

Exploring Toronto, Canada: The battle of neighborhoods!

Table of contents:

- [Introduction: Business Problem](#)
- [Data](#)
- [Methodology](#)
- [Results and Discussion](#)
- [Conclusion](#)

Introduction: Business Problem

Toronto is the capital city of the Canadian province of Ontario, and the most populous city in Canada. Toronto is an international centre of business, finance, arts, and culture, and is recognized as one of the most multicultural and cosmopolitan cities in the world. It showcases diversity with strengths in technology, education, fashion, food services, and tourism.

Let's explore the neighbourhoods around Toronto using data science!

In this data science capstone project, we will explore Toronto, and find out the most popular places (such as museums, parks, café, restaurants, etc.), to help guide the tourists, investors and general public interested in visiting Toronto.

We will use the data science skills acquired as part of the IBM Data Science Professional Certification (by Coursera), and generate a few most popular neighbourhoods with information about interesting venues to visit. The details about each venue will then be suggested for the best possible exploration of Toronto.

Data

Based on the problem definition, following factors will contribute in deciding which neighborhood is popular:

- number of museums and attractions in the neighborhood.
- number of café, shops and restaurants in the neighborhood.
- whether the neighborhood is close to the city center.

Following data sources will be needed to extract the required information:

- **Wikipedia**, https://en.wikipedia.org/wiki/List_of_postal_codes_of_Canada:_M, to obtain the information related to the neighbourhoods in Toronto.
- **Foursquare API** to obtain the location/venue data (i.e. number of museums, attractions, café, restaurants, etc.)
- **BeautifulSoup** to parse the area information from a HTML table.
- **Geocoder** to obtain the area coordinates.
- **Folium** to visualize the maps.

Neighborhood Candidates

So let's get started!

The first step is to extract information from the Wikipedia page: https://en.wikipedia.org/wiki/List_of_postal_codes_of_Canada:_M, to extract information about the neighbourhoods in Toronto. The information thus extracted requires cleaning and preprocessing, for example: the rows with "Not assigned" values will be removed.

Further, we will find the latitude and longitude coordinates for the centroids of our candidate neighborhoods around Toronto. And then find the total number of unique boroughs.

In [15]:

```
print('Total number of Boroughs = ', len(df['Borough'].unique()))
```

Total number of Boroughs = 12

In [16]:

```
toronto_data.head()
```

(74, 5)

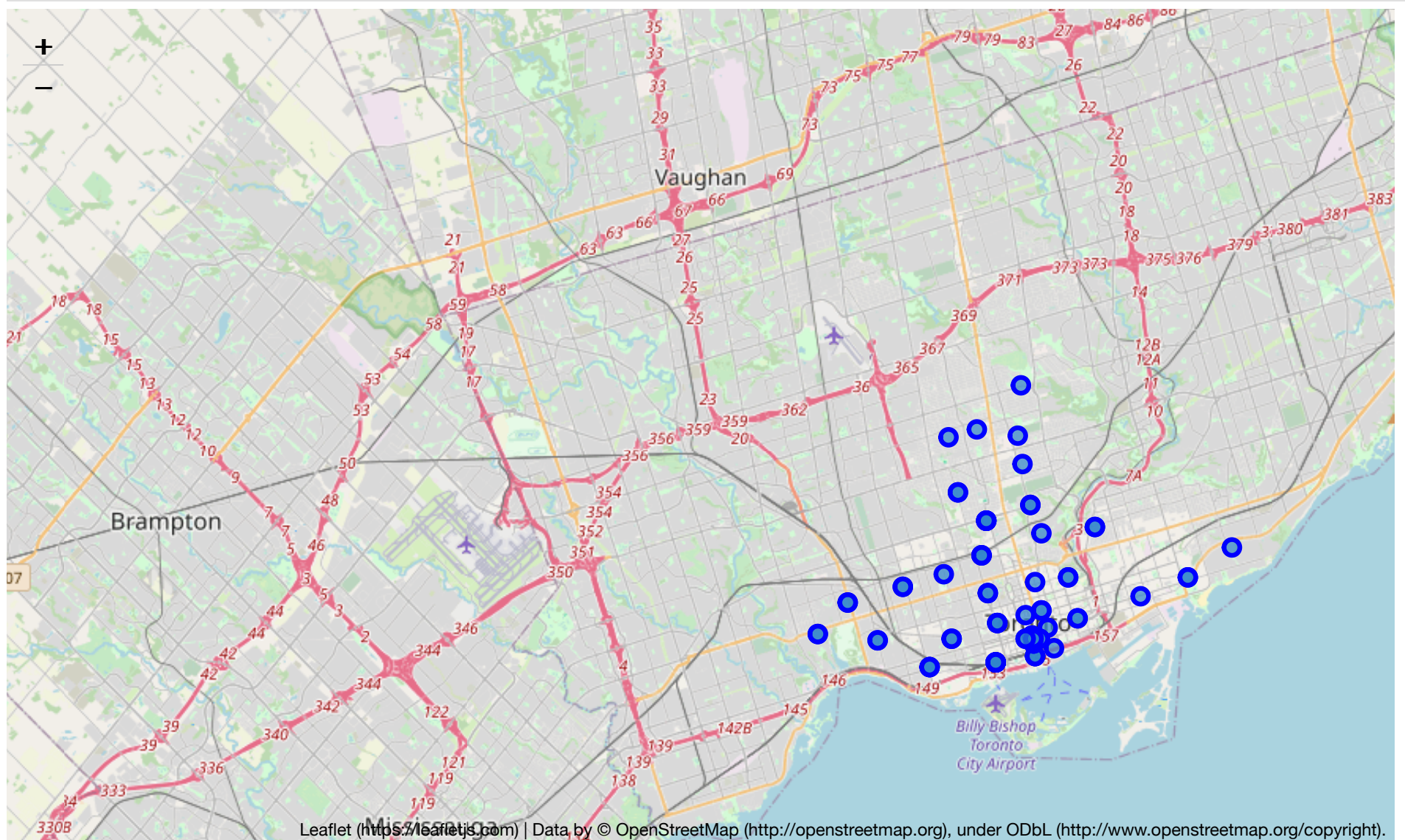
Out[16]:

	Postcode	Borough	Neighbourhood	Latitude	Longitude
0	M5A	Downtown Toronto	Harbourfront	43.65512	-79.36264
1	M5A	Downtown Toronto	Regent Park	43.65512	-79.36264
2	M5B	Downtown Toronto	Ryerson	43.65739	-79.37804
3	M5B	Downtown Toronto	Garden District	43.65739	-79.37804
4	M5C	Downtown Toronto	St. James Town	43.65215	-79.37587

Let's visualize on the map

```
In [17]: map_toronto
```

```
Out[17]:
```



Methodology

After successfully extracting the information about Toronto and neighbourhoods from its Wikipedia page, and visualizing it on the city map, we will now use the Foursquare API to explore venues around the area.

```
In [21]: toronto_venues = getNearbyVenues(names=df['Neighbourhood'], latitudes=df['Latitude'], longitudes=df['Longitude'])
```

Harbourfront
Regent Park
Ryerson
Garden District
St. James Town
The Beaches
Berczy Park
Central Bay Street
Christie
Adelaide
King
Richmond
Dovercourt Village
Dufferin
Harbourfront East
Toronto Islands
Union Station
Little Portugal
Trinity
The Danforth West
Riverdale
Design Exchange
Toronto Dominion Centre
Brockton
Exhibition Place
Parkdale Village
The Beaches West
India Bazaar
Commerce Court
Victoria Hotel
Studio District
Lawrence Park
Roselawn
Davisville North
Forest Hill North
Forest Hill West
High Park
The Junction South
North Toronto West
The Annex
North Midtown
Yorkville
Parkdale
Roncesvalles
Davisville
Harbord
University of Toronto
Runnymede
Swansea
Moore Park
Summerhill East
Chinatown
Grange Park
Kensington Market
Deer Park
Forest Hill SE
Rathnelly
South Hill
Summerhill West
CN Tower
Bathurst Quay
Island airport
Harbourfront West
King and Spadina
Railway Lands
South Niagara
Rosedale
Stn A PO Boxes 25 The Esplanade
Cabbagetown
St. James Town
First Canadian Place
Underground city
Church and Wellesley
Business Reply Mail Processing Centre 969 Eastern

```
In [24]: print(toronto_venues.shape)
         toronto_venues.head(20)
```

(3376, 7)

Out[24]:

	Neighborhood	Neighborhood Latitude	Neighborhood Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
0	Harbourfront	43.65512	-79.36264	Tandem Coffee	43.653559	-79.361809	Coffee Shop
1	Harbourfront	43.65512	-79.36264	Roselle Desserts	43.653447	-79.362017	Bakery
2	Harbourfront	43.65512	-79.36264	Souvlaki Express	43.655584	-79.364438	Greek Restaurant
3	Harbourfront	43.65512	-79.36264	Berkeley Church	43.655123	-79.365873	Event Space
4	Harbourfront	43.65512	-79.36264	Figs Breakfast & Lunch	43.655675	-79.364503	Breakfast Spot
5	Harbourfront	43.65512	-79.36264	Body Blitz Spa East	43.654735	-79.359874	Spa
6	Harbourfront	43.65512	-79.36264	Rooster Coffee	43.651900	-79.365609	Coffee Shop
7	Harbourfront	43.65512	-79.36264	Sumach Espresso	43.658135	-79.359515	Coffee Shop
8	Harbourfront	43.65512	-79.36264	Subway	43.655701	-79.364644	Sandwich Place
9	Harbourfront	43.65512	-79.36264	Mangia and Bevi Resto-Bar	43.652250	-79.366355	Italian Restaurant
10	Harbourfront	43.65512	-79.36264	Sukhothai	43.658444	-79.365681	Thai Restaurant
11	Harbourfront	43.65512	-79.36264	Impact Kitchen	43.656369	-79.356980	Restaurant
12	Harbourfront	43.65512	-79.36264	Cooper Koo Family YMCA	43.653249	-79.358008	Distribution Center
13	Harbourfront	43.65512	-79.36264	Starbucks	43.651613	-79.364917	Coffee Shop
14	Harbourfront	43.65512	-79.36264	Dominion Pub and Kitchen	43.656919	-79.358967	Pub
15	Harbourfront	43.65512	-79.36264	Savoury Grounds	43.656821	-79.358970	Coffee Shop
16	Harbourfront	43.65512	-79.36264	Dollarama	43.651227	-79.365170	Discount Store
17	Harbourfront	43.65512	-79.36264	Vistek	43.657046	-79.359667	Electronics Store
18	Regent Park	43.65512	-79.36264	Tandem Coffee	43.653559	-79.361809	Coffee Shop
19	Regent Park	43.65512	-79.36264	Roselle Desserts	43.653447	-79.362017	Bakery

In [27]:

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

There are 215 uniques categories.

One hot encoding

In [28]:

```
toronto_onehot.head()
```

Out[28]:

	Yoga Studio	Accessories Store	Adult Boutique	Afghan Restaurant	American Restaurant	Antique Shop	Aquarium	Art Gallery	Arts & Crafts Store	Asian Restaurant	Athletics & Sports	BBQ Joint	Baby Store	Bagel Shop	Bar
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

In [31]:

```
toronto_grouped.head(20)
```


Out[31]:

	Neighborhood	Yoga Studio	Accessories Store	Adult Boutique	Afghan Restaurant	American Restaurant	Antique Shop	Aquarium	Art Gallery	Arts & Crafts Store	Asian Restaurant	Athleti & Spor
0	Adelaide	0.000000	0.000000	0.000000	0.000000	0.020000	0.000000	0.0	0.010000	0.000000	0.040000	0.000000
1	Bathurst Quay	0.012987	0.000000	0.000000	0.000000	0.000000	0.000000	0.0	0.000000	0.000000	0.012987	0.000000
2	Berczy Park	0.000000	0.000000	0.000000	0.000000	0.000000	0.020833	0.0	0.020833	0.000000	0.000000	0.000000
3	Brockton	0.037037	0.012346	0.000000	0.000000	0.000000	0.000000	0.0	0.000000	0.024691	0.000000	0.000000
4	Business Reply Mail Processing Centre 969 Eastern	0.000000	0.000000	0.000000	0.000000	0.010204	0.000000	0.0	0.010204	0.000000	0.030612	0.000000
5	CN Tower	0.012987	0.000000	0.000000	0.000000	0.000000	0.000000	0.0	0.000000	0.000000	0.012987	0.000000
6	Cabbagetown	0.026316	0.000000	0.000000	0.000000	0.000000	0.000000	0.0	0.000000	0.000000	0.000000	0.000000
7	Central Bay Street	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0	0.000000	0.000000	0.000000	0.000000
8	Chinatown	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0	0.041667	0.020833	0.000000	0.000000
9	Christie	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0	0.000000	0.000000	0.000000	0.111111
10	Church and Wellesley	0.000000	0.000000	0.014286	0.014286	0.014286	0.000000	0.0	0.000000	0.000000	0.000000	0.000000
11	Commerce Court	0.000000	0.000000	0.000000	0.000000	0.020000	0.000000	0.0	0.010000	0.000000	0.020000	0.000000
12	Davisville	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0	0.000000	0.000000	0.000000	0.000000
13	Davisville North	0.000000	0.000000	0.000000	0.000000	0.111111	0.000000	0.0	0.000000	0.000000	0.000000	0.000000
14	Deer Park	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0	0.000000	0.000000	0.000000	0.000000
15	Design Exchange	0.000000	0.000000	0.000000	0.000000	0.020000	0.000000	0.0	0.010000	0.000000	0.040000	0.000000
16	Dovercourt Village	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0	0.055556	0.000000	0.000000	0.000000
17	Dufferin	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0	0.055556	0.000000	0.000000	0.000000
18	Exhibition Place	0.037037	0.012346	0.000000	0.000000	0.000000	0.000000	0.0	0.000000	0.024691	0.000000	0.000000
19	First Canadian Place	0.000000	0.000000	0.000000	0.000000	0.020000	0.000000	0.0	0.010000	0.000000	0.030000	0.000000

Most popular venues around the neighborhood

In [33]:

```
num_top_venues

----Adelaide----
      venue  freq
0   Coffee Shop  0.13
1       Café    0.08
2       Hotel   0.06
3 Sandwich Place  0.06
4 Asian Restaurant 0.04

----Bathurst Quay----
      venue  freq
0 Italian Restaurant 0.08
1   Coffee Shop    0.06
2   Sandwich Place  0.05
3       Park       0.05
4 Gym / Fitness Center 0.04

----Berczy Park----
      venue  freq
0   Cocktail Bar  0.08
1       Bakery   0.06
2   Sandwich Place  0.06
3 Seafood Restaurant 0.04
4   Farmers Market  0.04

----Brockton----
      venue  freq
0       Bar    0.09
1 Sandwich Place  0.06
2   Coffee Shop  0.05
3   Restaurant   0.05
4     Yoga Studio  0.04
```

----Business Reply Mail Processing Centre 969 Eastern----

	venue	freq
0	Coffee Shop	0.11
1	Café	0.06
2	Hotel	0.04
3	Restaurant	0.03
4	Gym	0.03

----CN Tower----

	venue	freq
0	Italian Restaurant	0.08
1	Coffee Shop	0.06
2	Sandwich Place	0.05
3	Park	0.05
4	Gym / Fitness Center	0.04

----Cabbagetown----

	venue	freq
0	Coffee Shop	0.11
1	Café	0.08
2	Bakery	0.05
3	Chinese Restaurant	0.05
4	Restaurant	0.05

----Central Bay Street----

	venue	freq
0	Coffee Shop	0.13
1	Clothing Store	0.07
2	Sandwich Place	0.05
3	Sushi Restaurant	0.05
4	Pizza Place	0.05

----Chinatown----

	venue	freq
0	Café	0.08
1	Vegetarian / Vegan Restaurant	0.04
2	Bakery	0.04
3	Burger Joint	0.04
4	Pizza Place	0.04

----Christie----

	venue	freq
0	Café	0.33
1	Grocery Store	0.22
2	Coffee Shop	0.11
3	Athletics & Sports	0.11
4	Baby Store	0.11

----Church and Wellesley----

	venue	freq
0	Coffee Shop	0.09
1	Sushi Restaurant	0.07
2	Japanese Restaurant	0.07
3	Gay Bar	0.04
4	Restaurant	0.04

----Commerce Court----

	venue	freq
0	Coffee Shop	0.12
1	Café	0.06
2	Hotel	0.06
3	Restaurant	0.05
4	Sandwich Place	0.05

----Davisville----

	venue	freq
0	Pizza Place	0.11
1	Dessert Shop	0.11
2	Coffee Shop	0.11
3	Indian Restaurant	0.05
4	Gas Station	0.05

----Davisville North----

	venue	freq
0	Hotel	0.11
1	Dog Run	0.11
2	Convenience Store	0.11
3	American Restaurant	0.11
4	Breakfast Spot	0.11

----Deer Park----

	venue	freq
--	-------	------

0	Coffee Shop	0.5
1	Light Rail Station	0.5
2	Yoga Studio	0.0
3	Music Venue	0.0
4	Middle Eastern Restaurant	0.0

----Design Exchange----

	venue	freq
0	Coffee Shop	0.14
1	Café	0.08
2	Hotel	0.06
3	Sandwich Place	0.04
4	Asian Restaurant	0.04

----Dovercourt Village----

	venue	freq
0	Grocery Store	0.06
1	Bakery	0.06
2	Smoke Shop	0.06
3	Bus Line	0.06
4	Furniture / Home Store	0.06

----Dufferin----

	venue	freq
0	Grocery Store	0.06
1	Bakery	0.06
2	Smoke Shop	0.06
3	Bus Line	0.06
4	Furniture / Home Store	0.06

----Exhibition Place----

	venue	freq
0	Bar	0.09
1	Sandwich Place	0.06
2	Coffee Shop	0.05
3	Restaurant	0.05
4	Yoga Studio	0.04

----First Canadian Place----

	venue	freq
0	Coffee Shop	0.13
1	Sandwich Place	0.09
2	Café	0.08
3	Hotel	0.06
4	Japanese Restaurant	0.04

----Forest Hill North----

	venue	freq
0	Park	1.0
1	Yoga Studio	0.0
2	Moving Target	0.0
3	Metro Station	0.0
4	Mexican Restaurant	0.0

----Forest Hill SE----

	venue	freq
0	Coffee Shop	0.5
1	Light Rail Station	0.5
2	Yoga Studio	0.0
3	Music Venue	0.0
4	Middle Eastern Restaurant	0.0

----Forest Hill West----

	venue	freq
0	Park	1.0
1	Yoga Studio	0.0
2	Moving Target	0.0
3	Metro Station	0.0
4	Mexican Restaurant	0.0

----Garden District----

	venue	freq
0	Coffee Shop	0.13
1	Sandwich Place	0.07
2	Hotel	0.04
3	Clothing Store	0.04
4	Café	0.04

----Grange Park----

	venue	freq
0	Café	0.08
1	Vegetarian / Vegan Restaurant	0.04
2	Bakery	0.04
3	Burger Joint	0.04

----Harbord----

	venue	freq
0	Coffee Shop	0.10
1	Café	0.10
2	Bakery	0.06
3	Pub	0.04
4	Gym	0.04

----Harbourfront----

	venue	freq
0	Coffee Shop	0.28
1	Electronics Store	0.06
2	Pub	0.06
3	Event Space	0.06
4	Sandwich Place	0.06

----Harbourfront East----

	venue	freq
0	Coffee Shop	0.14
1	Sandwich Place	0.08
2	Japanese Restaurant	0.06
3	Aquarium	0.04
4	Bank	0.04

----Harbourfront West----

	venue	freq
0	Italian Restaurant	0.08
1	Coffee Shop	0.06
2	Sandwich Place	0.05
3	Park	0.05
4	Gym / Fitness Center	0.04

----High Park----

	venue	freq
0	Convenience Store	0.2
1	Park	0.2
2	Sandwich Place	0.2
3	Intersection	0.2
4	Residential Building (Apartment / Condo)	0.2

----India Bazaar----

	venue	freq
0	Fast Food Restaurant	0.12
1	Park	0.06
2	Pub	0.06
3	Food & Drink Shop	0.06
4	Sandwich Place	0.06

----Island airport----

	venue	freq
0	Italian Restaurant	0.08
1	Coffee Shop	0.06
2	Sandwich Place	0.05
3	Park	0.05
4	Gym / Fitness Center	0.04

----Kensington Market----

	venue	freq
0	Café	0.08
1	Vegetarian / Vegan Restaurant	0.04
2	Bakery	0.04
3	Burger Joint	0.04
4	Pizza Place	0.04

----King----

	venue	freq
0	Coffee Shop	0.13
1	Café	0.08
2	Hotel	0.06
3	Sandwich Place	0.06
4	Asian Restaurant	0.04

----King and Spadina----

	venue	freq
0	Italian Restaurant	0.08
1	Coffee Shop	0.06
2	Sandwich Place	0.05
3	Park	0.05
4	Gym / Fitness Center	0.04

----Lawrence Park----

	venue	freq
0	Construction & Landscaping	0.33
1	Bus Line	0.33
2	Swim School	0.33
3	Yoga Studio	0.00
4	Moving Target	0.00

----Little Portugal----

	venue	freq
0	Cocktail Bar	0.07
1	Bar	0.07
2	Coffee Shop	0.05
3	Vietnamese Restaurant	0.05
4	Asian Restaurant	0.05

----Moore Park----

	venue	freq
0	Park	0.25
1	Gym	0.25
2	Trail	0.25
3	Restaurant	0.25
4	Yoga Studio	0.00

----North Midtown----

	venue	freq
0	Sandwich Place	0.14
1	Café	0.09
2	BBQ Joint	0.05
3	Coffee Shop	0.05
4	Liquor Store	0.05

----North Toronto West----

	venue	freq
0	Park	0.25
1	Gym Pool	0.25
2	Playground	0.25
3	Music Venue	0.25
4	Yoga Studio	0.00

----Parkdale----

	venue	freq
0	Coffee Shop	0.10
1	Bakery	0.06
2	Thai Restaurant	0.06
3	Eastern European Restaurant	0.06
4	Food & Drink Shop	0.06

----Parkdale Village----

	venue	freq
0	Bar	0.09
1	Sandwich Place	0.06
2	Coffee Shop	0.05
3	Restaurant	0.05
4	Yoga Studio	0.04

----Railway Lands----

	venue	freq
0	Italian Restaurant	0.08
1	Coffee Shop	0.06
2	Sandwich Place	0.05
3	Park	0.05
4	Gym / Fitness Center	0.04

----Rathnelly----

	venue	freq
0	Coffee Shop	0.5
1	Light Rail Station	0.5
2	Yoga Studio	0.0
3	Music Venue	0.0
4	Middle Eastern Restaurant	0.0

----Regent Park----

	venue	freq
0	Coffee Shop	0.28
1	Electronics Store	0.06
2	Pub	0.06
3	Event Space	0.06
4	Sandwich Place	0.06

----Richmond----

	venue	freq
0	Coffee Shop	0.13
1	Café	0.08
2	Hotel	0.06

3	Sandwich Place	0.06
4	Asian Restaurant	0.04

----Riverdale----

	venue	freq
0	Coffee Shop	0.12
1	Bus Line	0.12
2	Ice Cream Shop	0.12
3	Business Service	0.12
4	Intersection	0.12

----Roncesvalles----

	venue	freq
0	Coffee Shop	0.10
1	Bakery	0.06
2	Thai Restaurant	0.06
3	Eastern European Restaurant	0.06
4	Food & Drink Shop	0.06

----Rosedale----

	venue	freq
0	Park	0.50
1	Playground	0.25
2	Bike Trail	0.25
3	Yoga Studio	0.00
4	Moving Target	0.00

----Roselawn----

	venue	freq
0	Home Service	1.0
1	Mediterranean Restaurant	0.0
2	Metro Station	0.0
3	Mexican Restaurant	0.0
4	Middle Eastern Restaurant	0.0

----Runnymede----

	venue	freq
0	Coffee Shop	0.09
1	Café	0.09
2	Bank	0.06
3	Bakery	0.06
4	Park	0.06

----Ryerson----

	venue	freq
0	Coffee Shop	0.13
1	Sandwich Place	0.07
2	Hotel	0.04
3	Clothing Store	0.04
4	Café	0.04

----South Hill----

	venue	freq
0	Coffee Shop	0.5
1	Light Rail Station	0.5
2	Yoga Studio	0.0
3	Music Venue	0.0
4	Middle Eastern Restaurant	0.0

----South Niagara----

	venue	freq
0	Italian Restaurant	0.08
1	Coffee Shop	0.06
2	Sandwich Place	0.05
3	Park	0.05
4	Gym / Fitness Center	0.04

----St. James Town----

	venue	freq
0	Coffee Shop	0.10
1	Italian Restaurant	0.05
2	Café	0.05
3	Restaurant	0.04
4	Bakery	0.03

----Stn A PO Boxes 25 The Esplanade----

	venue	freq
0	Coffee Shop	0.11
1	Café	0.06
2	Hotel	0.04
3	Restaurant	0.03
4	Gym	0.03

----Studio District----

	venue	freq
0	Pizza Place	0.07
1	Italian Restaurant	0.07
2	Diner	0.07
3	Coffee Shop	0.05
4	Bar	0.05

----Summerhill East----

	venue	freq
0	Park	0.25
1	Gym	0.25
2	Trail	0.25
3	Restaurant	0.25
4	Yoga Studio	0.00

----Summerhill West----

	venue	freq
0	Coffee Shop	0.5
1	Light Rail Station	0.5
2	Yoga Studio	0.0
3	Music Venue	0.0
4	Middle Eastern Restaurant	0.0

----Swansea----

	venue	freq
0	Coffee Shop	0.09
1	Café	0.09
2	Bank	0.06
3	Bakery	0.06
4	Park	0.06

----The Annex----

	venue	freq
0	Sandwich Place	0.14
1	Café	0.09
2	BBQ Joint	0.05
3	Coffee Shop	0.05
4	Liquor Store	0.05

----The Beaches----

	venue	freq
0	Health Food Store	0.25
1	Pub	0.25
2	Coffee Shop	0.25
3	Yoga Studio	0.00
4	Museum	0.00

----The Beaches West----

	venue	freq
0	Fast Food Restaurant	0.12
1	Park	0.06
2	Pub	0.06
3	Food & Drink Shop	0.06
4	Sandwich Place	0.06

----The Danforth West----

	venue	freq
0	Coffee Shop	0.12
1	Bus Line	0.12
2	Ice Cream Shop	0.12
3	Business Service	0.12
4	Intersection	0.12

----The Junction South----

	venue	freq
0	Convenience Store	0.2
1	Park	0.2
2	Sandwich Place	0.2
3	Intersection	0.2
4	Residential Building (Apartment / Condo)	0.2

----Toronto Dominion Centre----

	venue	freq
0	Coffee Shop	0.14
1	Café	0.08
2	Hotel	0.06
3	Sandwich Place	0.04
4	Asian Restaurant	0.04

----Toronto Islands----

	venue	freq
0	Coffee Shop	0.14
1	Sandwich Place	0.08

```
2 Japanese Restaurant 0.06
3 Aquarium 0.04
4 Bank 0.04

----Trinity----
      venue  freq
0 Cocktail Bar 0.07
1 Bar 0.07
2 Coffee Shop 0.05
3 Vietnamese Restaurant 0.05
4 Asian Restaurant 0.05

----Underground city----
      venue  freq
0 Coffee Shop 0.13
1 Sandwich Place 0.09
2 Café 0.08
3 Hotel 0.06
4 Japanese Restaurant 0.04

----Union Station----
      venue  freq
0 Coffee Shop 0.14
1 Sandwich Place 0.08
2 Japanese Restaurant 0.06
3 Aquarium 0.04
4 Bank 0.04

----University of Toronto----
      venue  freq
0 Coffee Shop 0.10
1 Café 0.10
2 Bakery 0.06
3 Pub 0.04
4 Gym 0.04

----Victoria Hotel----
      venue  freq
0 Coffee Shop 0.12
1 Café 0.06
2 Hotel 0.06
3 Restaurant 0.05
4 Sandwich Place 0.05

----Yorkville----
      venue  freq
0 Sandwich Place 0.14
1 Café 0.09
2 BBQ Joint 0.05
3 Coffee Shop 0.05
4 Liquor Store 0.05
```

Clustering the Neighborhoods using K-means

In [67]: `df.head(10)`

Out[67]:

	Postcode	Borough	Neighbourhood	Latitude	Longitude
0	M5A	Downtown Toronto	Harbourfront	43.65512	-79.36264
1	M5A	Downtown Toronto	Regent Park	43.65512	-79.36264
2	M5B	Downtown Toronto	Ryerson	43.65739	-79.37804
3	M5B	Downtown Toronto	Garden District	43.65739	-79.37804
4	M5C	Downtown Toronto	St. James Town	43.65215	-79.37587
5	M4E	East Toronto	The Beaches	43.67709	-79.29547
6	M5E	Downtown Toronto	Berczy Park	43.64536	-79.37306
7	M5G	Downtown Toronto	Central Bay Street	43.65609	-79.38493
8	M6G	Downtown Toronto	Christie	43.66869	-79.42071
9	M5H	Downtown Toronto	Adelaide	43.64970	-79.38258

Merged dataframe, with Cluster Labels

In [68]: `toronto_merged.head(10)`

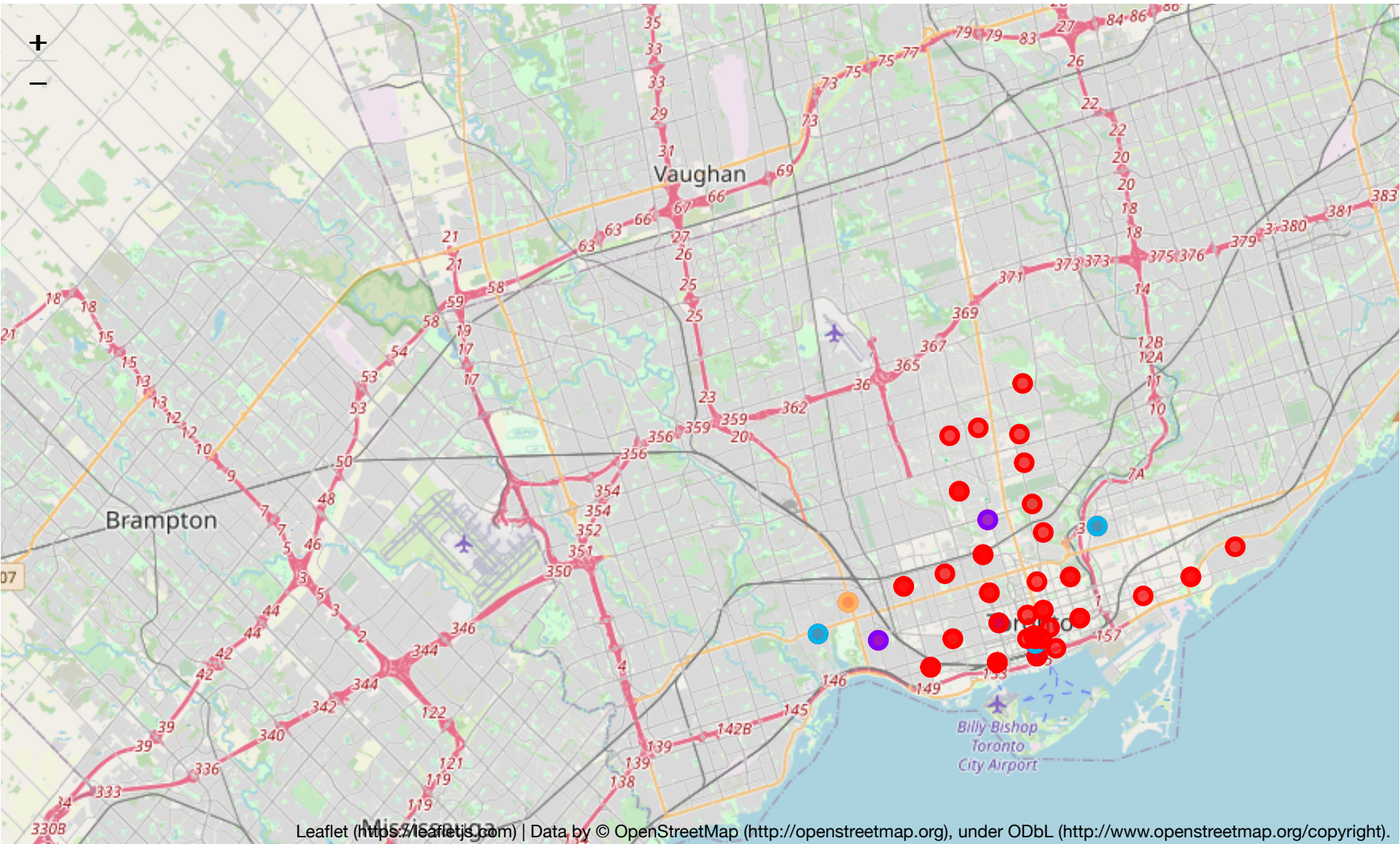
Out[68]:

	Postcode	Borough	Neighbourhood	Latitude	Longitude	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue
0	M5A	Downtown Toronto	Harbourfront	43.65512	-79.36264	0	Coffee Shop	Pub	Distribution Center	Italian Restaurant	Discount Store	Electronics Store
1	M5A	Downtown Toronto	Regent Park	43.65512	-79.36264	0	Coffee Shop	Pub	Distribution Center	Italian Restaurant	Discount Store	Electronics Store
2	M5B	Downtown Toronto	Ryerson	43.65739	-79.37804	0	Coffee Shop	Sandwich Place	Hotel	Café	Clothing Store	Middle Eastern Restaurant
3	M5B	Downtown Toronto	Garden District	43.65739	-79.37804	0	Coffee Shop	Sandwich Place	Hotel	Café	Clothing Store	Middle Eastern Restaurant
4	M5C	Downtown Toronto	St. James Town	43.65215	-79.37587	0	Coffee Shop	Italian Restaurant	Café	Restaurant	Cocktail Bar	Clothing Store
5	M4E	East Toronto	The Beaches	43.67709	-79.29547	0	Health Food Store	Coffee Shop	Pub	Dog Run	Farmers Market	Farm
6	M5E	Downtown Toronto	Berczy Park	43.64536	-79.37306	0	Cocktail Bar	Sandwich Place	Bakery	Farmers Market	Coffee Shop	Seafood Restaurant
7	M5G	Downtown Toronto	Central Bay Street	43.65609	-79.38493	0	Coffee Shop	Clothing Store	Pizza Place	Sandwich Place	Sushi Restaurant	Bank
8	M6G	Downtown Toronto	Christie	43.66869	-79.42071	0	Café	Grocery Store	Baby Store	Italian Restaurant	Athletics & Sports	Coffee Shop
9	M5H	Downtown Toronto	Adelaide	43.64970	-79.38258	0	Coffee Shop	Café	Sandwich Place	Hotel	Japanese Restaurant	Restaurant

Visualize the cluster!

In [70]: map_clusters

Out[70]:



Results and Discussion

As a result, the neighborhoods around Toronto were segmented into 5 clusters using the K-means clustering approach (unsupervised machine learning), where each cluster represent a group of similar neighborhods. In the following data frames, one can observe the details about the venues in each of the 5 clusters.

First cluster (see Cluster Label 0) represents the neighborhoods sharing similar venues, such as coffee shops, pubs, hotels, café, restaurants, shops, etc. being the most popular. This is a nice neighborhood from both living and tourist point of view, and is quite popular amongst the locals and the visitors. There are many coffee shpps, pubs and restaurants, with a wide variety of cuisines. It is near the downtown, and there are many interesting shops to buy clothes, groceries, etc. Also, there are hotels nearby, making it a perfect neighborhood for tourists to stay and explore.

Second cluster (see Cluster Label 1) is focused around central Toronto, and includes venues of interest such rail station, coffee shop, wings joint, dogs running area, and farmers market, etc.

Third cluster (see Cluster Label 2) highlights child friendly neighbourhood, with parks, playgrounds and bike trails being the most common venues.

Fourth cluster (see Cluster Label 3) is dominated by facilities such as home service, restaurants and farms. It is relatively a quiet neighbourhood in the central Toronto area.

Fifth cluster (see Cluster Label 4) consists of neighborhoods popular for parks, gyms, trail, restaurants, etc. and is popular amongst the locals. There is also an escape room in the neighbourhood.

```
In [74]: toronto_merged.loc[toronto_merged['Cluster Labels'] == 0, toronto_merged.columns[[0]+[1]+list(range(5, toronto_mer
```

Out[74]:

	Postcode	Borough	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	
0	M5A	Downtown Toronto	0	Coffee Shop	Pub	Distribution Center	Italian Restaurant	Discount Store	Electronics Store	Thai Restaurant	Restaurant	
1	M5A	Downtown Toronto	0	Coffee Shop	Pub	Distribution Center	Italian Restaurant	Discount Store	Electronics Store	Thai Restaurant	Restaurant	
2	M5B	Downtown Toronto	0	Coffee Shop	Sandwich Place	Hotel	Café	Clothing Store	Middle Eastern Restaurant	Cosmetics Shop	Japanese Restaurant	Pi
3	M5B	Downtown Toronto	0	Coffee Shop	Sandwich Place	Hotel	Café	Clothing Store	Middle Eastern Restaurant	Cosmetics Shop	Japanese Restaurant	Pi
4	M5C	Downtown Toronto	0	Coffee Shop	Italian Restaurant	Café	Restaurant	Cocktail Bar	Clothing Store	Cosmetics Shop	Diner	R
5	M4E	East Toronto	0	Health Food Store	Coffee Shop	Pub	Dog Run	Farmers Market	Farm	Falafel Restaurant	Event Space	R
6	M5E	Downtown Toronto	0	Cocktail Bar	Sandwich Place	Bakery	Farmers Market	Coffee Shop	Seafood Restaurant	Beer Bar	Vegetarian / Vegan Restaurant	
7	M5G	Downtown Toronto	0	Coffee Shop	Clothing Store	Pizza Place	Sandwich Place	Sushi Restaurant	Bank	Cosmetics Shop	Restaurant	
8	M6G	Downtown Toronto	0	Café	Grocery Store	Baby Store	Italian Restaurant	Athletics & Sports	Coffee Shop	Escape Room	Electronics Store	El
9	M5H	Downtown Toronto	0	Coffee Shop	Café	Sandwich Place	Hotel	Japanese Restaurant	Restaurant	Asian Restaurant	Deli / Bodega	R
10	M5H	Downtown Toronto	0	Coffee Shop	Café	Sandwich Place	Hotel	Japanese Restaurant	Restaurant	Asian Restaurant	Deli / Bodega	R
11	M5H	Downtown Toronto	0	Coffee Shop	Café	Sandwich Place	Hotel	Japanese Restaurant	Restaurant	Asian Restaurant	Deli / Bodega	R
12	M6H	West Toronto	0	Furniture / Home Store	Pharmacy	Bus Line	Liquor Store	Smoke Shop	Brazilian Restaurant	Middle Eastern Restaurant	Pool	Pi
13	M6H	West Toronto	0	Furniture / Home Store	Pharmacy	Bus Line	Liquor Store	Smoke Shop	Brazilian Restaurant	Middle Eastern Restaurant	Pool	Pi
14	M5J	Downtown Toronto	0	Coffee Shop	Sandwich Place	Japanese Restaurant	Boat or Ferry	Hotel	Aquarium	Bank	Plaza	
15	M5J	Downtown Toronto	0	Coffee Shop	Sandwich Place	Japanese Restaurant	Boat or Ferry	Hotel	Aquarium	Bank	Plaza	
16	M5J	Downtown Toronto	0	Coffee Shop	Sandwich Place	Japanese Restaurant	Boat or Ferry	Hotel	Aquarium	Bank	Plaza	
17	M6J	West Toronto	0	Bar	Cocktail Bar	Asian Restaurant	Vietnamese Restaurant	Coffee Shop	New American Restaurant	Cosmetics Shop	Brewery	R
18	M6J	West Toronto	0	Bar	Cocktail Bar	Asian Restaurant	Vietnamese Restaurant	Coffee Shop	New American Restaurant	Cosmetics Shop	Brewery	R
19	M4K	East Toronto	0	Park	Ice Cream Shop	Bus Line	Business Service	Coffee Shop	Intersection	Discount Store	Grocery Store	
20	M4K	East Toronto	0	Park	Ice Cream Shop	Bus Line	Business Service	Coffee Shop	Intersection	Discount Store	Grocery Store	

21	M5K	Downtown Toronto	0	Coffee Shop	Café	Hotel	Sandwich Place	Asian Restaurant	Deli / Bodega	Restaurant	Pharmacy	
22	M5K	Downtown Toronto	0	Coffee Shop	Café	Hotel	Sandwich Place	Asian Restaurant	Deli / Bodega	Restaurant	Pharmacy	
23	M6K	West Toronto	0	Bar	Sandwich Place	Coffee Shop	Restaurant	Japanese Restaurant	Café	Yoga Studio	Gift Shop	
24	M6K	West Toronto	0	Bar	Sandwich Place	Coffee Shop	Restaurant	Japanese Restaurant	Café	Yoga Studio	Gift Shop	
25	M6K	West Toronto	0	Bar	Sandwich Place	Coffee Shop	Restaurant	Japanese Restaurant	Café	Yoga Studio	Gift Shop	
26	M4L	East Toronto	0	Fast Food Restaurant	Gym	Movie Theater	Food & Drink Shop	Pub	Burrito Place	Italian Restaurant	Restaurant	'
27	M4L	East Toronto	0	Fast Food Restaurant	Gym	Movie Theater	Food & Drink Shop	Pub	Burrito Place	Italian Restaurant	Restaurant	'
28	M5L	Downtown Toronto	0	Coffee Shop	Café	Hotel	Sandwich Place	Restaurant	Beer Bar	Japanese Restaurant	Gym	
29	M5L	Downtown Toronto	0	Coffee Shop	Café	Hotel	Sandwich Place	Restaurant	Beer Bar	Japanese Restaurant	Gym	
30	M4M	East Toronto	0	Pizza Place	Italian Restaurant	Diner	Brewery	Gastropub	Coffee Shop	Bakery	Sushi Restaurant	
31	M4N	Central Toronto	0	Construction & Landscaping	Bus Line	Swim School	Fish & Chips Shop	Fast Food Restaurant	Farmers Market	Farm	Falafel Restaurant	
33	M4P	Central Toronto	0	Park	Breakfast Spot	Gym / Fitness Center	American Restaurant	Hotel	Convenience Store	Dog Run	Food & Drink Shop	De
36	M6P	West Toronto	0	Park	Residential Building (Apartment / Condo)	Convenience Store	Sandwich Place	Intersection	Farm	Falafel Restaurant	Event Space	R
37	M6P	West Toronto	0	Park	Residential Building (Apartment / Condo)	Convenience Store	Sandwich Place	Intersection	Farm	Falafel Restaurant	Event Space	R
38	M4R	Central Toronto	0	Gym Pool	Park	Playground	Music Venue	Wings Joint	Distribution Center	Falafel Restaurant	Event Space	R
39	M5R	Central Toronto	0	Sandwich Place	Café	Middle Eastern Restaurant	Cheese Shop	Pub	Coffee Shop	Pizza Place	Pharmacy	R
40	M5R	Central Toronto	0	Sandwich Place	Café	Middle Eastern Restaurant	Cheese Shop	Pub	Coffee Shop	Pizza Place	Pharmacy	R
41	M5R	Central Toronto	0	Sandwich Place	Café	Middle Eastern Restaurant	Cheese Shop	Pub	Coffee Shop	Pizza Place	Pharmacy	R
42	M6R	West Toronto	0	Coffee Shop	Bakery	Pizza Place	Eastern European Restaurant	Food & Drink Shop	Thai Restaurant	Breakfast Spot	Café	
43	M6R	West Toronto	0	Coffee Shop	Bakery	Pizza Place	Eastern European Restaurant	Food & Drink Shop	Thai Restaurant	Breakfast Spot	Café	
44	M4S	Central Toronto	0	Dessert Shop	Coffee Shop	Pizza Place	Gym	Thai Restaurant	Sandwich Place	Fast Food Restaurant	Café	
45	M5S	Downtown Toronto	0	Coffee Shop	Café	Bakery	Gym	Restaurant	Japanese Restaurant	Bar	Pub	
46	M5S	Downtown Toronto	0	Coffee Shop	Café	Bakery	Gym	Restaurant	Japanese Restaurant	Bar	Pub	
47	M6S	West Toronto	0	Café	Coffee Shop	Bank	Bakery	Park	Pilates Studio	Indian Restaurant	Pharmacy	
48	M6S	West Toronto	0	Café	Coffee Shop	Bank	Bakery	Park	Pilates Studio	Indian Restaurant	Pharmacy	
51	M5T	Downtown Toronto	0	Café	Art Gallery	Vietnamese Restaurant	Gaming Cafe	Vegetarian / Vegan Restaurant	Pizza Place	Bakery	Burger Joint	
52	M5T	Downtown Toronto	0	Café	Art Gallery	Vietnamese Restaurant	Gaming Cafe	Vegetarian / Vegan Restaurant	Pizza Place	Bakery	Burger Joint	
		Downtown				Vietnamese	Gaming	Vegetarian			Burger	

53	M5T	Toronto	0	Café	Art Gallery	Restaurant	Cafe	/ Vegan Restaurant	Pizza Place	Bakery	Joint	
59	M5V	Downtown Toronto	0	Italian Restaurant	Coffee Shop	Park	Sandwich Place	French Restaurant	Gym / Fitness Center	Restaurant	Pub	
60	M5V	Downtown Toronto	0	Italian Restaurant	Coffee Shop	Park	Sandwich Place	French Restaurant	Gym / Fitness Center	Restaurant	Pub	
61	M5V	Downtown Toronto	0	Italian Restaurant	Coffee Shop	Park	Sandwich Place	French Restaurant	Gym / Fitness Center	Restaurant	Pub	
62	M5V	Downtown Toronto	0	Italian Restaurant	Coffee Shop	Park	Sandwich Place	French Restaurant	Gym / Fitness Center	Restaurant	Pub	
63	M5V	Downtown Toronto	0	Italian Restaurant	Coffee Shop	Park	Sandwich Place	French Restaurant	Gym / Fitness Center	Restaurant	Pub	
64	M5V	Downtown Toronto	0	Italian Restaurant	Coffee Shop	Park	Sandwich Place	French Restaurant	Gym / Fitness Center	Restaurant	Pub	
65	M5V	Downtown Toronto	0	Italian Restaurant	Coffee Shop	Park	Sandwich Place	French Restaurant	Gym / Fitness Center	Restaurant	Pub	
67	M5W	Downtown Toronto	0	Coffee Shop	Café	Hotel	Asian Restaurant	Gym	Restaurant	Sushi Restaurant	Pharmacy	R
68	M4X	Downtown Toronto	0	Coffee Shop	Café	Bakery	Chinese Restaurant	Pizza Place	Italian Restaurant	Pub	Restaurant	
69	M4X	Downtown Toronto	0	Coffee Shop	Italian Restaurant	Café	Restaurant	Cocktail Bar	Clothing Store	Cosmetics Shop	Diner	R
70	M5X	Downtown Toronto	0	Coffee Shop	Sandwich Place	Café	Hotel	Japanese Restaurant	Restaurant	Bank	Gym	R
71	M5X	Downtown Toronto	0	Coffee Shop	Sandwich Place	Café	Hotel	Japanese Restaurant	Restaurant	Bank	Gym	R
72	M4Y	Downtown Toronto	0	Coffee Shop	Japanese Restaurant	Sushi Restaurant	Restaurant	Gay Bar	Grocery Store	Mediterranean Restaurant	Burrito Place	
73	M7Y	East Toronto	0	Coffee Shop	Café	Hotel	Asian Restaurant	Gym	Restaurant	Sushi Restaurant	Pharmacy	R

```
In [75]: toronto_merged.loc[toronto_merged['Cluster Labels'] == 1, toronto_merged.columns[[0]+[1]+list(range(5, toronto_mer
```

Out[75]:

	Postcode	Borough	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
54	M4V	Central Toronto	1	Light Rail Station	Coffee Shop	Wings Joint	Dog Run	Farmers Market	Farm	Falafel Restaurant	Event Space	Ethiopian Restaurant	Escape Room
55	M4V	Central Toronto	1	Light Rail Station	Coffee Shop	Wings Joint	Dog Run	Farmers Market	Farm	Falafel Restaurant	Event Space	Ethiopian Restaurant	Escape Room
56	M4V	Central Toronto	1	Light Rail Station	Coffee Shop	Wings Joint	Dog Run	Farmers Market	Farm	Falafel Restaurant	Event Space	Ethiopian Restaurant	Escape Room
57	M4V	Central Toronto	1	Light Rail Station	Coffee Shop	Wings Joint	Dog Run	Farmers Market	Farm	Falafel Restaurant	Event Space	Ethiopian Restaurant	Escape Room
58	M4V	Central Toronto	1	Light Rail Station	Coffee Shop	Wings Joint	Dog Run	Farmers Market	Farm	Falafel Restaurant	Event Space	Ethiopian Restaurant	Escape Room

```
In [76]: toronto_merged.loc[toronto_merged['Cluster Labels'] == 2, toronto_merged.columns[[0]+[1]+list(range(5, toronto_mer
```

Out[76]:

	Postcode	Borough	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
34	M5P	Central Toronto	2	Park	Wings Joint	Dog Run	Farmers Market	Farm	Falafel Restaurant	Event Space	Ethiopian Restaurant	Escape Room	Elementar Scho
35	M5P	Central Toronto	2	Park	Wings Joint	Dog Run	Farmers Market	Farm	Falafel Restaurant	Event Space	Ethiopian Restaurant	Escape Room	Elementar Scho
66	M4W	Downtown Toronto	2	Park	Playground	Bike Trail	Wings Joint	Dog Run	Farmers Market	Farm	Falafel Restaurant	Event Space	Ethiopia Restaur

```
In [77]: toronto_merged.loc[toronto_merged['Cluster Labels'] == 3, toronto_merged.columns[[0]+[1]+list(range(5, toronto_mer
```

Out[77]:

	Postcode	Borough	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
32	M5N	Central Toronto	3	Home Service	Wings Joint	Dog Run	Fast Food Restaurant	Farmers Market	Farm	Falafel Restaurant	Event Space	Ethiopian Restaurant	Escape Room

In [78]:

```
toronto_merged.loc[toronto_merged['Cluster Labels'] == 4, toronto_merged.columns[[0]+[1]+list(range(5, toronto_mer
```

Out[78]:

	Postcode	Borough	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
49	M4T	Central Toronto	4	Park	Gym	Trail	Restaurant	Wings Joint	Distribution Center	Falafel Restaurant	Event Space	Ethiopian Restaurant	Escape Room
50	M4T	Central Toronto	4	Park	Gym	Trail	Restaurant	Wings Joint	Distribution Center	Falafel Restaurant	Event Space	Ethiopian Restaurant	Escape Room

Conclusion

The purpose of this project was to explore Toronto and find out the most popular venues around the neighbourhood. Using the Foursquare API, we gathered the location data about the popular venues around Toronto. Using unsupervised machine learning approach, K-means clustering, we clustered the locations to generate the major areas of interest containing the most popular places to explore.

Final decision on the best neighborhood to visit will be made by the tourists, visitors or investors, based on their personal preferences about the specific characteristics they like in a neighborhood in every recommended zone (or cluster).

For example:

- If you are a tourist visiting Toronto, the neighborhoods in the first cluster are a must visit!
- If you are an investor, interested in the restaurant business, do check the neighborhoods and venues in the first, second and fifth cluster.
- If you want to visit trails, check out the third and fifth cluster.
- Do check out the map above to explore the neighborhoods, and refer to the tables for information about the venues that interests you.

Thank you!

This page will be further updated, as I am interested in learning more about data science!