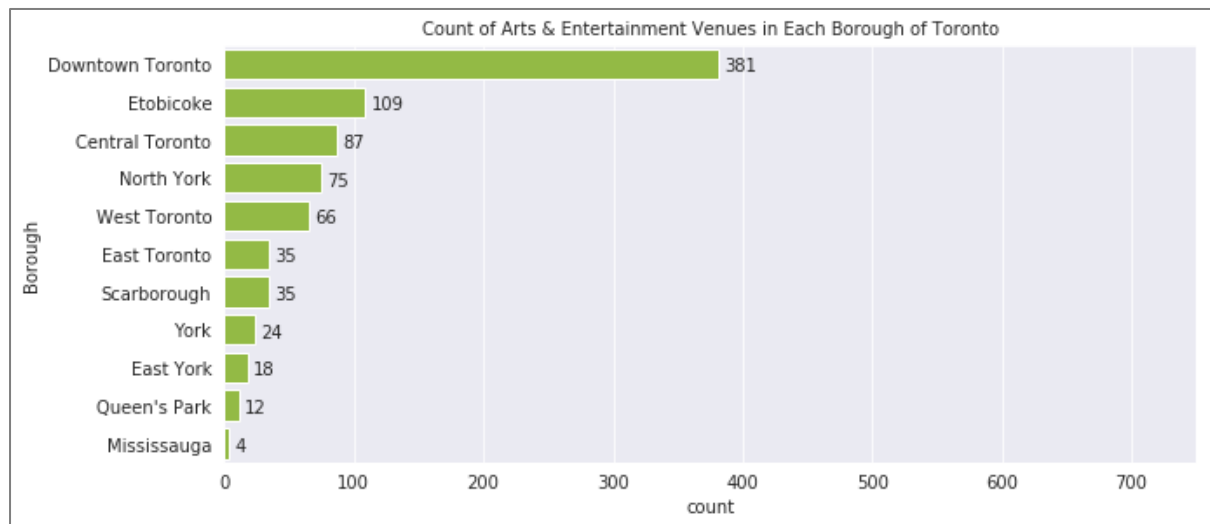


Figure 17 Count of Arts &amp; Entertainments venues in each Borough of Toronto

#### 3.2.2.B.n Count of Arts & Entertainment Venues in each Borough of New York City

The maximum number of Arts & Entertainment venues was found in Manhattan. The count was 581. Staten Island on the other hand had the minimum number of Arts & Entertainment venues. It had 181 Arts & Entertainment venues.

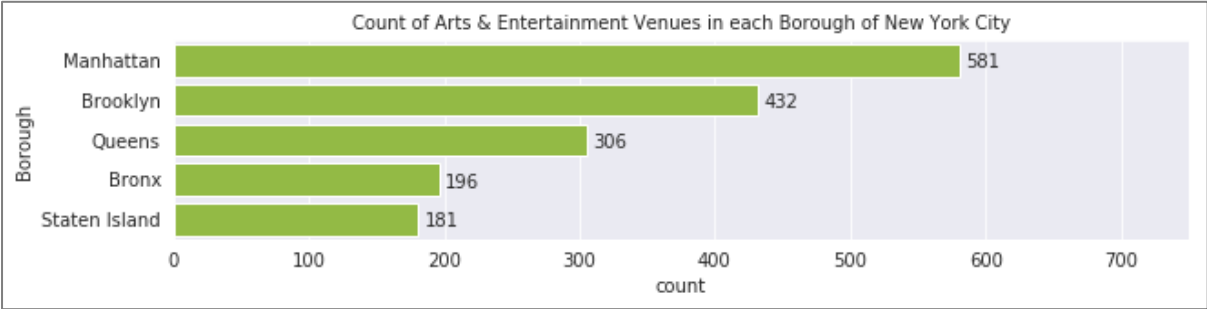


Figure 18 Count of Arts & Entertainments venues in each Borough of New York City

3.2.1.C. Count of Arts and Entertainments Venues in Each Neighborhood

3.2.1.C.t Count of Arts & Entertainment Venues in Each Neighborhood of Toronto

Following Figure 19 shows the first 5 of 209 neighbourhoods of Toronto by the count of Arts & Entertainment venues. ‘Adelaide’ and 2 others have a count of 69 each, while ‘Cliffcrest’ and others in Figure 20 have a count of 1 each.

The maximum number of venues returned by Foursquare API is 100. So if a neighborhood has more than 100 Arts & Entertainment venues within 1000 meters then it will not be included in the result. As Figure 19 below shows, the first 5 of 209 neighborhoods in Toronto seems to have more than 100 Arts & Entertainment venues within 1000 meters of radius.

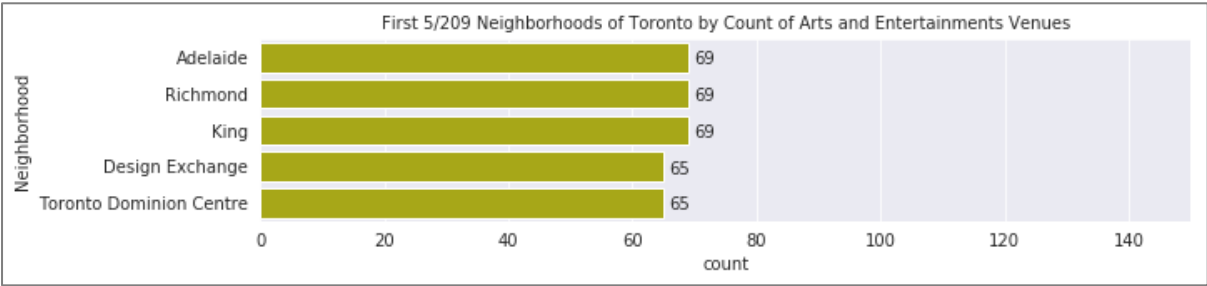


Figure 19 First 5/209 Neighborhoods of Toronto by Count of Arts & Entertainment Venues



Figure 20 Last 5/209 Neighborhoods of Toronto by Count of Arts & Entertainment Venues

3.2.2.C.n Count of Arts & Entertainment Venues in Each Neighborhood of New York City

Figure 21 below shows the first 5 of 306 neighbourhoods of New York City by the count of Arts & Entertainment venues. ‘Chelsea’ had the highest count of 105. Figure 22 shows that ‘Queensboro Hill’ has a lowest count of just 1.

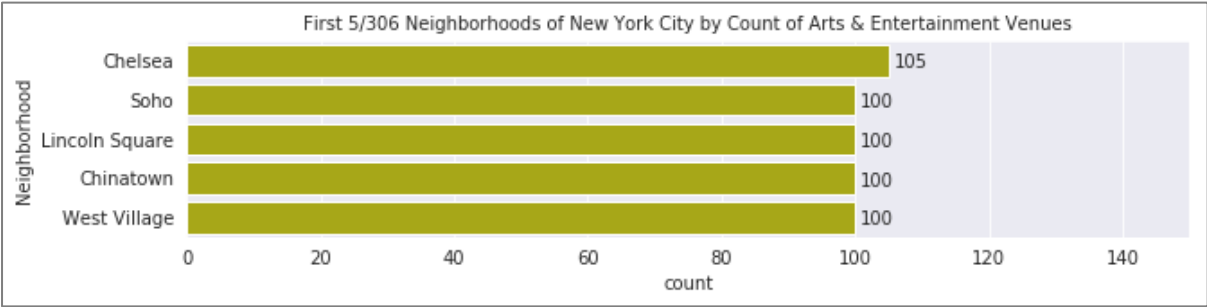


Figure 21 First 5/209 Neighborhoods of New York City by Count of Arts & Entertainment Venues

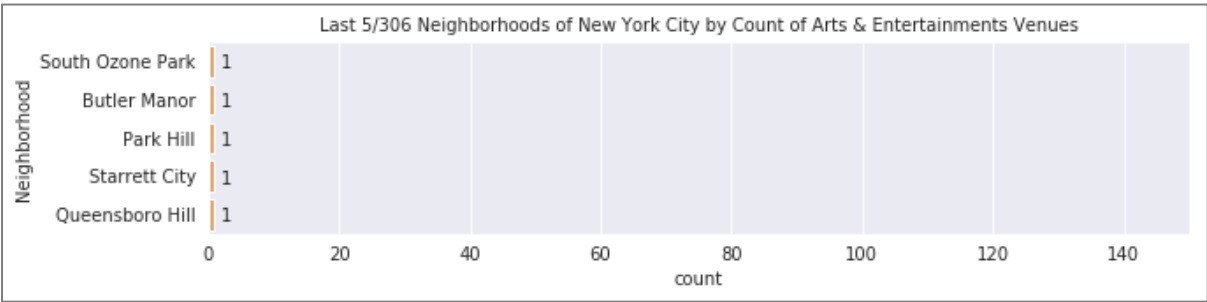


Figure 22 Last 5/209 Neighborhoods of New York City by Count of Arts & Entertainment Venues

**3.2.2.D. Count of Arts & Entertainment Venues of Each Arts & Entertainment Venue Category**

**3.2.2.D.t Count of Arts & Entertainment Venues of Each Arts & Entertainment Venue Category in Toronto**

Figure 23 shows the first 10 out the 30 unique Arts & Entertainment venue categories of Toronto. ‘Art Gallery’ turns out to be the first Arts & Entertainment venue category of Toronto by count. It has a count of 450 in all the neighborhoods of Toronto. A total of 52 ‘History Museum’ are also found in the city for tourists to explore.

Figure 24 shows the last 10 out the 30 unique Arts & Entertainment venue categories of Toronto. As we could see that ‘Salsa Club’ has just 1 venue in all the neighborhoods of Toronto.

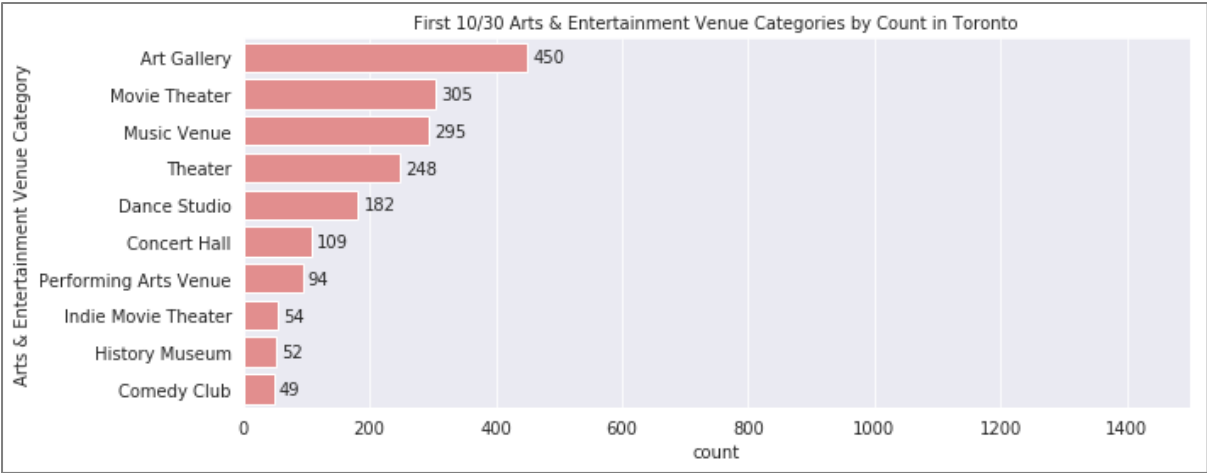


Figure 23 First 10/30 Arts & Entertainment venue categories in Toronto by Count

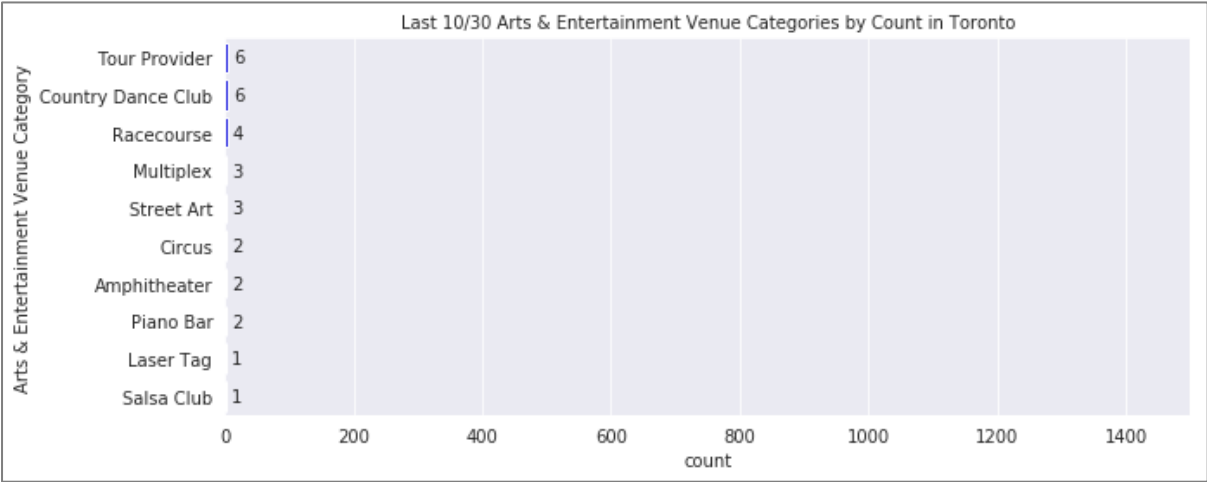


Figure 24 Last 10/30 Arts & Entertainment venue categories in Toronto by Count

3.2.2.D.n Count of Arts & Entertainment Venues of Each Arts & Entertainment Venue Category in New York City

Figure 25 shows the first 10 out the 37 unique Arts & Entertainment venue categories of New York City. Just like Toronto, ‘Art Gallery’ turns out to be the first Arts & Entertainment venue category by count in New York City as well. It has a count of 1418 in all the neighborhoods of New York City.

Compared to Toronto, New York City has 125 ‘History Museum’ to be explored. Toronto had just 52 of them.

Figure 26 shows the last 10 out the 37 unique Arts & Entertainment venue categories of Toronto. As we could see that while Toronto had just 1 ‘Salsa Club’, New York City also has just 2 of these. Also, just like Toronto, New York City has just 1 ‘Laser Tag’.

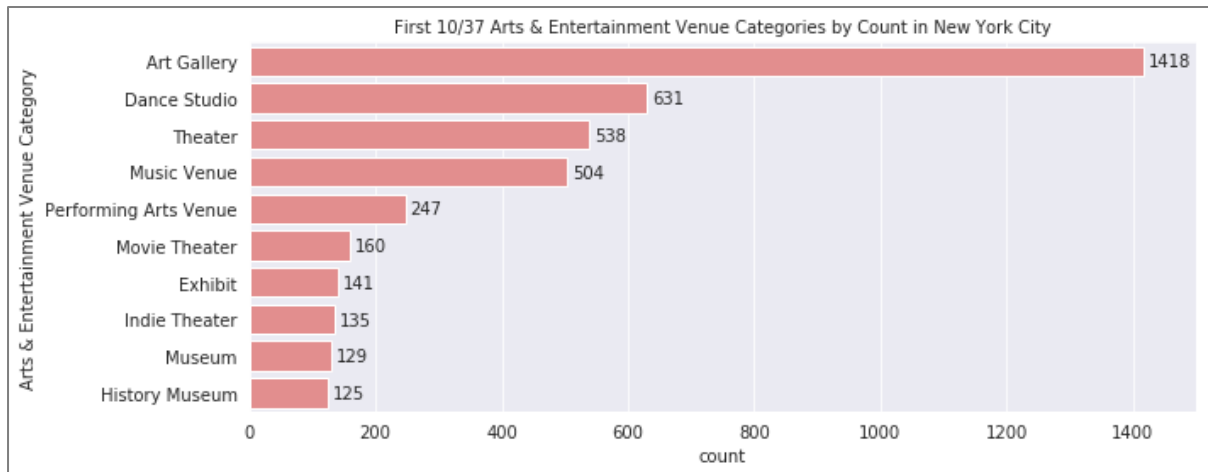


Figure 25 First 10/37 Arts &amp; Entertainment venue categories in New York City by Count

Both Toronto and New York City have a lot of ‘Art Gallery’ venues to visit. Toronto has a total of 450 while New York City has 1418 of them.

When it comes to ‘Museum’ and ‘History Museum’, New York City has 129 and 125 of them while Toronto has 39 and 52 of them.

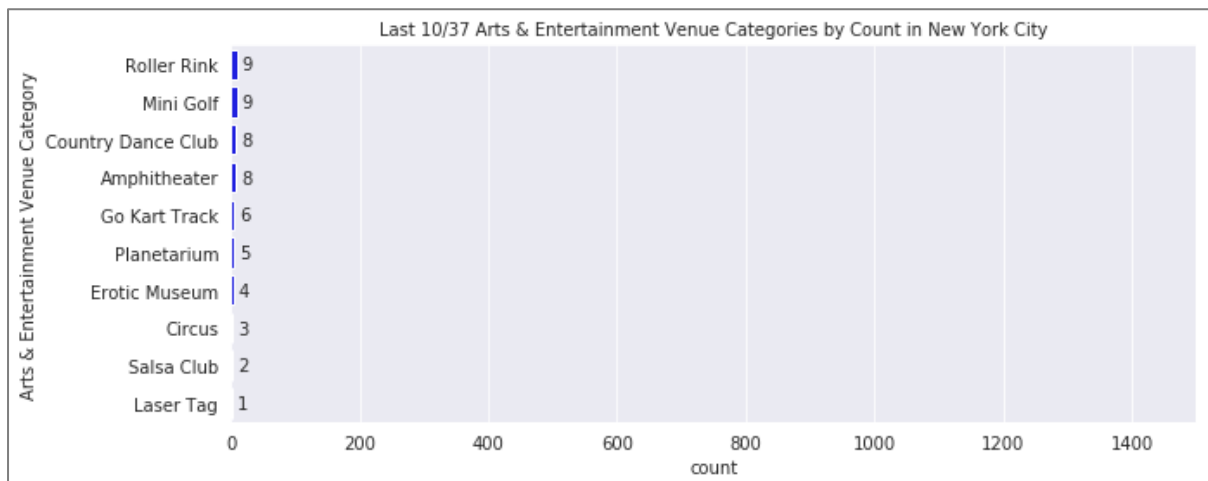


Figure 26 Last 10/37 Arts &amp; Entertainment venue categories in New York City by Count

### 3.2.2.E. Arts & Entertainment Venue Categories found in X, but not in Y

**3.2.2.E.t Arts & Entertainment Venue Categories found in Toronto, but not in New York City**  
A total of just 1 Arts & Entertainment venue categories were found in the neighborhoods of Toronto, but not in New York City. Figure 27 shows that Arts & Entertainment venue category along with its count. As the figure shows, it is just ‘Racecourse’ in the Arts & Entertainment Venue Category that is found in Toronto but not in New York City. According to Foursquare Places API there is no ‘Racecourse’ in New York City while Toronto has 4 of them.

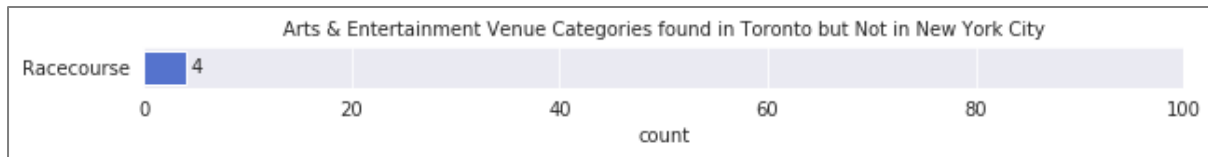


Figure 27 Arts &amp; Entertainment Venue Categories found in Toronto, but not in New York City

### 3.2.2.E.n Arts & Entertainment Venue Categories found in New York City, but not in Toronto

A total of 8 Arts & Entertainment venue categories were found in the neighborhoods of New York City, but not in Toronto. Figure 28 below shows these 8 Arts & Entertainment venue categories along with their counts. According to Foursquare Places API there is no 'Memorial Site' or 'Erotic Museum' in Toronto, but found in New York City.

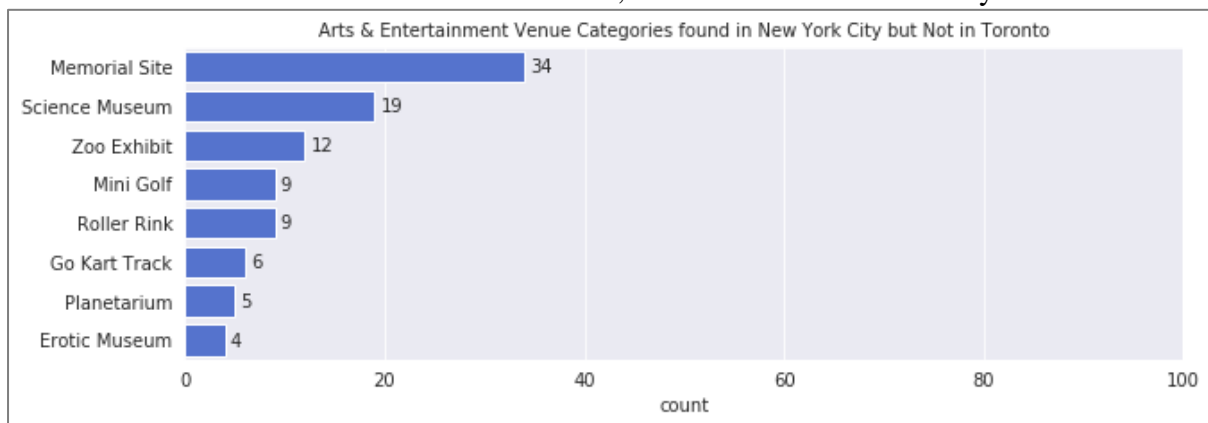


Figure 28 Arts &amp; Entertainment Venue Categories found in New York City, but not in Toronto

[This](#) page from Wikipedia tells us that Toronto has many war 'Mamorial Site' venues.

### 3.2.2.F. Arts & Entertainment Venue Categories by Count in Each Borough

#### 3.2.2.F.t First 4 Arts & Entertainment Venue Categories by Count in Each Borough of Toronto

Earlier in 3.2.2.D.t we found that 'Art Gallery', 'Movie Theater', 'Music Venue' and 'Theater' were the 4 first 4 Arts & Entertainment venue categories in Toronto by count. The count of these 4 Food venue categories in each Borough of the Toronto is shown in the Figure 29 below. As we could in the Figure 29 that 'Downtown Toronto' has the highest number of Arts & Entertainment venues of each of these 4 Food Venue Categories, while others are comparatively quite far behind it.

The 3<sup>rd</sup> Food Venue Category by count in Toronto is 'Theater'. It seems to be the kind of theater where all the different kinds of events like song, movie, dance, opera, speech, gesture etc. are performed in front of an audience.

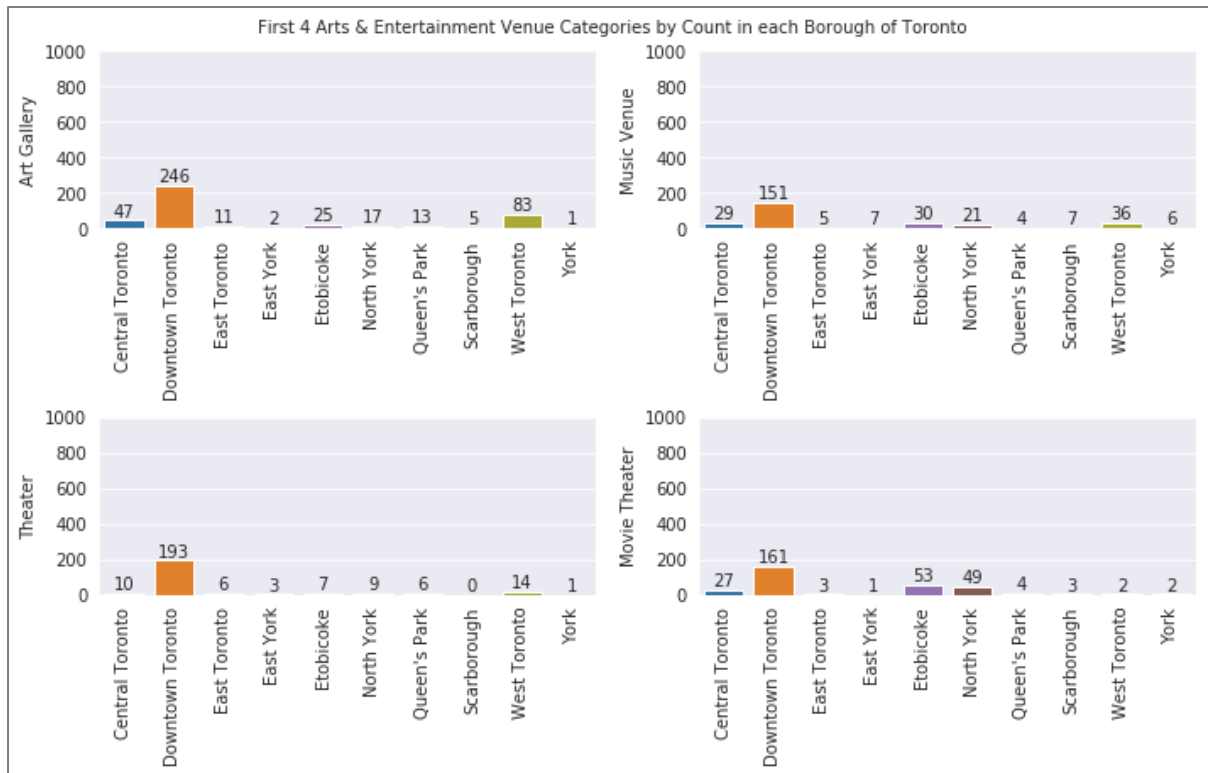


Figure 29 First 4 Arts &amp; Entertainment venue categories by Count in each Borough of Toronto

### 3.2.2.F.n First 4 Arts & Entertainment Venue Categories by Count in Each Borough of New York City

Earlier in 3.2.2.D.n we found that 'Art Gallery', 'Dance Studio', 'Theater' and 'Music Venue' were the first 4 Arts & Entertainment venue categories in New York City. The count of these 4 Arts & Entertainment venue categories in each Borough of the Toronto is shown in the Figure 30 below. As we could in the Figure 30 that 'Manhattan' has the highest number of 'Art Gallery', 'Dance Studio', 'Theater' venues, while 'Bronx' has the lowest of these venues'.

Brooklyn has the highest count for 'Music Venue', while Manhattan is not far behind even in that category.

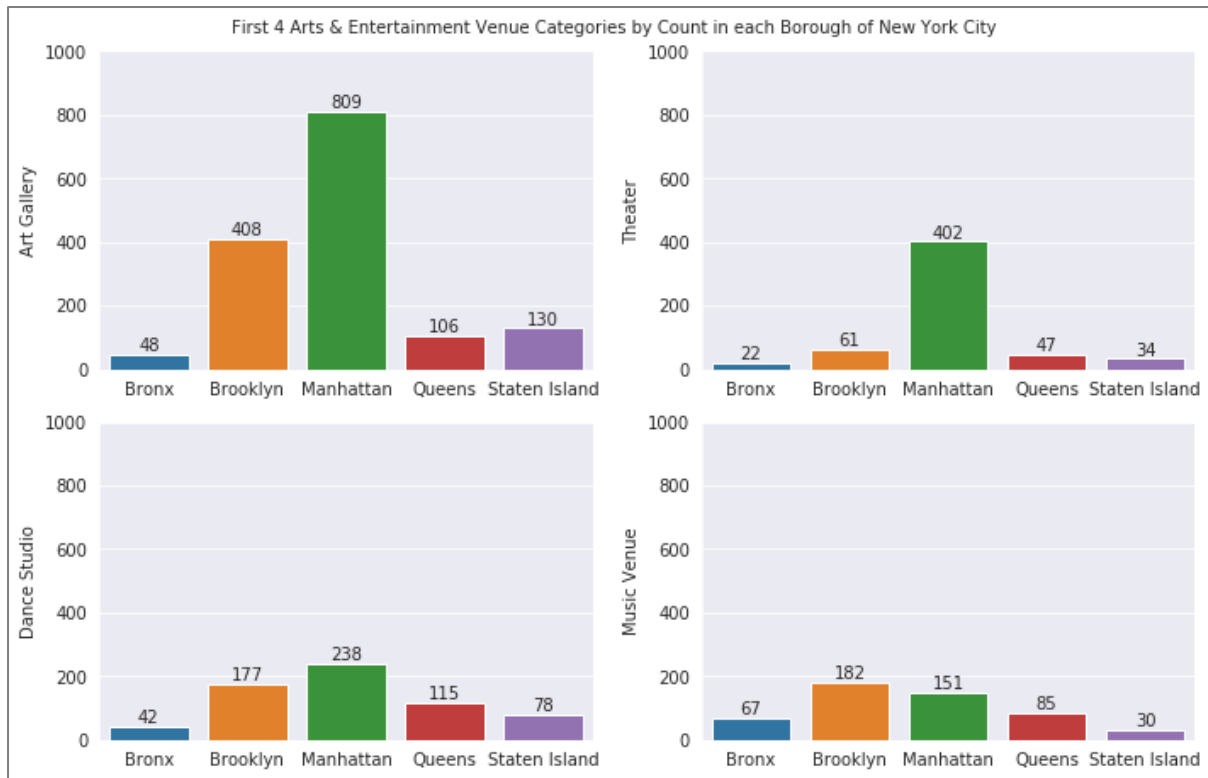


Figure 30 First 4 Arts &amp; Entertainment venue categories by Count in each Borough of Toronto

### 3.2.2.G. 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> Most Common Arts & Entertainment Venues in Neighborhoods

#### 3.2.2.G.t 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> Most Common Arts & Entertainment Venues in the Neighborhoods of Toronto

Figure 31 shows 'Art Gallery' is the 1<sup>st</sup> most common Arts & Entertainment venue in the neighborhoods of Toronto. 'Music Venue' to be the 2<sup>nd</sup> most common category. On 3<sup>rd</sup> we have 'Tour Provider' and on 4<sup>th</sup> the 'Jazz Club' category.

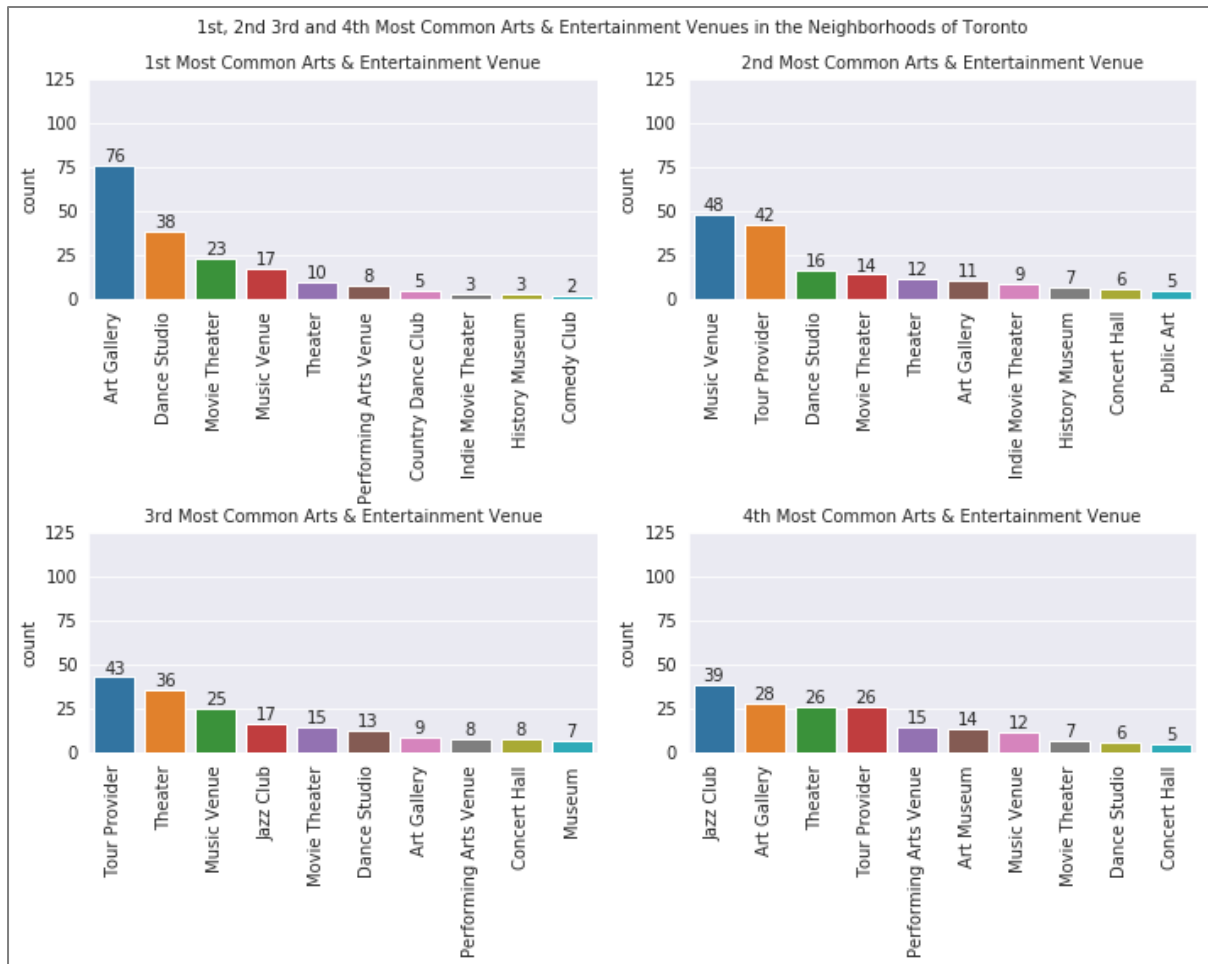
It is important to note that even though we had 'Movie Theater', 'Music Venue' and 'Theater' at the 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> number based on the count of these categories, when it comes to most common categories there is a difference in their respective positions.

This difference could be due to the fact that A neighborhood might have a high number of venues for a particular category X, but it doesn't make the category X to be the most common category, because the category X might not be evenly spread out across all the neighborhoods of a city.

For example, 'Music Venue' has a total count of 295 for 209 neighborhoods of Toronto, standing at the 3<sup>rd</sup> position by its total count, that is more than 1 venue per neighbourhood. But it stands at the 2<sup>nd</sup> most commonly found category with 48 venues. 48 venues of 'Music Venue' category means in every 4 neighborhood there is a 'Music Venue'.

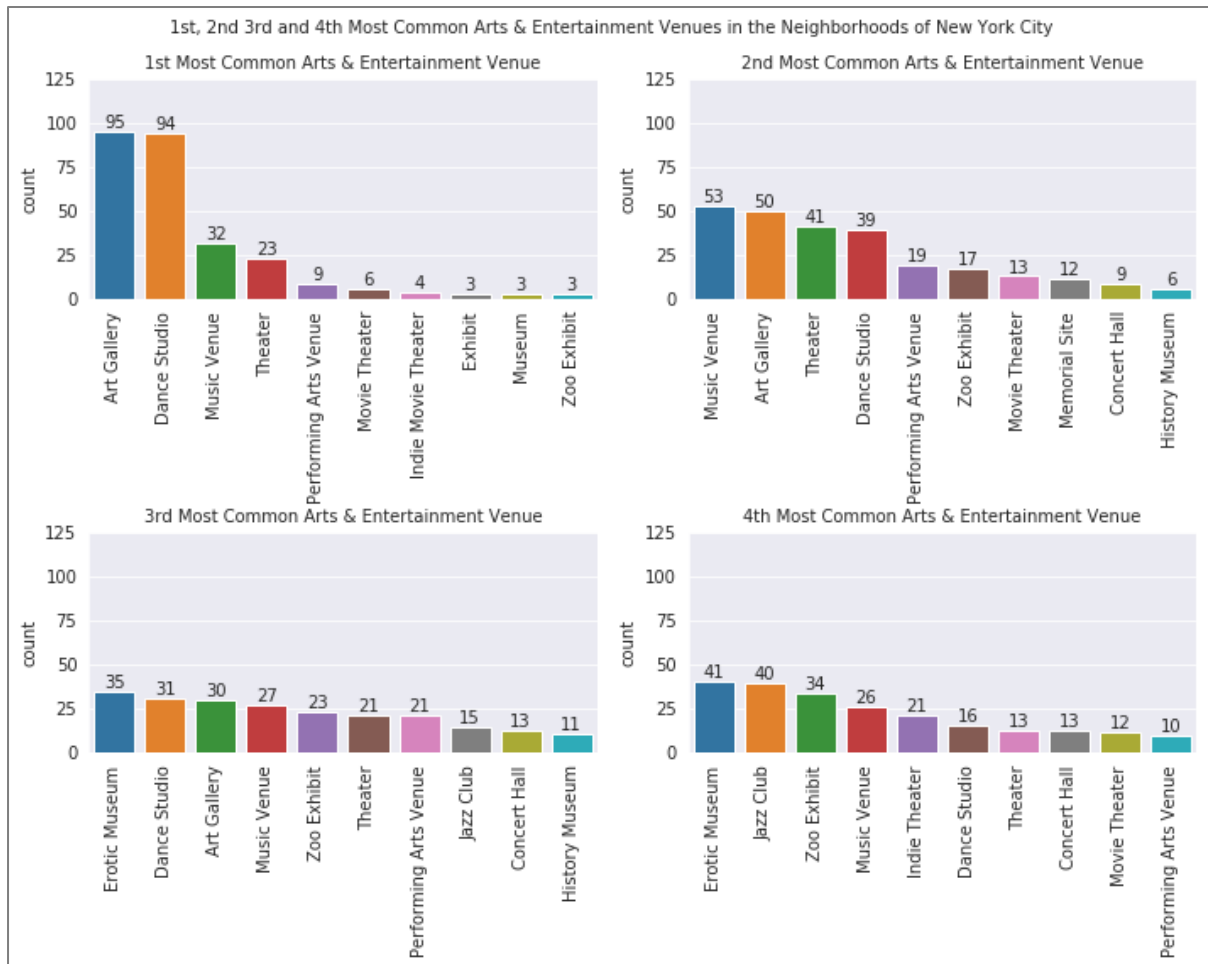
It basically means that the position of a category based on its total venue count doesn't necessarily mean that its position in the most commonly found categories will be the same.



Figure 31 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> most common Arts and Entertainment venues in neighborhoods of Toronto

### 3.2.2.G.n 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> Most Common Arts & Entertainment Venues in the Neighborhoods of New York City

Figure 32 shows 'Art Gallery' and 'Dance Studio' stand neck and neck as the former beats the later just by 1 venue. 'Music Venue' comes 2<sup>nd</sup>. 'Erotic Museum' seems to be quite well spread out in new York city as it turns out to be the 3<sup>rd</sup> and 4<sup>th</sup> most commonly found.

Figure 32 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> most common Arts and Entertainment venues in neighborhoods of New York City

### 3.2.2.H Highly Disproportionate Arts & Entertainment Venue Categories in Toronto and NYC

Unlike Food category, in Arts & Entertainment venue categories, there was just 1 venue category that had less than 5% venue count in one city compared to the other. It was 'Indie Theater'. NYC had 135 venues of it while Toronto had just 6 of them.

### 3.2.2 Nightlife Spot

Using Foursquare Places API, the number of Nightlife Spot venues in Toronto were 3331, while New York City had 6169 of them. The number of unique Arts & Entertainment Venue Categories in Toronto was 72, while in New York City it was 135.

### 3.2.3.A. Neighborhoods Without Any Nightlife Spot Venues

#### 3.2.3.A.t Neighborhoods Without Any Nightlife Spot Venues in Toronto

Number of unique neighborhoods in Toronto before being filtered by Nightlife Spot venue categories was 209 but after filtering it come down to 175. So we had 34 neighborhoods that did not have any Arts & Entertainment venues within a circle of 1000 meters of radius. Table 4 below shows these 34 neighborhoods in the Toronto dataset used in the project.

Table 4 Toronto neighborhoods without any Nightlife Spot venues

	<b>Borough</b>	<b>Neighborhood</b>	<b>Latitude</b>	<b>Longitude</b>
<b>68</b>	North York	Bayview Village	43.786947	-79.385975
<b>81</b>	North York	Silver Hills	43.757490	-79.374714
<b>82</b>	North York	York Mills	43.757490	-79.374714
<b>83</b>	North York	Downsview West	43.739015	-79.506944
<b>97</b>	North York	Downsview Central	43.728496	-79.495697
<b>105</b>	North York	Emery	43.724766	-79.532242
<b>106</b>	North York	Humberlea	43.724766	-79.532242
<b>110</b>	North York	Downsview Northwest	43.761631	-79.520999
<b>111</b>	Central Toronto	Lawrence Park	43.728020	-79.388790
<b>146</b>	Scarborough	Clarks Corners	43.781638	-79.304302
<b>147</b>	Scarborough	Sullivan	43.781638	-79.304302
<b>148</b>	Scarborough	Tam O'Shanter	43.781638	-79.304302
<b>154</b>	Scarborough	Agincourt North	43.815252	-79.284577
<b>155</b>	Scarborough	L'Amoreaux East	43.815252	-79.284577
<b>156</b>	Scarborough	Milliken	43.815252	-79.284577
<b>157</b>	Scarborough	Steeles East	43.815252	-79.284577
<b>173</b>	Etobicoke	Albion Gardens	43.739416	-79.588437
<b>174</b>	Etobicoke	Beaumont Heights	43.739416	-79.588437
<b>175</b>	Etobicoke	Humbergate	43.739416	-79.588437
<b>176</b>	Etobicoke	Jamestown	43.739416	-79.588437
<b>177</b>	Etobicoke	Mount Olive	43.739416	-79.588437
<b>178</b>	Etobicoke	Silverstone	43.739416	-79.588437
<b>179</b>	Etobicoke	South Steeles	43.739416	-79.588437
<b>180</b>	Etobicoke	Thistletown	43.739416	-79.588437
<b>181</b>	Scarborough	L'Amoreaux West	43.799525	-79.318389
<b>187</b>	Scarborough	Upper Rouge	43.836125	-79.205636
<b>197</b>	Etobicoke	Humber Bay	43.636258	-79.498509
<b>198</b>	Etobicoke	King's Mill Park	43.636258	-79.498509
<b>199</b>	Etobicoke	Kingsway Park South East	43.636258	-79.498509
<b>200</b>	Etobicoke	Mimico NE	43.636258	-79.498509
<b>201</b>	Etobicoke	Old Mill South	43.636258	-79.498509
<b>202</b>	Etobicoke	The Queensway East	43.636258	-79.498509
<b>203</b>	Etobicoke	Royal York South East	43.636258	-79.498509
<b>204</b>	Etobicoke	Sunnylea	43.636258	-79.498509

### 3.2.3.A.n Neighborhoods Without Any Nightlife Spot Venues in New York City

Number of unique neighborhoods in New York City before being filtered by Nightlife Spot venue categories was 302 but after filtering it come down to 294. So we had 8 neighborhoods that did not have any Nightlife Spot venues within a circle of 1000 meters of radius. Table 5 below shows these 8 neighborhoods in the New York City dataset used in the project

Table 5 New York City neighborhoods without any Nightlife Spot venues

	Borough	Neighborhood	Latitude	Longitude
76	Brooklyn	Mill Island	40.606336	-73.908186
176	Queens	Edgemere	40.595642	-73.776133
203	Staten Island	Todt Hill	40.597069	-74.111329
204	Staten Island	South Beach	40.580247	-74.079553
243	Staten Island	Heartland Village	40.589139	-74.159022
251	Staten Island	Richmond Town	40.569606	-74.134057
287	Staten Island	Egbertville	40.579119	-74.127272
292	Staten Island	Lighthouse Hill	40.576506	-74.137927

### 3.2.3.B. Count of Nightlife Spot Venues in each Borough

#### 3.2.3.B.t Count of Nightlife Spot Venues in each Borough of Toronto

The maximum number of Nightlife venues was found in Downtown Toronto. The count was 381. Mississauga on the other hand had the minimum number of them. It had only 4 venues.

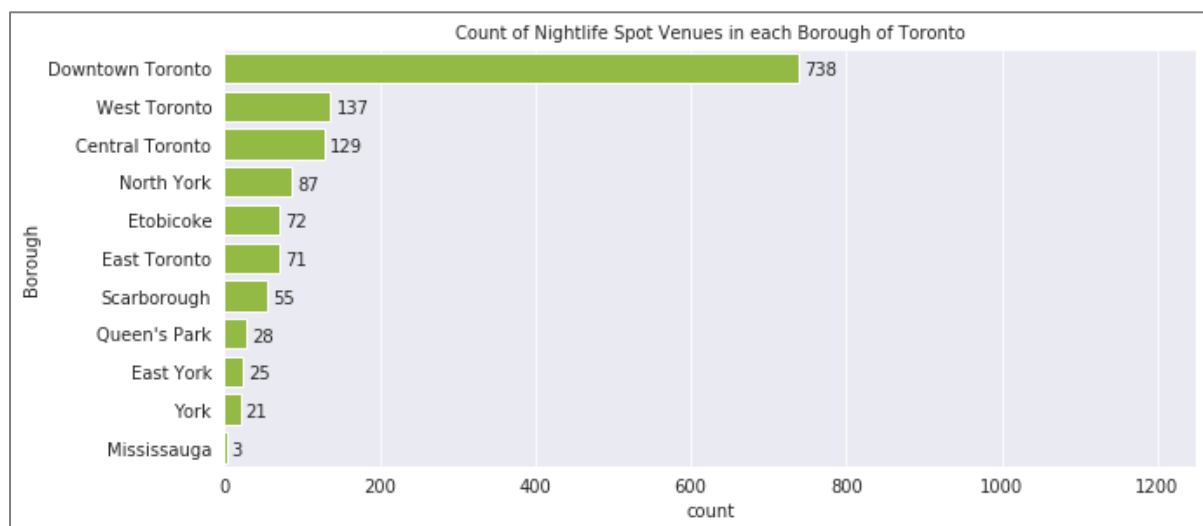


Figure 33 Count of Nightlife Spot venues in each Borough of Toronto

#### 3.2.3.B.n Count of Nightlife Spot Venues in each Borough of New York City

The maximum number of Nightlife Spot venues was found in Manhattan. The count was 1112. Bronx on the other hand had the minimum of them. It had 233 venues.

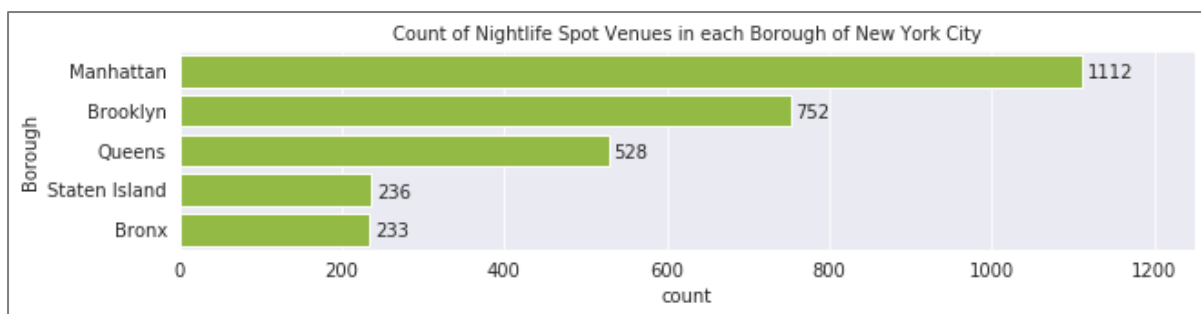


Figure 34 Count of Nightlife Spot venues in each Borough of New York City

### 3.2.3.C. Count of Nightlife Spot Venues in Each Neighborhood

#### 3.2.3.C.t Count of Nightlife Spot Venues in Each Neighborhood of Toronto

Figure 35 shows the first 5 of 209 neighbourhoods of Toronto by the count of Nightlife Spot venues. 'Adelaide' and all others have a count of 100, while 'Martin Grove Gardens' and others in Figure 36 have a count of 1 each.

The maximum number of venues returned by Foursquare API is 100. So if a neighborhood has more than 100 Nightlife Spot venues within 1000 meters then it will not be included in the result. As Figure 35 shows, the first 5 of 209 neighborhoods in Toronto seems to have more than 100 Nightlife Spot venues within 1000 meters of radius.

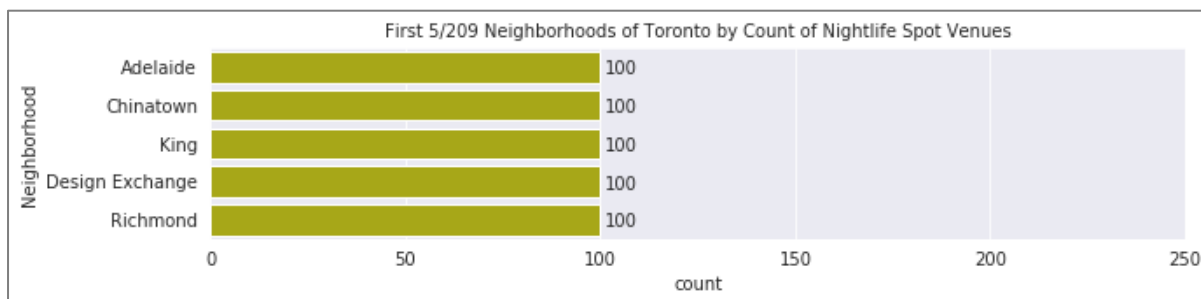


Figure 35 First 5/209 Neighborhoods of Toronto by Count of Nightlife Spot Venues

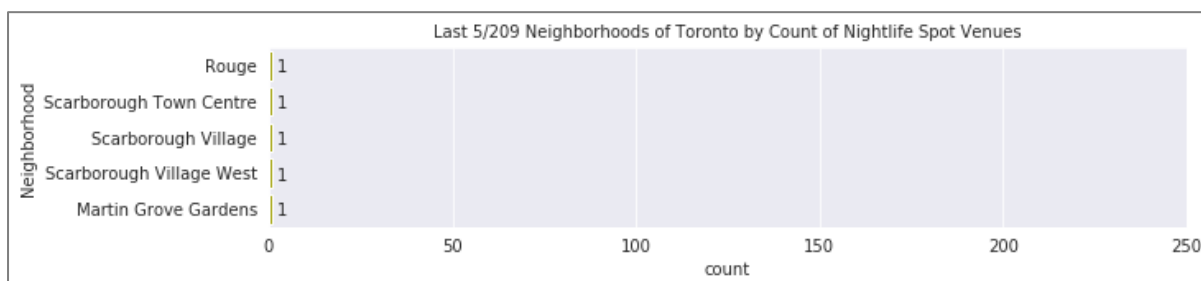


Figure 36 Last 5/209 Neighborhoods of Toronto by Count of Nightlife Spot Venues

#### 3.2.3.C.n Count of Nightlife Spot Venues in Each Neighborhood of New York City

Figure 37 below shows the first 5 of 306 neighbourhoods of New York City by the count of Nightlife Spot venues. 'Murray Hill' had the highest count of 122. Figure 38 on the other hand shows that 'Howland Hook' and others have a lowest count of just 1.

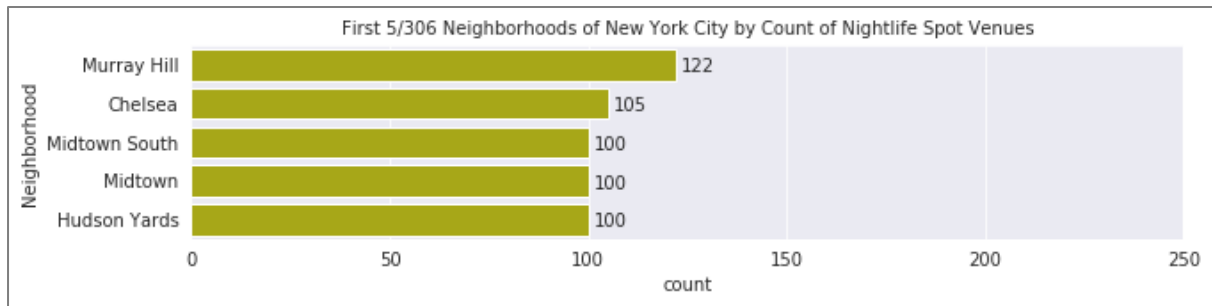


Figure 37 First 5/306 neighborhoods of New York City by Count of Nightlife Spot Venues

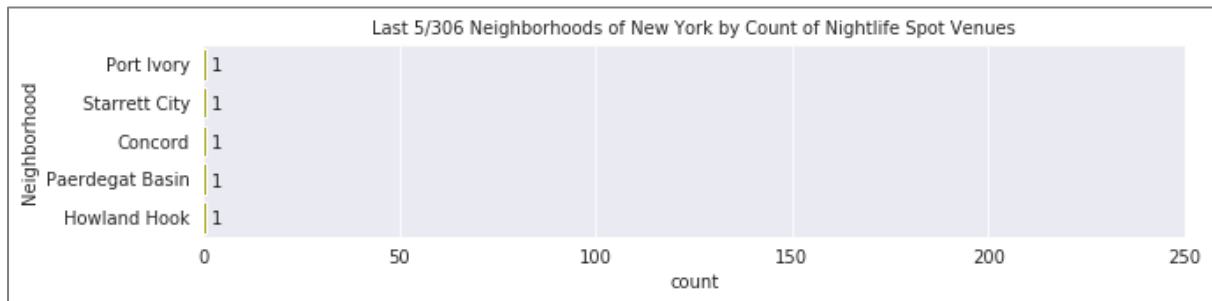


Figure 38 Last 5/306 neighborhoods of New York City by Count of Nightlife Spot Venues

### 3.2.3.D. Count of Nightlife Spot Venues of Each Nightlife Spot Venue Category

#### 3.2.3.D.t Count of Nightlife Spot Venues of Each Nightlife Spot Venue Category in Toronto

Figure 39 shows the first 10 out the 72 unique Nightlife Spot venue categories of Toronto. 'Bar' turns out to be the first Nightlife Spot venue category of Toronto by count. It has a count of 713 in all the neighborhoods of Toronto.

A total of 136 'Night Club' venues are also found in the city for tourists to explore.

Figure 40 shows the last 10 out the 72 unique Nightlife Spot venue categories of Toronto. As we could see that there is a 'Night Market' in Toronto and also a couple of 'Piano Bars'.

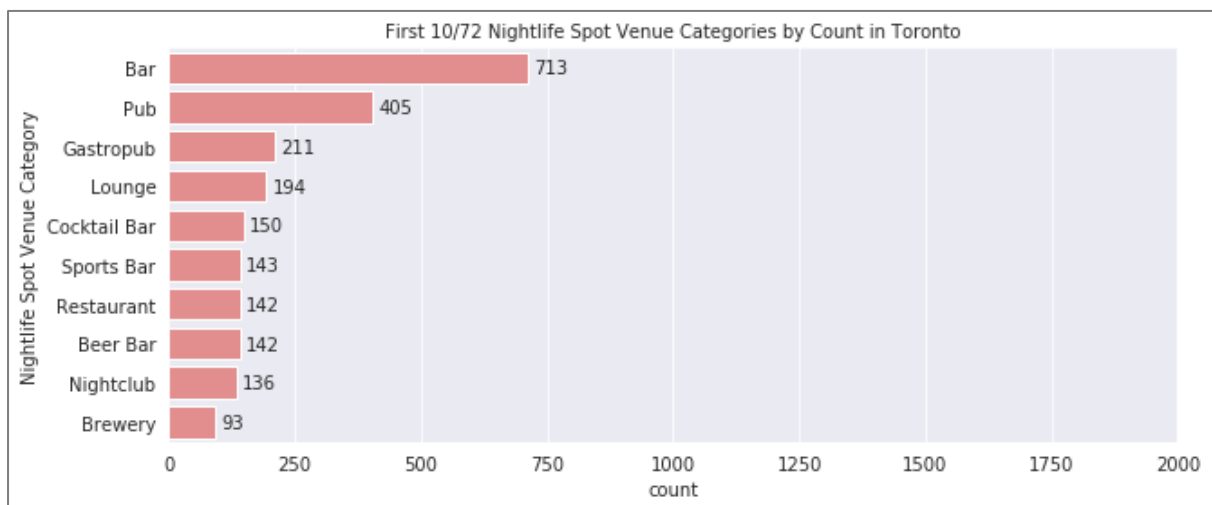


Figure 39 First 10/72 Nightlife Spot venue categories in Toronto by Count

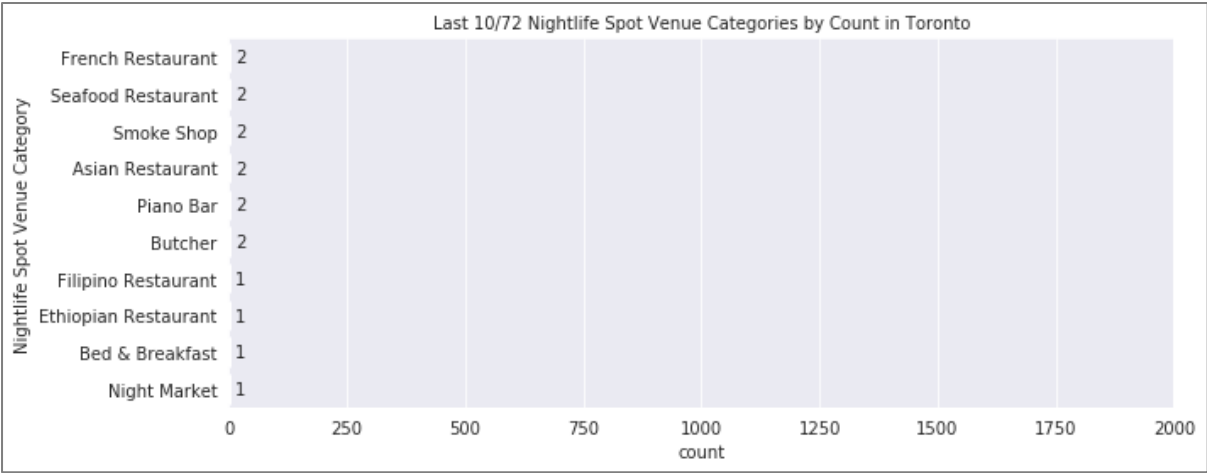


Figure 40 Last 10/72 Nightlife Spot venue categories in Toronto by Count

3.2.3.D.n Count of Nightlife Spot Venues of Each Nightlife Spot Venue Category in New York City

Figure 41 shows the first 10 out the 135 unique Nightlife Spot venue categories of New York City. Just like Toronto, ‘Bar’ turns out to be the first Nightlife Spot venue category by count in New York City as well. It has a count of 1538 in all the neighborhoods of New York City. Compared to Toronto, New York City has 204 ‘History Museum’ to be explored. Toronto also had 136 of them.

Figure 42 shows the last 10 out the 135 unique Nightlife Spot venue categories of Toronto. As we could see that just like Toronto, New York City also has a ‘Night Market’.

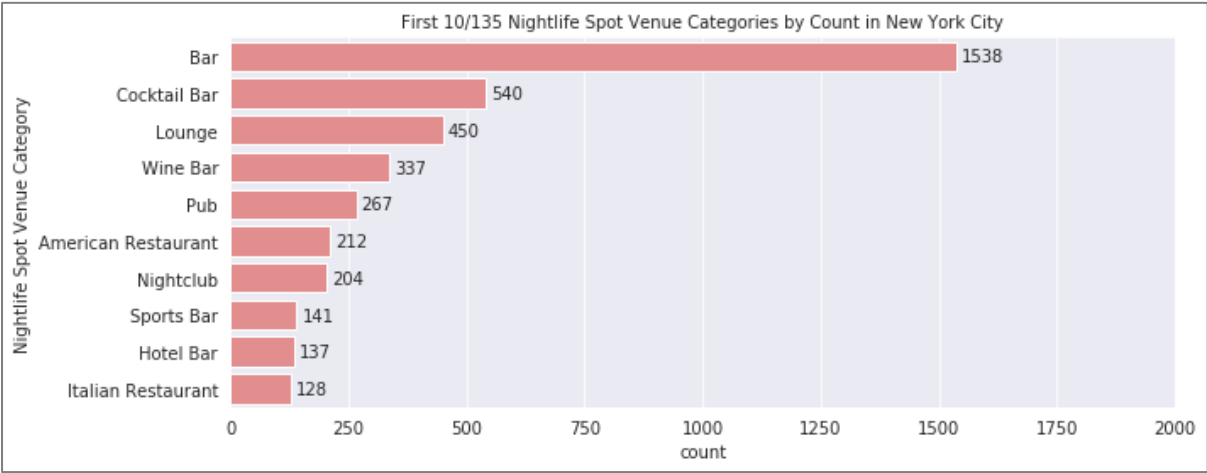


Figure 41 First 10/135 Nightlife Spot venue categories in New York City by Count

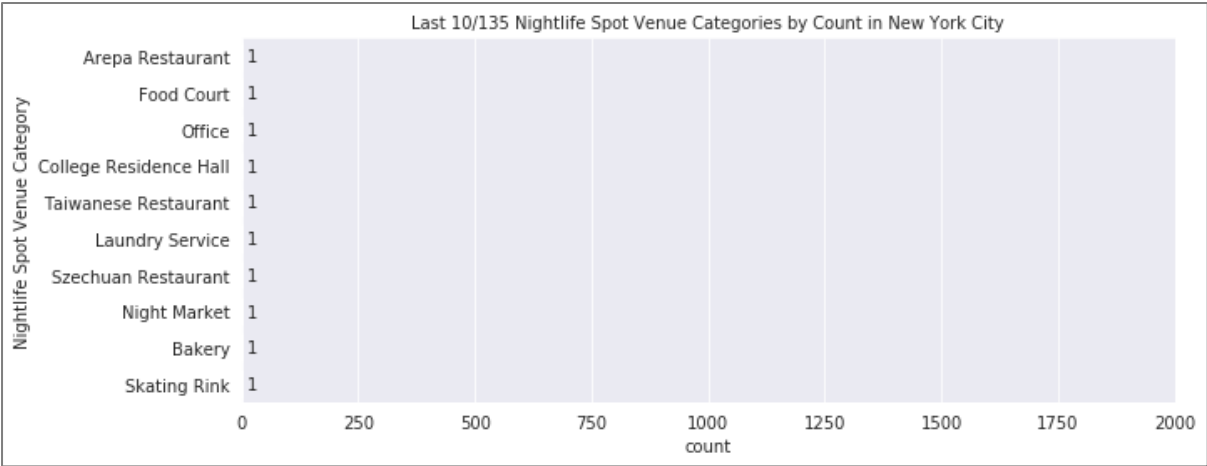


Figure 42 Last 10/135 Nightlife Spot venue categories in New York City by Count

3.2.3.E. Nightlife Spot Venue Categories found in X, but not in Y

3.2.3.E.t Nightlife Spot Venue Categories found in Toronto, but not in New York City

A total of just 10 Nightlife Spot venue categories were found in the neighborhoods of Toronto, but not in New York City. Figure 43 shows these Nightlife Spot venue categories along with their counts.

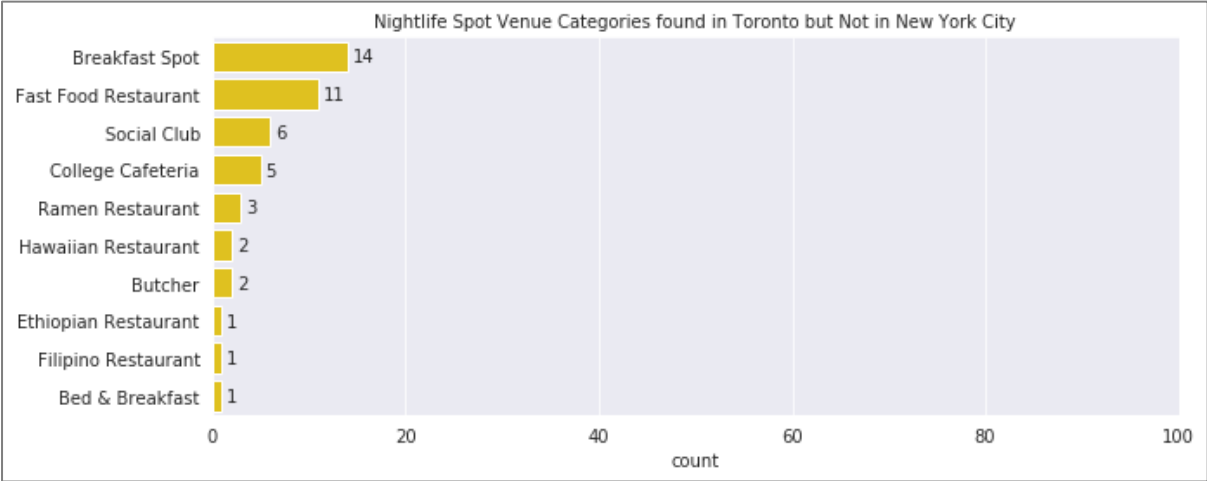


Figure 43 Nightlife Spot Venue Categories found in Toronto, but not in New York City

3.2.3.E.n Nightlife Spot Venue Categories found in New York City, but not in Toronto

A total of 73 Nightlife Spot venue categories were found in the neighborhoods of New York City, but not in Toronto. Table 6 shows these Nightlife Spot venue categories along with their counts. As the figure shows, it is just ‘Racecourse’ in the Nightlife Spot Venue Category that is found in Toronto but not in New York City.



# IBM Applied Data Science Capstone Project

Table 6 Nightlife Spot Venue Categories found in Toronto, but not in New York City

	Nightlife Spot Venue Category	Count
0	Mexican Restaurant	65
1	Caribbean Restaurant	32
2	Tapas Restaurant	30
3	Latin American Restaurant	26
4	German Restaurant	25
5	Roof Deck	22
6	Wine Shop	18
7	Other Nightlife	18
8	Rock Club	17
9	Tiki Bar	15
10	Beer Store	11
11	Indian Restaurant	11
12	Southern / Soul Food Restaurant	10
13	Sandwich Place	9
14	Taco Place	8
15	English Restaurant	8
16	Vietnamese Restaurant	8
17	South American Restaurant	8
18	Cuban Restaurant	8
19	Spanish Restaurant	6
20	Performing Arts Venue	6
21	Tea Room	6
22	Fried Chicken Joint	5
23	Cajun / Creole Restaurant	5
24	Australian Restaurant	5
25	Lebanese Restaurant	5
26	Turkish Restaurant	5
27	Brazilian Restaurant	5
28	African Restaurant	4
29	Chinese Restaurant	4
30	Coworking Space	4
31	Distillery	3
32	Greek Restaurant	3
33	Hostel	3
34	Salon / Barbershop	3
35	Gourmet Shop	3
36	Cheese Shop	3
37	Art Gallery	3

	Nightlife Spot Venue Category	Count
38	Harbor / Marina	3
39	General Entertainment	3
40	Food Truck	3
41	Juice Bar	3
42	Ice Cream Shop	3
43	Nail Salon	2
44	Street Food Gathering	2
45	Tech Startup	2
46	Russian Restaurant	2
47	Paella Restaurant	2
48	Residential Building (Apartment / Condo)	2
49	Middle Eastern Restaurant	2
50	Theater	2
51	Colombian Restaurant	2
52	Snack Place	2
53	Indie Movie Theater	2
54	Vegetarian / Vegan Restaurant	2
55	Szechuan Restaurant	1
56	Skating Rink	1
57	Food Court	1
58	Eastern European Restaurant	1
59	College Residence Hall	1
60	Modern European Restaurant	1
61	Bookstore	1
62	Indie Theater	1
63	Bakery	1
64	Pool	1
65	Market	1
66	Scenic Lookout	1
67	Laundry Service	1
68	Building	1
69	Arepa Restaurant	1
70	Professional & Other Places	1
71	Food & Drink Shop	1
72	Taiwanese Restaurant	1

### 3.2.3.F. Nightlife Spot Venue Categories by Count in Each Borough

#### 3.2.3.F.t First 4 Nightlife Spot Venue Categories by Count in Each Borough of Toronto

Earlier in 3.2.3.D.t we found that ‘Bar’, ‘Pub’, ‘Gastropub’ and ‘Lounge’ were the first 4 Arts & Entertainment venue categories in Toronto by count. The count of these 4 Food venue categories in each Borough of the Toronto is shown in the Figure 44 below. As we could in the Figure 44 that ‘Downtown Toronto’ has the highest number of Nightlife Spot venues of each of these 4 Food Venue Categories, while others are comparatively very far behind it.

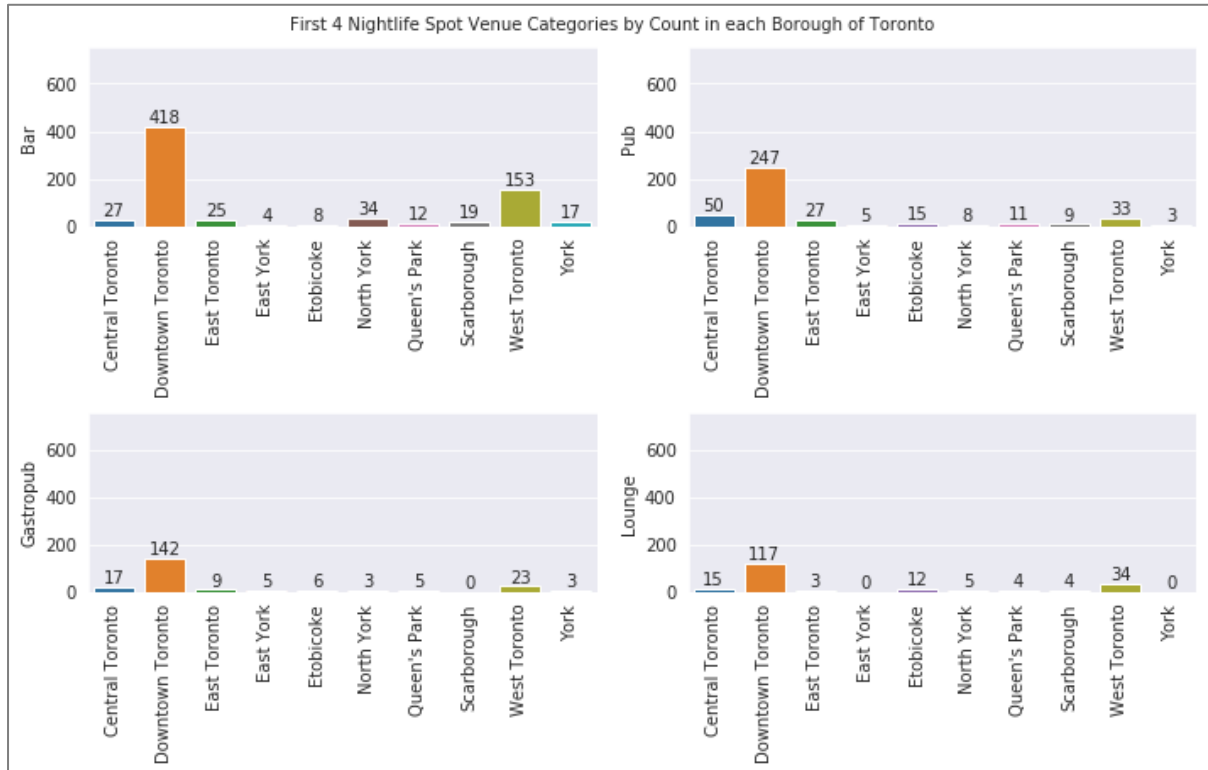


Figure 44 First 4 Nightlife Spot venue categories by Count in each Borough of Toronto

#### 3.2.3.F.n First 4 Nightlife Spot Venue Categories by Count in Each Borough of New York City

Earlier in 3.2.3.D.n we found that ‘Bar’, ‘Cocktail Bar’, ‘Longue’ and ‘Wine Bar’ were the first 4 Nightlife Spot venue categories in New York City by count. The count of these 4 Nightlife Spot venue categories in each Borough of the Toronto is shown in the Figure 45 below. As we could in the Figure 45 that ‘Manhattan’ has the highest number of all of these 4 venues, while ‘Bronx’ is pretty close to it when it comes to ‘Bar’ and ‘Lounge’.

‘Staten Island’ has the minimum number of these 4 Nightlife Spot venue categories among all the 5 boroughs.

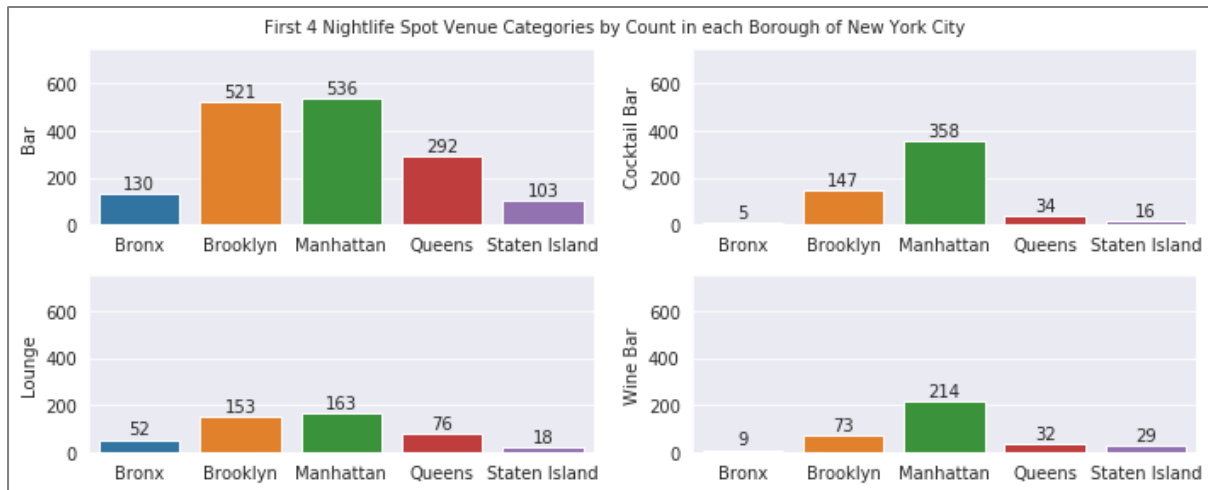
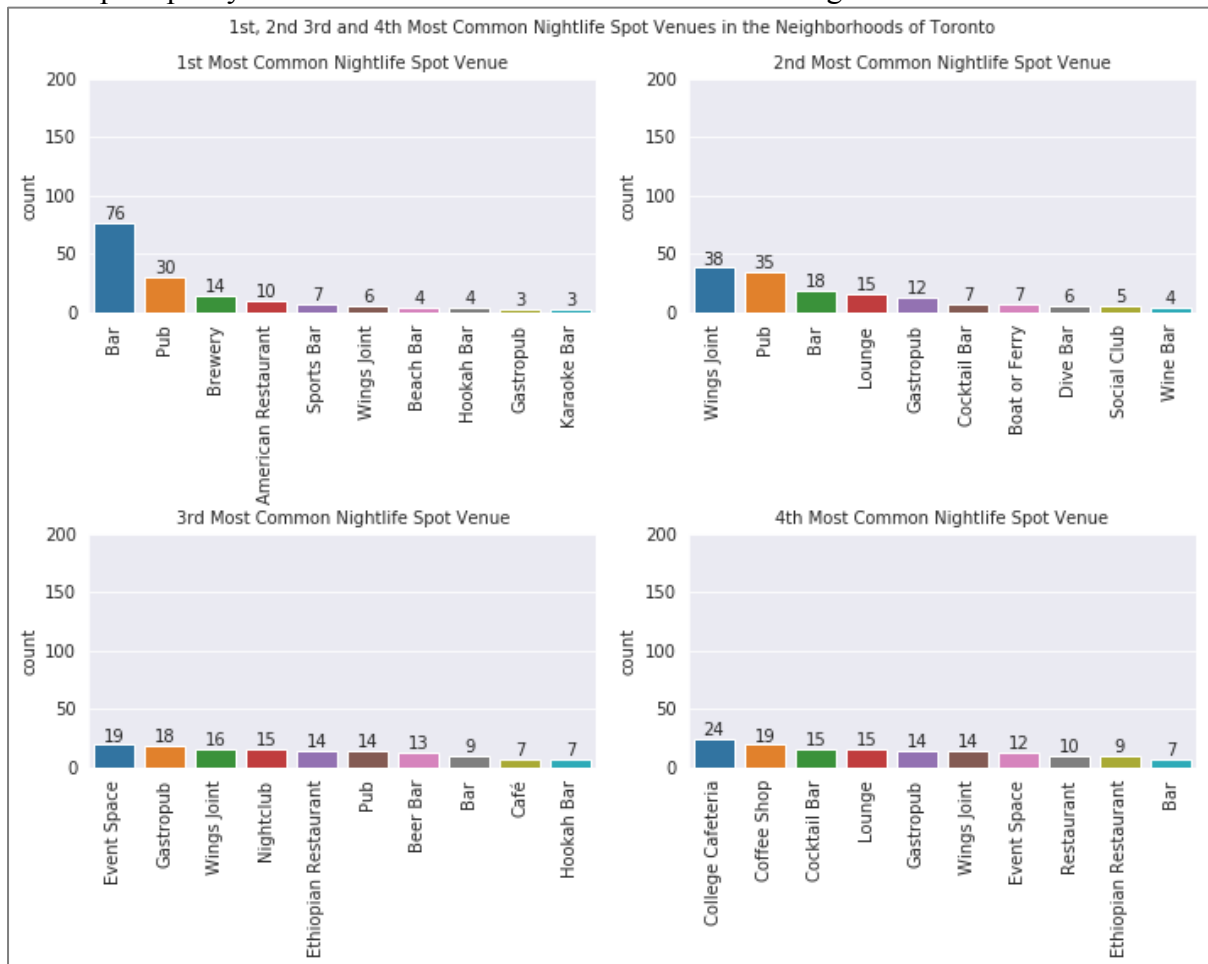


Figure 45 First 4 Nightlife Spot venue categories by Count in each Borough of New York City

### 3.2.3.G. 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> Most Common Nightlife Spot Venues in Neighborhoods

#### 3.2.3.G.t 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> Most Common Nightlife Spot Venues in the Neighborhoods of Toronto

Figure 46 shows 'Bar' is the 1<sup>st</sup> most common Nightlife Spot venue in the neighborhoods of Toronto. 'Wings Joint' is the 2<sup>nd</sup> most common category. On 3<sup>rd</sup> we have 'Event Space' and 'Gastropub' pretty close to one another and then we have 'College Cafeteria' on 4<sup>th</sup>.

Figure 46 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> most common Nightlife Spot venues in neighborhoods of Toronto

### 3.2.3.G.n 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> Most Common Nightlife Spot Venues in the Neighborhoods of New York City

Figure 47 shows 'Bar' is the 1<sup>st</sup> most common venue by a long margin than any other Nightlife Spot venue category. 'Lounge' is also quite commonly found in the neighborhoods of New York City.

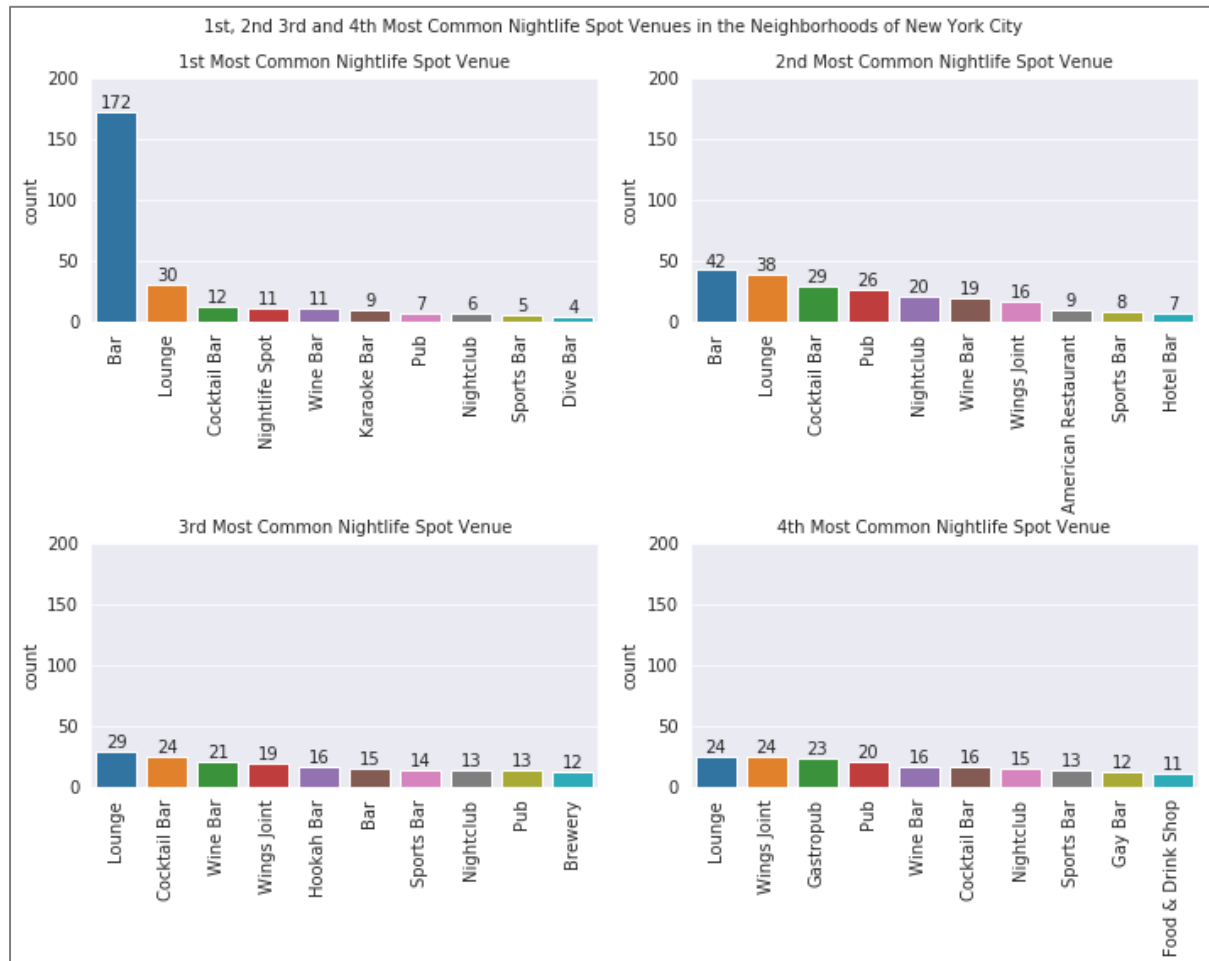


Figure 47 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> most common Nightlife Spot venues in neighborhoods of New York City

### 3.2.3.H Highly Disproportionate Nightlife Venue Categories in Toronto and NYC

There were some important numbers about the counts of various Nightlife Spot venue categories that were found in both Toronto and NYC but were disproportionate by a huge margin (less than 5%). These are shown in the following Table 3.2.3.H.

Table 3.2.3.H Count Comparison of highly disproportionate Nightlife Spot Venue between NYC and Toronto

Nightlife Spot Venue Category	New York City (NYC)	Toronto
Seafood Restaurant	40	2
French Restaurant	57	2

### 3.3 Clustering of Neighborhoods

The project does the clustering of neighborhoods based on 3 different *Venue Categories*: 'Food', 'Arts & Entertainment' and 'Nightlife Spot'. So I broke them down into 3 sub-headings accordingly.

We used **k-means Clustering** to cluster similar neighborhoods, where  $k$  represents the optimum number of clusters. The k-means Clustering algorithm is used to find groups which have not been explicitly labelled in the data. This can be used to confirm business assumptions about what types of groups exist or to identify unknown groups in complex data sets. Once the algorithm has been run and the groups are defined, any new data can be easily assigned to the correct group. One of the examples of the usage of k-means clustering is *Behavioral Segmentation* where users are segmented based on their purchase history.

Before we used k-means clustering algorithm to find clusters of similar neighborhoods we found the optimum value of  $k$ . In general, there is no method for determining exact value of  $k$ , but an accurate estimate can be obtained using a technique called '**Elbow Method**'.

The basic idea behind *elbow method* is that it plots the various values of cost with changing  $k$ . As the value of  $k$  increases, there will be fewer elements in the cluster. So the average distortion will decrease. The lesser number of elements means closer to the centroid. So, the point where this distortion declines the most is the **elbow point**.

Figure 48 shows an example of *elbow point*.

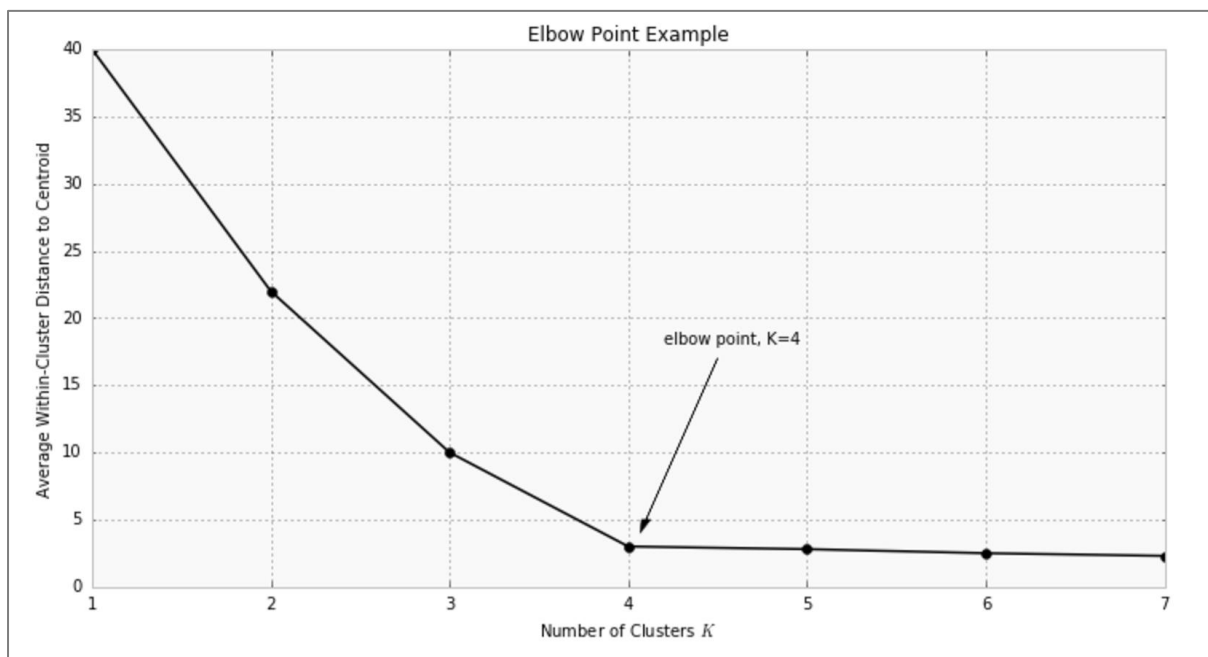


Figure 48 Example of Elbow Point (source: <https://www.datascience.com/blog/k-means-clustering>)

To find the optimum value of  $k$ , we first plotted the *Squared Error (Cost)* for a range of values for  $k$  and then used the *kneed* project from [here](#) to automatically find the value of  $k$  where the curvature is maximum.

### 3.3.1 Food

#### 3.3.1.A Clustering of Neighborhoods based on Food

##### 3.3.1.A.t Clustering of Toronto Neighborhoods based on Food Venue Categories

The optimum value of  $k$  for clustering the similar neighborhoods of Toronto based on Food venue categories was 5. Figure 49 below shows the clustering of Toronto neighborhoods based on Food venue categories.

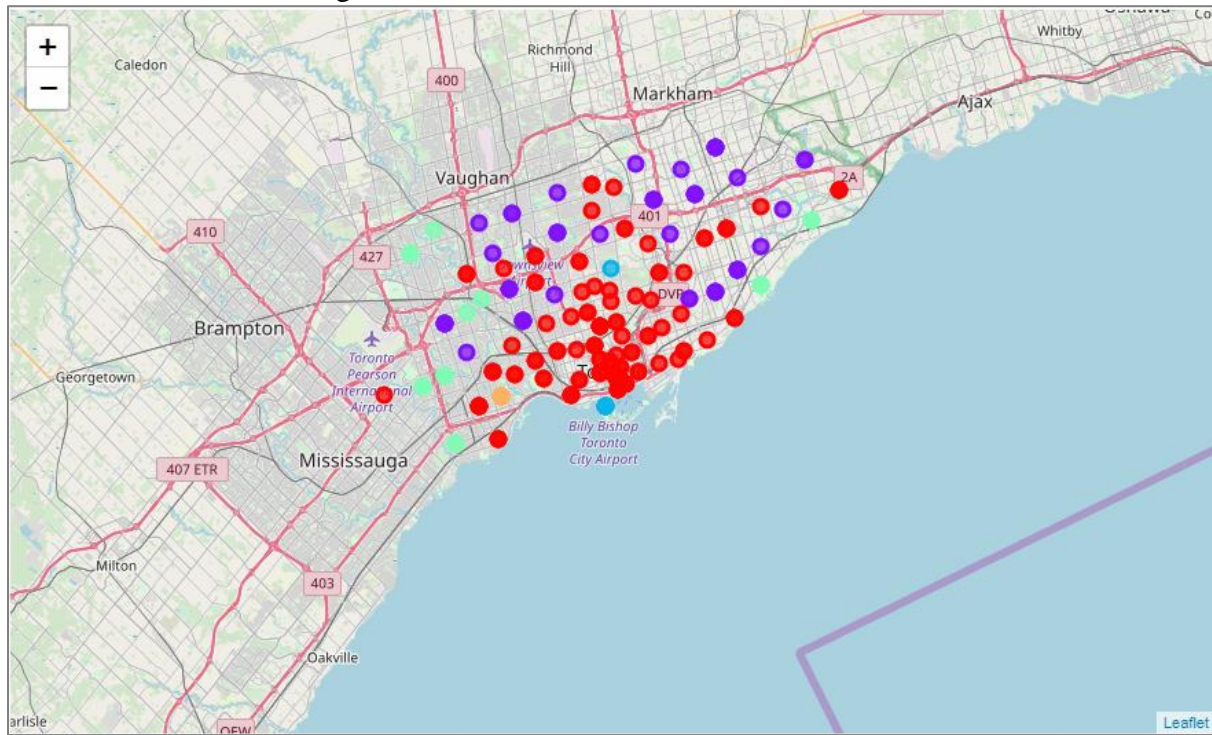


Figure 49 Clustering of neighborhoods in Toronto based on Food Venue Categories



### 3.3.1.A.n Clustering of New York City Neighborhoods based on Food Venue Categories

Just like Toronto, the optimum value of  $k$  for clustering the similar neighborhoods of New York City based on Food venue categories was also 5. Figure 50 below shows the clustering of Toronto neighborhoods based on Food venue categories.

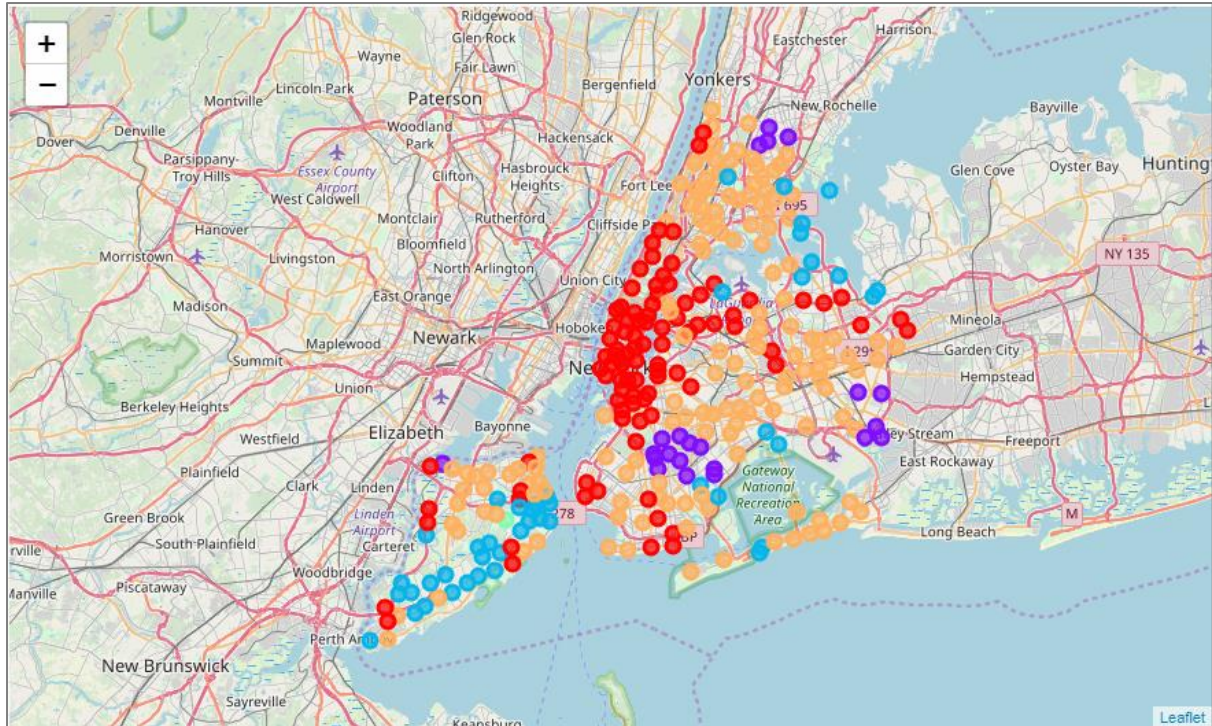


Figure 50 Clustering of neighborhoods in New York City based on Food Venue Categories

## 3.3.2 Arts & Entertainment

### 3.3.2.A Clustering of Neighborhoods based on Arts & Entertainment

#### 3.3.2.A.t Clustering of Toronto Neighborhoods based on Arts & Entertainment Venue Categories

The optimum value of  $k$  for clustering the similar neighborhoods of Toronto based on Arts & Entertainment venue categories was 5. Figure 51 below shows the clustering of Toronto neighborhoods based on Arts & Entertainment venue categories.

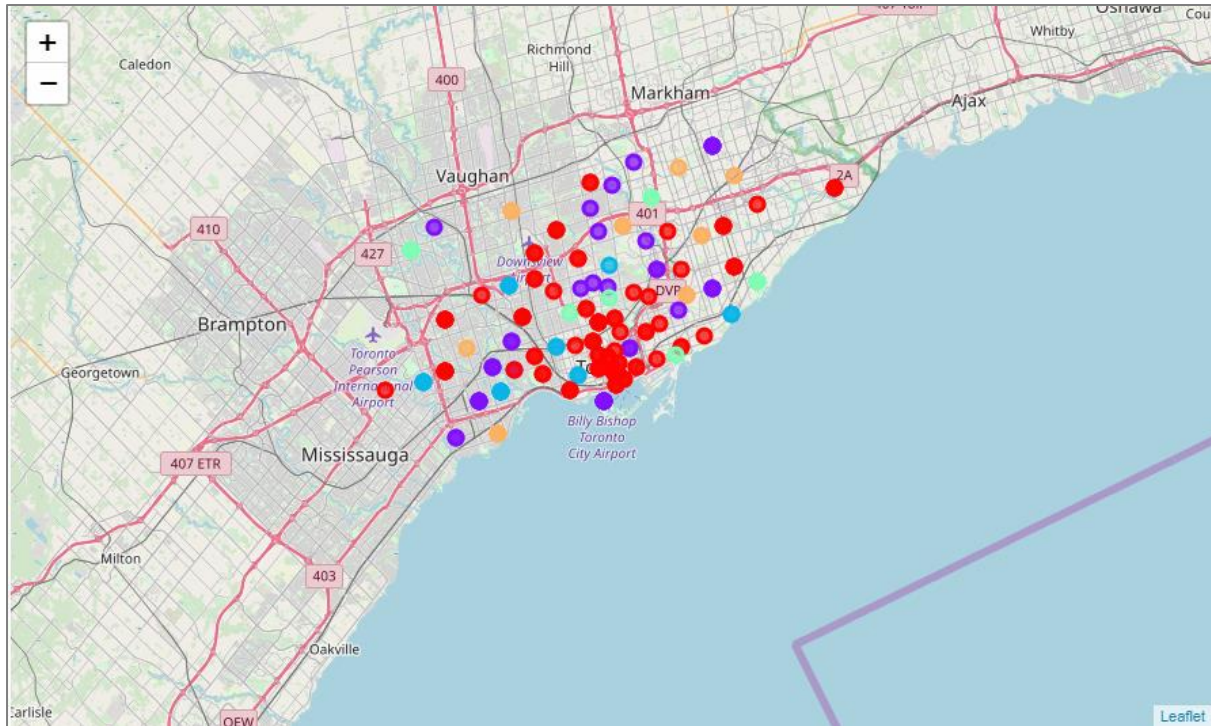


Figure 51 Clustering of neighborhoods in Toronto based on Arts & Entertainment Venue Categories

### 3.3.2.A.t Clustering of New York City Neighborhoods based on Arts & Entertainment Venue Categories

The optimum value of  $k$  for clustering the similar neighborhoods of Toronto based on Arts & Entertainment venue categories was 4. Figure 52 below shows the clustering of Toronto neighborhoods based on Arts & Entertainment venue categories.

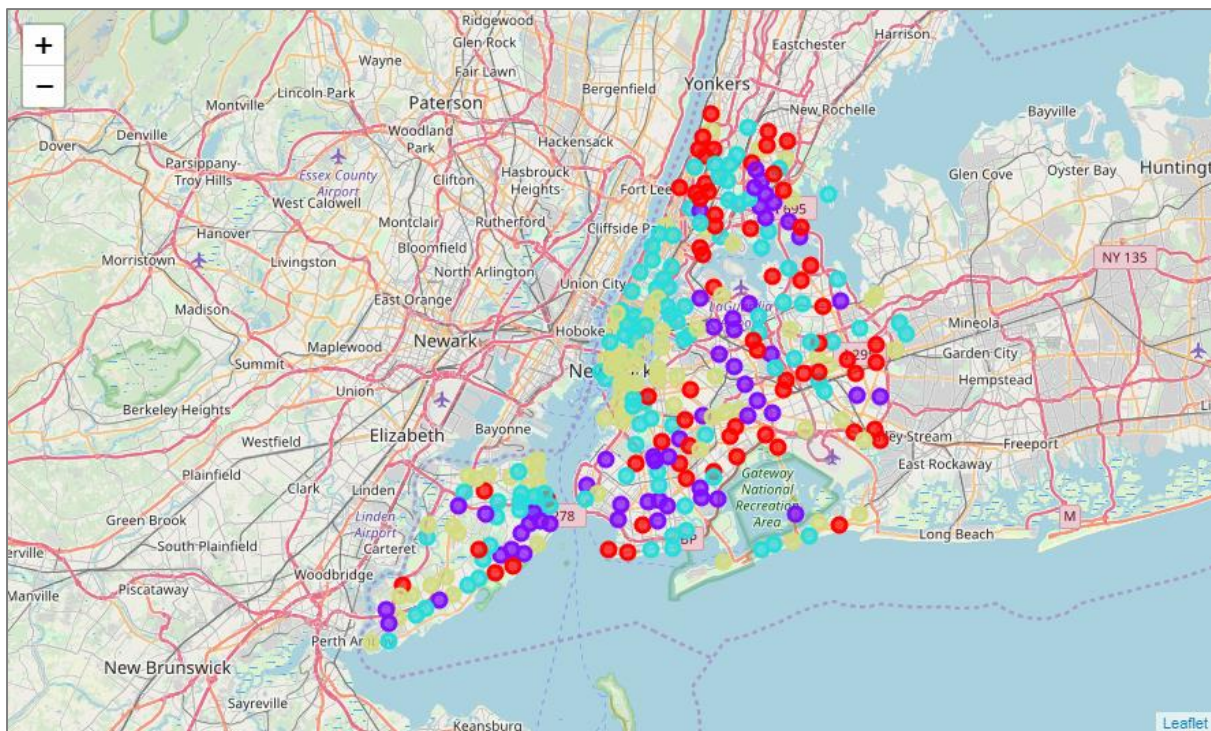


Figure 52 Clustering of neighborhoods in Toronto based on Food Venue Categories



### 3.3.3 Nightlife Spot

#### 3.3.3.A Clustering of Neighborhoods based on Nightlife Spot

##### 3.3.3.A.t Clustering of Toronto Neighborhoods based on Nightlife Spot Venue Categories

The optimum value of  $k$  for clustering the similar neighborhoods of Toronto based on Nightlife Spot venue categories was 3. Figure 53 below shows the clustering of Toronto neighborhoods based on Nightlife Spot venue categories.

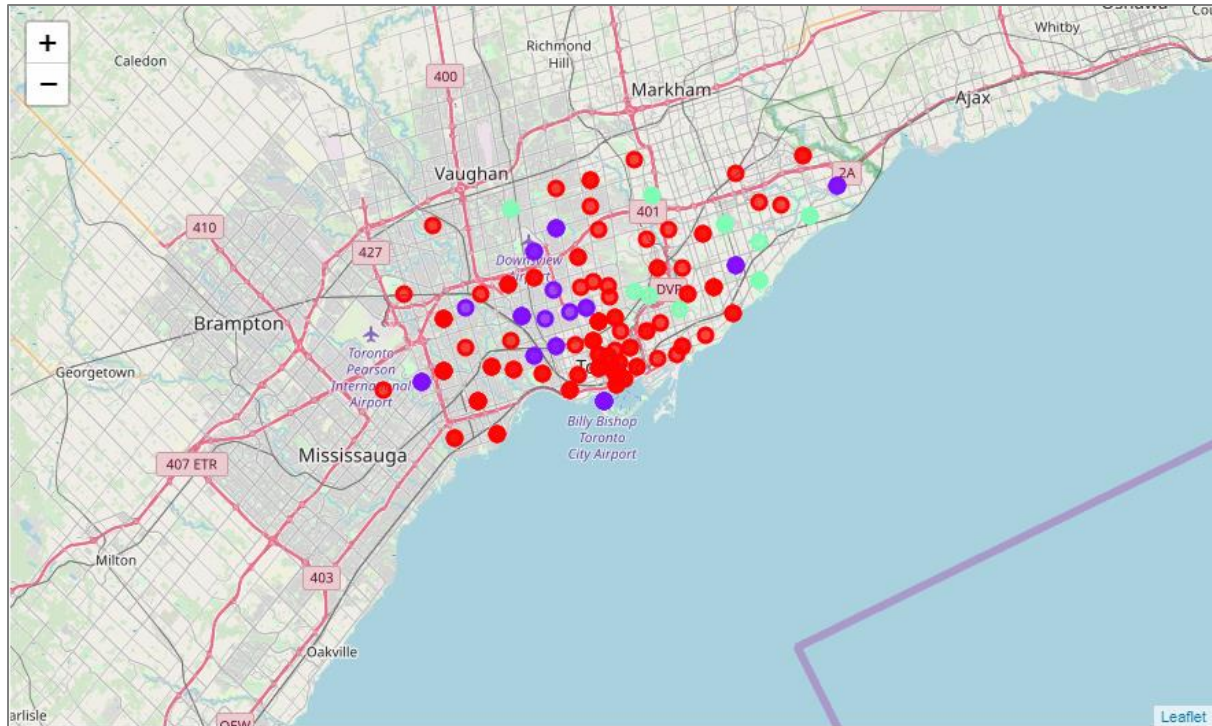


Figure 53 Clustering of neighborhoods in Toronto based on Nightlife Spot Venue Categories

##### 3.3.3.A.n Clustering of New York City Neighborhoods based on Nightlife Spot Venue Categories

The optimum value of  $k$  for clustering the similar neighborhoods of Toronto based on Nightlife Spot venue categories was 4. Figure 54 below shows the clustering of Toronto neighborhoods based on Nightlife Spot venue categories.

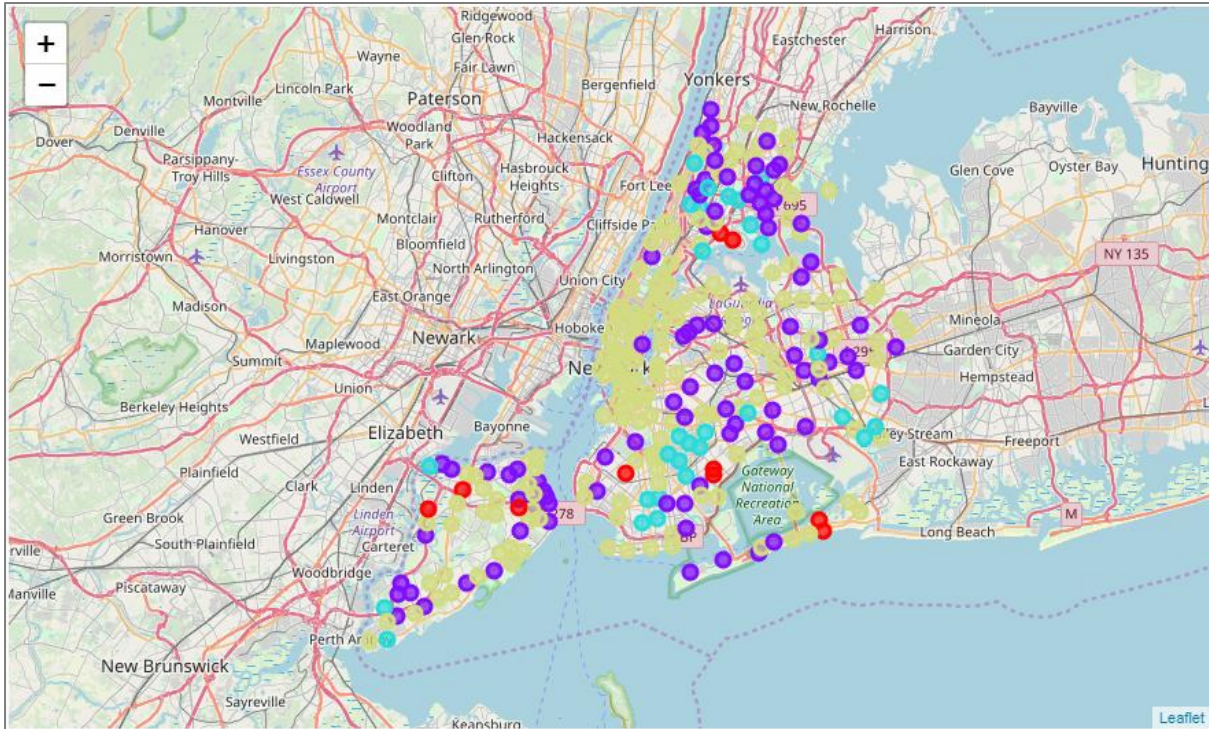


Figure 54 Clustering of neighborhoods in New York City based on Nightlife Spot Venue Categories

## 4. Results

This results section provides an overview of some of the outcomes of the methodology and their relevance to the similarities and dissimilarities between Toronto and New York City on Food, Arts & Entertainment and Nightlife.

We'll start with the 3 example questions we had mentioned 1.1 Business Problem section of this report.

### 1. How frequent Japanese Restaurants are in the neighborhoods of Toronto as compared to New York City?

The total count of 'Japanese Restaurant' in Toronto is 225, while its count in the New York City is 322. Also, 'Japanese Restaurant' also falls in the 5<sup>th</sup> place (with a count of 14) in the 2<sup>nd</sup> most commonly found Food venues in Toronto, but it is not found in the first 4 most commonly found Food venues in New York City. So 'Japanese Restaurant' is more commonly found in Toronto than in New York City.

But overall, it could be said that New York City and Toronto are more similar to each other than dissimilar as both have a lot of 'Japanese Restaurant' venues in them.

### 2. If Museums play an important role in deciding which place to tour, then should you choose Toronto or New York City?

New York City has 129 'Museum' venues while Toronto has 39 of them. There are actually various sub-categories of 'Museum' in both Toronto and New York City. These are 'History Museum', 'Art Museum', 'Science Museum' and also 'Erotic Museum'.

In New York City, 'Erotic Museum' is the 3<sup>rd</sup> and 4<sup>th</sup> most common Arts and Entertainment venue with a count of 35 and 41. It has a presence of 'Museum' and 'History Museum' venues as well in the 1<sup>st</sup> and 2<sup>nd</sup> most common venues.

Just like New York City, Toronto also has a presence of 'History Museum', 'Museum' and 'Art Museum' in 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> most common venues of Arts and Entertainment.

So, New York City and Toronto are similar to each other when it comes to 'Museum', 'History Museum', 'Art Museum' and 'Science Museum' venues, but dissimilar when it comes to 'Erotic Museum' as Toronto does not have any 'Erotic Museum' venues in it.

So people interested in only 'Erotic Museum' category of museums might feel a bit disappointed in Toronto as compared to New York City.

### 3. If Art Galleries are your favourite place to explore in your free time, would it matter much if you choose to visit New York City rather than Toronto?

Toronto has 450 'Art Gallery' venues while New York City has 1418 of them. 'Art Gallery' venues is the 1<sup>st</sup> most common Arts and Entertainment venue in both Toronto and New York City. 'Downtown Toronto' in Toronto has the highest count of 246 'Art Gallery' venues while 'Manhattan' in New York City has a total 809 of them.

Both the cities have a lot of 'Art Gallery' venues, so it could be easily said that Toronto and New York City are quite similar to each other when it comes to 'Art Gallery' venues.

So, it doesn't matter much which city is chosen for a visit or tour as both the cities have many of 'Art Gallery' venues in them.

---

For all the 3 categories, the easiest way to find the dissimilarities between Toronto and New York City is to find the venue categories in Toronto that are not found in New York City and vice-versa. So we explored the venue categories in both the cities and found the following dissimilarities and similarities:

## I. Dissimilarities between Toronto and New York City

### I.A Food Category

One of the major dissimilarity between Toronto and New York was that Toronto had 28 of 'Poutine Place' venues while New York City had none of them. Toronto had a total of 6 food venue categories were not found in New York City.

On the other hand, New York City was found to have 61 of 'Peruvian Restaurant', 28 of 'Russian Restaurant' and 26 of 'Argentinian Restaurant' as the top 3 out of 39 food venue categories that were not found in Toronto.

Another major dissimilarity between NYC and Toronto is regarding 'Deli / Bodega', which has the second highest venue count in NYC. NYC had 1426 of them while Toronto had just 128 of them.

## I.B Arts & Entertainment Category

With Arts & Entertainment, Toronto was dissimilar to New York City with just 1 venue category. It was Racecourse. Toronto had 4 of them, while New York City had none.

On the other hand, the one major dissimilarity between New York City and Toronto was caused by 'Memorial Site' venues. New York City had 34 of them while Toronto had none. Also, New York City also had 4 'Erotic Museum' venues while Toronto had none. Toronto also didn't have any 'Science Museum' and 'Planetarium' was NYC had 19 and 5 of them.

Although in our data exploration, we got to know that Toronto had no 'Memorial Site' venues, [this](#) page from Wikipedia told us otherwise as it showed us that Toronto in-fact had many war 'Mamorial Site' venues.

## I.C Nightlife Spot Category

Nightlife Spot venues get even more interesting when Toronto has 14 of 'Breakfast Spot' venues while NYC has none. Also, there are no 'Ramen Restaurant', 'Hawaiian Restaurant', 'Ethiopian Restaurant' and 'Filipino Restaurant' venues that are open as a Nightlife Spot type venues in NYC. A total of 10 categories of these venues are not found in NYC to make it dissimilar to Toronto.

On the other hand, NYC has a total of 39 Nightlife Spot venue categories that are not found in Toronto. Almost all of them are restaurants. 65 of 'Mexican Restaurant' to 6 of 'Spanish Restaurant', while there are 16 of 'Rock Club' and 6 of 'Performing Arts Venue' as well.

## II. Similarities between Toronto and New York City

### II.A Food Category

5 of the first 10 Food venue categories by count in both Toronto and NYC are common. These include, 'Pizza Place', 'Café', 'Italian Restaurant', 'Bakery' and 'Sandwich Place'. They're all high in numbers. It is a good indication that Based on Food venue categories, Toronto and NYC are more similar than others.

Out of first 4, 2 of the Food venue categories by count are common in Toronto and NYC. These are, 'Pizza Place' and 'Italian Restaurant'.

In face the 1<sup>st</sup> most common Food venue in both Toronto and NYC is 'Pizza Place'. Just like 'Café' is almost the 1<sup>st</sup> most common Food venue in Toronto, 'Deli / Bodega' is also frequently found in NYC.

The first 4 Food venue categories by count in Toronto are, 'Café', 'Pizza Place', 'Restaurant' and 'Italian Restaurant'. For NYC, these are, 'Pizza Place', 'Deli / Bodega', 'Chinese Restaurant' and 'Italian Restaurant'.

When comparing the counts of all the Food venue category between Toronto and New York City, it could be easily seen that Toronto and NYC are more similar to NYC than dissimilar.



## II.B Arts & Entertainment Category

Just like Food, when it comes to Arts & Entertainment, both Toronto and NYC has 3 out of 4 venues in common based on their counts. These are 'Art Gallery', 'Theater' and 'Music venue'.

If this wasn't enough to reflect how similar they are, out of first 10 by count, 7 of venues are common, and if you consider 'Indie Movie Theater' and 'Indie Theater' same, then it make 8 out of first 10 venue categories to be common between the 2 cities.

These common venue categories are, 'Art Gallery', 'Movie Theater', 'Music Venue', 'Theater', 'Dance Studio', 'Performing Arts Venue' and 'History Museum.'

When it comes to first 4 most commonly found venues in Toronto, these include, 'Art Gallery', 'Music Venue', 'Tour Provider' and 'Jazz Club'. For NYC, these are, 'Art Gallery', 'Music Venue', 'Erotic Venue' and even on the 4<sup>th</sup> position as well we have 'Erotic Venue'.

## II.C Nightlife Spot Category

When it comes to Nightlife Spot both NYC and Toronto are very similar. They're full of 'Bar', 'Pub', 'Lounge', 'Nightclub' and different kind of restaurant venues.

Out of first 10 by count, 5 of venues are common between the 2 cities. These common venue categories are, 'Bar', 'Pub', 'Lounge', 'Cocktail Bar', 'Sports Bar', and 'Nightclub'.

Out of first 4 common venues, 'Bar' and 'Pub' are the 1<sup>st</sup> and 2<sup>nd</sup> most common Nightlife Spot venues in both Toronto, while in NYC, these are 'Bar' and 'Lounge'.

## 5. Discussions

1. One of the limitation of the data provided by Foursquare Place API is that it returns a maximum of 100 venues for an *explore* endpoint API call that we used in our project for all the 3 categories. This was the reason why many neighborhoods in Toronto were showing 100 as the maximum value for venues of a particular category within a circle of 1000 meters of radius.

But for New York City and Food venue categories it returned 200, 115 and 105 for 'Murray Hill', 'Chelsea' and 'Sunny Side'.

This was due to the fact out of 306 neighborhoods in New York City, 4 of them were duplicates, as shown in the Table 5.1 below.

Table 5.1 4 Duplicate Neighborhoods in New York City

	Borough	Neighborhood	Latitude	Longitude
115	Manhattan	Murray Hill	40.748303	-73.978332
116	Manhattan	Chelsea	40.744035	-74.003116
140	Queens	Sunnyside	40.740176	-73.926916
175	Queens	Bay Terrace	40.782843	-73.776802
180	Queens	Murray Hill	40.764126	-73.812763
220	Staten Island	Sunnyside	40.612760	-74.097126
235	Staten Island	Bay Terrace	40.553988	-74.139166
244	Staten Island	Chelsea	40.594726	-74.189560

As we can see from above table that all the 4 duplicate neighborhoods ('Murray Hill', 'Chelsea', 'Sunnyside', 'Bay Terrace') are found in two different boroughs. It means that 4 neighborhoods of the same name are found in 2 different boroughs. But they all have different (Latitude, Longitude) values.

According to Wikipedia at [https://en.wikipedia.org/wiki/Murray\\_Hill](https://en.wikipedia.org/wiki/Murray_Hill), 'Murray Hill' neighborhood is not only found in Manhattan and Queens, but a few other places as well. So we kept 'Murray Hill' and other 3 neighborhoods in the dataset used for our exploratory analysis.

So it looks like, that because 'Murray Hill', 'Chelsea' and 'Sunny Side' were found in two boroughs, the sum of food venues from two boroughs got added up and resulted in a value above 100.

2. It is important to note is the setting of the radius used in the analysis. As we keep increasing the radius a neighbourhood might start overlapping with its neighbour neighbourhood resulting in an increase in the total number of venues in a neighbourhood. The default setting by Foursquare is a radius of 250 meters, but that seemed a little undervalued for a neighborhood in our analysis so we increased it to 1000 meters.

3. We have a 'Restaurant' Venue Category who is among the 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> most common food venues with a total count of 397 in Toronto. It seems to be a generic restaurant where most of the different kinds of cuisines are served.

4. While exploring data to find the dissimilarities between Toronto and NYC, it turned out that Toronto didn't have any 'Memorial Site' venues. We were quite surprised just with the thought of it. So we did a web search, and it didn't take much time to find out that Toronto had in-fact many war 'Memorial Site' venues, according to [this](#) Wikipedia page. The two reasons behind this discrepancy that immediately come to mind are, either Foursquare Place API does not have enough data, or the value of radius 1000 meters chosen for gathering data missed all of those 'Memorial Site' venues.

5. The exact number of venues for a neighbourhood is next to impossible to find as *radius* is going to be fixed when gathering data regardless of the population densities of the neighborhoods in Toronto or NYC.

6. For all the 3 categories we had neighborhoods that did not have any venues of any of the venue categories. For example, Toronto had 20 neighborhoods that did not have any Arts & Entertainment venues. This number is likely to go down if the *radius* setting is increased. In some cases, it might be genuine as there is a possibility that Foursquare explore API call missed a venue which was indeed available in a neighbourhood due to selection of short *radius*, but there is also a possibility that a neighbourhood indeed did not have venue and the *radius* was increased it overlapped with its neighbour neighbourhood and picked a venue from its neighbour neighbourhood. Hence, the selection of *radius* is very important.

7. There was a clear conflict in the data that came to the fore during the data exploration. It was about the number of 'Erotic Museum' venues in NYC. When we compared the counts of them Toronto and NYC, Toronto had 0 and NYC had 4. But when we analysed our neighborhoods to find the first 4 most commonly found venues, in NYC 'Erotic Museum' was on the first position in count for the 3<sup>rd</sup> and 4<sup>th</sup> most common venues. The count of 'Erotic Museum' venues was 41 for the 4<sup>th</sup> most common 'Art & Entertainment' category. How could this be possible if NYC had a count of just 4 'Erotic Museum' venues?

## 6. Conclusion

This project and the Notebook it comes with serves as a reference to identify the similarities and dissimilarities between Toronto and New York City on Food, Arts & Entertainment and Nightlife. It can be extended to include data from many other categories provided in the Foursquare Places API.

As expected, more venue categories are found in NYC than Toronto. This could be attributed to the fact that people from all walks of life from different countries have been coming to US for a better life, so from the culture's perspective it is more diverse than Toronto.

Data provided by the Foursquare is not perfect and needs to be worked upon. For example, In 'Food' category there is a venue category called 'Food'. It is not clear what type of Food is served here, but NYC has 241 of these while Toronto has 12. Many such venue categories are found in the datasets provided by Foursquare for all the 3 categories explored in this project that need to be made better sense of.

## 7. Future Directions

The preceding discussions have highlighted, in addition to factors and insights resulting from the data analysis, other factors beyond the scope of this project at this point.

1. It would be interesting to gather, explore data and analyse it with a different setting of radius and try to find difference in the outcomes compared this project.

2. If findings of this project could be supplemented with the dataset from a Food ordering web portal, [zomato](#) for example, it would add additional value to this project and its outcomes.

3. Incorporating population along with area of neighbourhoods can aid additional analysis and visualization to complement this project.