# Segmenting and Clustering Neighbourhoods in Toronto - Part 3

```
pip install geopy
```

Requirement already satisfied: geopy in ./anaconda3/lib/python3.8/site-packag
es (2.1.0)
Requirement already satisfied: geographiclib<2,>=1.49 in ./anaconda3/lib/pyth
on3.8/site-packages (from geopy) (1.50)
Note: you may need to restart the kernel to use updated packages.

```
pip install folium
```

Requirement already satisfied: folium in ./anaconda3/lib/python3.8/site-packa
ges (0.12.0)
Requirement already satisfied: jinja2>=2.9 in ./anaconda3/lib/python3.8/site-
packages (from folium) (2.11.2)
Requirement already satisfied: branca>=0.3.0 in ./anaconda3/lib/python3.8/sit
e-packages (from folium) (0.4.2)
Requirement already satisfied: requests in ./anaconda3/lib/python3.8/site-pac
kages (from folium) (2.24.0)
Requirement already satisfied: numpy in ./anaconda3/lib/python3.8/site-packag
es (from folium) (1.18.5)
Requirement already satisfied: MarkupSafe>=0.23 in ./anaconda3/lib/python3.8/
site-packages (from jinja2>=2.9->folium) (1.1.1)
Requirement already satisfied: certifi>=2017.4.17 in ./anaconda3/lib/python3.
8/site-packages (from requests->folium) (2020.6.20)
Requirement already satisfied: idna<3,>=2.5 in ./anaconda3/lib/python3.8/site
-packages (from requests->folium) (2.10)
Requirement already satisfied: urllib3!=1.25.0,!=1.25.1,<1.26,>=1.21.1 in ./a
naconda3/lib/python3.8/site-packages (from requests->folium) (1.25.9)
Requirement already satisfied: chardet<4,>=3.0.2 in ./anaconda3/lib/python3.8
/site-packages (from requests->folium) (3.0.4)
Note: you may need to restart the kernel to use updated packages.

```
import folium
import requests
import json
import matplotlib.cm as cm
import matplotlib.colors as colors
import pandas as pd

from pandas.io.json import json_normalize
from sklearn.cluster import KMeans
```

```python
from geopy.geocoders import Nominatim

pd.set_option('display.max_columns', None)
pd.set_option('display.max_rows', None)

print("Imported!")
```

Imported!

```python
df = pd.read_csv('toronto_part2.csv')
print(df.shape)
df.head()
```

(180, 5)

| | Postalcode | Borough | Neighborhood | Latitude | Longitude |
|---|---|---|---|---|---|
| 0 | M1A\n | Notassigned\n | Notassigned\n | 43.64869 | -79.385444 |

| | Postalcode | Borough | Neighborhood | Latitude | Longitude |
|---|---|---|---|---|---|
| 1 | M1B\n | Scarborough\n | Malvern,Rouge | 43.81139 | -79.19662 |
| 2 | M1C\n | Scarborough\n | RougeHill,PortUn | 43.78574 | -79.15875 |

| | Postalcode | Borough | Neighborhood | Latitude | Longitude |
|---|---|---|---|---|---|
| | | | ion,HighlandCreek | | |
| 3 | M1E\n | Scarborough | Guildwood,Mo | 43.76575 | -79.17470 |

| | Postalcode | Borough | Neighborhood | Latitude | Longitude |
|---|---|---|---|---|---|
| | | \n | rningside,West Hill | | |
| 4 | M1G\n | Scarborough | Woburn | 43.76812 | -79.21761 |

| | Postalcode | Borough | Neighborhood | Latitude | Longitude |
|---|---|---|---|---|---|
| | | | \n | | |

```python
address = 'Toronto, Ontario Canada'
geolocator = Nominatim(user_agent="http")
location = geolocator.geocode(address)
latitude = location.latitude
longitude = location.longitude
print('The geograpical coordinate of Toronto Canada are {}, {}.'.format(latit
ude, longitude))
```

The geograpical coordinate of Toronto Canada are 43.6534817, -79.3839347.

```python
map_toronto = folium.Map(location=[latitude, longitude], zoom_start=11)
for lat, lng, borough, neighborhood in zip(df['Latitude'], df['Longitude'], d
f['Borough'], df['Neighborhood']):
    label = '{}, {}'.format(neighborhood, borough)
    label = folium.Popup(label, parse_html=True)
    folium.CircleMarker(
        [lat, lng],
        radius=4,
        popup=label,
        color='blue',
        fill=True,
        fill_color='#87cefa',
        fill_opacity=0.5,
        parse_html=False).add_to(map_toronto)
map_toronto
```

Make this Notebook Trusted to load map: File -> Trust Notebook

```
toronto_data = df[df['Borough'].str.contains("Toronto")].reset_index(drop=True)
print(toronto_data.shape)
toronto_data.head()
```

(39, 5)

| | Postalcode | Borough | Neighborhood | Latitude | Longitude |
|---|---|---|---|---|---|
| 0 | M4E\n | EastToronto\n | TheBeaches | 43.67709 | -79.292547 |
| 1 | M4K\n | EastToro | TheDanfo | 43.6833 | -79.3555 |

| | Postalcode | Borough | Neighborhood | Latitude | Longitude |
| --- | --- | --- | --- | --- | --- |
| | | nto\n | rthWest,Riverdale | 75 | 12 |
| 2 | M4L\n | EastToronto | IndiaBazaar, | 43.66797 | -79.31467 |

| Postalcode | Borough | Neighborhood | Latitude | Longitude |
|---|---|---|---|---|
| | \n | The Beaches West | | |
| **3** M4M\n | East Toronto\n | Studio District | 43.66213 | -79.33497 |

|   | Postalcode | Borough | Neighborhood | Latitude | Longitude |
|---|---|---|---|---|---|
| 4 | M4N\n | CentralToronto\n | LawrencePark | 43.72843 | -79.38713 |

```python
map_toronto = folium.Map(location=[latitude, longitude], zoom_start=11)

for lat, lng, label in zip(toronto_data['Latitude'], toronto_data['Longitude'], toronto_data['Neighborhood']):
    label = folium.Popup(label, parse_html=True)
    folium.CircleMarker([lat, lng], radius=5, popup=label, color='blue', fill=True, fill_color='#3186cc', fill_opacity=0.7,parse_html=False).add_to(map_toronto)
map_toronto
```

Make this Notebook Trusted to load map: File -> Trust Notebook

```python
# Foursquare API
CLIENT_ID = 'DPBYY4JUY3DU20ALPSUV4ONY2K1GOJJKJ1NIHBB32XEMOVYY' # Put Your Cli
ent Id
CLIENT_SECRET = '1MV443TYEP4HUO0WDUW5NQ5W10L2Y4G05NWG11WIR3NUGC5B' # Put You
Client Secret
VERSION = '20180604'
LIMIT = 30
print('Your credentails:')
print('CLIENT_ID: Hidden')
print('CLIENT_SECRET: Hidden')
Your credentails:
CLIENT_ID: Hidden
CLIENT_SECRET: Hidden
```

## 1. Exploring Neighbourhood in Toronto

In [15]:

```python
def getNearbyVenues(names, latitudes, longitudes, radius=500):

    venues_list=[]
    for name, lat, lng in zip(names, latitudes, longitudes):
        print(name)

        url = 'https://api.foursquare.com/v2/venues/explore?&client_id={}&cli
ent_secret={}&v={}&ll={},{}&radius={}&limit={}'.format(
            CLIENT_ID, CLIENT_SECRET, VERSION, lat, lng, radius, LIMIT)

        results = requests.get(url).json()["response"]['groups'][0]['items']

        venues_list.append([( name, lat, lng, v['venue']['name'], v['venue'][
'location']['lat'], v['venue']['location']['lng'], v['venue']['categories'][0
]['name']) for v in results])

    nearby_venues = pd.DataFrame([item for venue_list in venues_list for item
in venue_list])
    nearby_venues.columns = ['Neighborhood', 'Neighborhood Latitude', 'Neighb
orhood Longitude', 'Venue', 'Venue Latitude', 'Venue Longitude', 'Venue Categ
ory']

    return(nearby_venues)
```

In [16]:

```python
df = toronto_data
toronto_venues = getNearbyVenues(names=df['Neighborhood'], latitudes=df['Lati
tude'],longitudes=df['Longitude'])

The Beaches
```

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

<div align="right">In [17]:</div>

```python
print(toronto_venues.shape)
toronto_venues.head()
```

(805, 7)

| | Neighborhood | NeighborhoodLatitude | NeighborhoodLongitude | Venue | VenueLatitude | VenueLongitude | VenueCategory |
|---|---|---|---|---|---|---|---|
| | TheBeaches | 43.67709 | -79.29547 | GlenManorRavine | 43.676821 | -79.293942 | Trail |
| | TheB | 43.6 | -79. | TheB | 43.6 | -79. | Heal |

| | | Neighborhood | NeighborhoodLatitude | NeighborhoodLongitude | Venue | VenueLatitude | VenueLongitude | VenueCategory |
|---|---|---|---|---|---|---|---|---|
| | | eaches | 7709 | 29547 | igCarrotNaturalFoodNark | 7879 | 29734 | thFoodStore |

| | | Neighborhood | NeighborhoodLatitude | NeighborhoodLongitude | Venue | VenueLatitude | VenueLongitude | VenueCategory |
|---|---|---|---|---|---|---|---|---|
| | | | | | et | | | |
| | | The Beaches | 43.67709 | -79.29547 | Grover Pub and Grub | 43.679181 | -79.297215 | Pub |

| | Neighborhood | NeighborhoodLatitude | NeighborhoodLongitude | Venue | VenueLatitude | VenueLongitude | VenueCategory |
|---|---|---|---|---|---|---|---|
| | TheBeaches | 43.67709 | -79.29547 | SeasprayRestaurant | 43.678888 | -79.298167 | AsianRestaurant |
| | Th | 43 | -7 | Up | 43 | -7 | Ne |

| | Neighborhood | NeighborhoodLatitude | NeighborhoodLongitude | Venue | VenueLatitude | VenueLongitude | VenueCategory |
|---|---|---|---|---|---|---|---|
| | eBeaches | .67709 | 9.29547 | perBeaches | .68053 | 9.29869 | ighborhood |

Dufferin, Dovercourt Village
Little Portugal, Trinity
Brockton, Parkdale Village, Exhibition Place
High Park, The Junction South
Parkdale, Roncesvalles
Runnymede, Swansea
Queen's Park, Ontario Provincial Government
Business reply mail Processing Centre, South Central Letter Processing Plant
Toronto

```python
print(toronto_venues.shape)
```

```
toronto_venues.head()
```

(805, 7)

| | Neighborhood | NeighborhoodLatitude | NeighborhoodLongitude | Venue | VenueLatitude | VenueLongitude | VenueCategory |
|---|---|---|---|---|---|---|---|
| | TheBeaches | 43.67709 | -79.29547 | GlenManorRavine | 43.67681 | -79.29... | Trail |

| Neighborhood | NeighborhoodLatitude | NeighborhoodLongitude | Venue | VenueLatitude | VenueLongitude | VenueCategory |
| --- | --- | --- | --- | --- | --- | --- |
| TheBeaches | 43.67709 | -79.29547 | TheBigCarrotNaturalFoo | 43.67889 | -79.29... | HealthFoodStore |

| Neighborhood | NeighborhoodLatitude | NeighborhoodLongitude | Venue | VenueLatitude | VenueLongitude | VenueCategory |
|---|---|---|---|---|---|---|
| | | | dMarket | | | |
| TheBeaches | 43.67709 | -79.29547 | GroverPubandG | 43.67918 1 | | Pub |

| Neighborhood | NeighborhoodLatitude | NeighborhoodLongitude | Venue | VenueLatitude | VenueLongitude | VenueCategory |
|---|---|---|---|---|---|---|
| | | | rub | | | |
| TheBeaches | 43.67709 | -79.29547 | SeasprayRestaura | 43.67888 | | AsianRestaurant |

| | Neighborhood | NeighborhoodLatitude | NeighborhoodLongitude | Venue | VenueLatitude | VenueLongitude | VenueCategory |
|---|---|---|---|---|---|---|---|
| | | | | nt | | | |
| | The Beaches | 43.67709 | -79.29547 | Upper Beaches | 43.680563 | -79.2986 | Neighborhood |
| HighP | | 4 | 4 | 4 | 4 | 4 | 4 |

| | Neighborhood | NeighborhoodLatitude | NeighborhoodLongitude | Venue | VenueLatitude | VenueLongitude | VenueCategory |
|---|---|---|---|---|---|---|---|
| ark,TheJunctionSouth | | | | | | | |
| Ind | 19 | 19 | 19 | 19 | 19 | 19 | 19 |

| Neighborhood | NeighborhoodLatitude | NeighborhoodLongitude | Venue | VenueLatitude | VenueLongitude | VenueCategory |
|---|---|---|---|---|---|---|
| iaBazaar,TheBeachesWest | | | | | | |

| | Neighborhood | NeighborhoodLatitude | NeighborhoodLongitude | Venue | VenueLatitude | VenueLongitude | VenueCategory |
|---|---|---|---|---|---|---|---|
| | KensingtonMarket ,Chinatow | 30 | 30 | 30 | 30 | 30 | 30 |

| Neighborhood | NeighborhoodLatitude | NeighborhoodLongitude | Venue | VenueLatitude | VenueLongitude | VenueCategory |
|---|---|---|---|---|---|---|
| n'GrangePark | | | | | | |
| LawrencePa | 2 | 2 | 2 | 2 | 2 | 2 |

| | Neighborhood | NeighborhoodLatitude | NeighborhoodLongitude | Venue | VenueLatitude | VenueLongitude | VenueCategory |
|---|---|---|---|---|---|---|---|
| rk | | | | | | | |
| | LittlePortugal ,Trini | 30 | 30 | 30 | 30 | 30 | 30 |

| | Neighborhood | NeighborhoodLatitude | NeighborhoodLongitude | Venue | VenueLatitude | VenueLongitude | VenueCategory |
|---|---|---|---|---|---|---|---|
| ty | | | | | | | |
| | MoorePark 'Summerhill E | 4 | 4 | 4 | 4 | 4 | 4 |

| | Neighborhood | NeighborhoodLatitude | NeighborhoodLongitude | Venue | VenueLatitude | VenueLongitude | VenueCategory |
|---|---|---|---|---|---|---|---|
| ast | | | | | | | |
| NorthTorontoWest,Law | 4 | 4 | 4 | 4 | 4 | 4 |

| | Neighborhood | NeighborhoodLatitude | NeighborhoodLongitude | Venue | VenueLatitude | VenueLongitude | VenueCategory |
|---|---|---|---|---|---|---|---|
| rencePark | | | | | | | |
| Parkdale,Ronce | 30 | 30 | 30 | 30 | 30 | | 30 |

| | Neighborhood | NeighborhoodLatitude | NeighborhoodLongitude | Venue | VenueLatitude | VenueLongitude | VenueCategory |
|---|---|---|---|---|---|---|---|
| svalles | | | | | | | |
| Queen'sPark,Onta | 17 | 17 | 17 | 17 | 17 | 17 | 17 |

| | rioProvincialGovernment | Neighborhood | NeighborhoodLatitude | NeighborhoodLongitude | Venue | VenueLatitude | VenueLongitude | VenueCategory |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |

| | Neighborhood | NeighborhoodLatitude | NeighborhoodLongitude | Venue | VenueLatitude | VenueLongitude | VenueCategory |
|---|---|---|---|---|---|---|---|
| RegentPark ,Harbourfront | | 21 | 21 | 21 | 21 | 21 | 21 |

| | Neighborhood | NeighborhoodLatitude | NeighborhoodLongitude | Venue | VenueLatitude | VenueLongitude | VenueCategory |
|---|---|---|---|---|---|---|---|
| Richmond,Adelaide,King | | 30 | 30 | 30 | 30 | 30 | 30 |

| | Neighborhood | NeighborhoodLatitude | NeighborhoodLongitude | Venue | VenueLatitude | VenueLongitude | VenueCategory |
|---|---|---|---|---|---|---|---|
| Rosedale | | 4 | 4 | 4 | 4 | 4 | 4 |
| Roselawn | | 1 | 1 | 1 | 1 | 1 | 1 |
| Runn | | 30 | 30 | 30 | 30 | 30 | 30 |

| Neighborhood | NeighborhoodLatitude | NeighborhoodLongitude | Venue | VenueLatitude | VenueLongitude | VenueCategory |
|---|---|---|---|---|---|---|
| ymede,'Swansea | | | | | | |
| St.JamesTo | 30 | 30 | 30 | 30 | 30 | 30 |

| | Neighborhood | NeighborhoodLatitude | NeighborhoodLongitude | Venue | VenueLatitude | VenueLongitude | VenueCategory |
|---|---|---|---|---|---|---|---|
| wn | | | | | | | |
| St. JamesTown, Cabbaget | 30 | 30 | 30 | 30 | 30 | 30 | 30 |

| | Neighborhood | NeighborhoodLatitude | NeighborhoodLongitude | Venue | VenueLatitude | VenueLongitude | VenueCategory |
|---|---|---|---|---|---|---|---|
| own | | | | | | | |
| StnAPOBoxes | 30 | 30 | 30 | 30 | 30 | | 30 |
| StudioD | 30 | 30 | 30 | 30 | 30 | | 30 |

| | | Neighborhood | NeighborhoodLatitude | NeighborhoodLongitude | Venue | VenueLatitude | VenueLongitude | VenueCategory |
|---|---|---|---|---|---|---|---|---|
| istrict | | | | | | | | |
| SummerhillWest,R | | 6 | 6 | 6 | 6 | 6 | 6 | |

| | Neighborhood | NeighborhoodLatitude | NeighborhoodLongitude | Venue | VenueLatitude | VenueLongitude | VenueCategory |
|---|---|---|---|---|---|---|---|
| athnelly,SouthHill,ForestH | | | | | | | |

| | Neighborhood | NeighborhoodLatitude | NeighborhoodLongitude | Venue | VenueLatitude | VenueLongitude | VenueCategory |
|---|---|---|---|---|---|---|---|
| illSE'DeerPark | | | | | | | |
| TheAnnex, | 2 2 | 2 2 | 2 2 | 2 2 | 2 2 | | 2 2 |

| | Neighborhood | NeighborhoodLatitude | NeighborhoodLongitude | Venue | VenueLatitude | VenueLongitude | VenueCategory |
|---|---|---|---|---|---|---|---|
| | North Midtown, Yorkville | | | | | | |

| | Neighborhood | NeighborhoodLatitude | NeighborhoodLongitude | Venue | VenueLatitude | VenueLongitude | VenueCategory |
|---|---|---|---|---|---|---|---|
| TheBeaches | | 5 | 5 | 5 | 5 | 5 | 5 |
| TheDanforthW | | 8 | 8 | 8 | 8 | 8 | 8 |

| | Neighborhood | NeighborhoodLatitude | NeighborhoodLongitude | Venue | VenueLatitude | VenueLongitude | VenueCategory |
|---|---|---|---|---|---|---|---|
| | est,Riverdale | | | | | | |
| | TorontoDom | 30 | 30 | 30 | 30 | 30 | 30 |

| | Neighborhood | NeighborhoodLatitude | NeighborhoodLongitude | Venue | VenueLatitude | VenueLongitude | VenueCategory |
|---|---|---|---|---|---|---|---|
| inionCentre,DesignExchan | | | | | | | |

| | Neighborhood | NeighborhoodLatitude | NeighborhoodLongitude | Venue | VenueLatitude | VenueLongitude | VenueCategory |
|---|---|---|---|---|---|---|---|
| ge | | | | | | | |

```
print('There are {} uniques categories.'.format(len(toronto_venues['Venue Cat
egory'].unique()))))
There are 177 uniques categories.
```

## 2. Analyze Each Borough Neighborhood

```
toronto_onehot = pd.get_dummies(toronto_venues[['Venue Category']], prefix=""
, prefix_sep="")

toronto_onehot['Neighborhood'] = toronto_venues['Neighborhood']

fixed_columns = [toronto_onehot.columns[-1]] + list(toronto_onehot.columns[:-
1])
toronto_onehot = toronto_onehot[fixed_columns]

toronto_onehot.head()
```

```
toronto_onehot.shape
```

```
(805, 177)
```

```
toronto_grouped = toronto_onehot.groupby('Neighborhood').mean().reset_index()
toronto_grouped
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7Commerce Court, Victoria Hotel0.0000000.0666670.0000000.0000000.0333330.0000000.0000000.0000000.0000000.0000000.0000000.0333330.0000000.0000000.0000000.0000000.0000000.000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000.0000000.1333330.0000000.0000000.0000000.0000000.0000000.0000000.0666670.0000000.0000000.0000000.0000000.0000000.000.0000000.0000000.0000000.0000000.0000000.0333330.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0333330.0333330.0000000.0000000.0000000.0000000.0000000.0000000.0666670.0000000.0000000.0000000.0333330.0000000.0000000.0000000.0333330.0333330.000.00.0000000.0000000.00.0666670.0000000.0000000.0000000.0000000.0000.0000000.0333330.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0333330.0000000.0000000.0000000.0000000.0000000.0333330.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0333330.0000000.0000000.000.1000000.0000000.0000000.0000000.0333330.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.00.0333330.0000000.0000000.0000000.000.0000000.0000000.0000000.0000000.000.0000000.0000000.0000000.0000000.0333330.0000008Davisville0.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000.0000000.0769230.0000000.0000000.0000000.0000000.0000000.0000000.0769230.0000000.0000000.0000000.0000000.0000000.000.0000000.0000000.0000000.0000000.0000000.0000000.1153850.0384620.0384620.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0384620.0384620.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0384620.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0384620.0000000.000.00.0000000.0000000.00.0000000.0000000.0000000.0000000.0384620.0000.0769230.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0384620.0000000.0000000.0000000.0769230.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.000.0384620.0000000.0000000.0000000.0769230.0384620.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0384620.00.0000000.0000000.0000000.0000000.000.0384620.0000000.0000000.0384620.000.0000000.0000000.0000000.0000000.0000000.0000009Davisville North0.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.000.0000000.0000000.0000000.0000000.0000000.2000000.0000000.0000000.0000000.0000000.0000000.0000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.000.0000000.0000000.0000000.0000000.0000000.0000000.2000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.2000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.00.0000000.0000000.0000000.0000000.000.00.0000000.0000000.00.2000000.0000000.0000000.0000000.0000000.0000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.2000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.0000000.00.0000000.0000000.0000000.000

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```
toronto_grouped.shape
```

```
(39, 177)
```

```python
num_top_venues = 5
for neigh in toronto_grouped['Neighborhood']:
    print("----"+neigh+"----")
    temp = toronto_grouped[toronto_grouped['Neighborhood'] == neigh].T.reset_index()
    temp.columns = ['venue','freq']
    temp = temp.iloc[1:]
    temp['freq'] = temp['freq'].astype(float)
    temp = temp.round({'freq': 2})
    print(temp.sort_values('freq', ascending=False).reset_index(drop=True).head(num_top_venues))
    print('\n')
```

```
----Berczy Park----
                venue  freq
0  Seafood Restaurant  0.07
1         Cheese Shop  0.07
2        Cocktail Bar  0.07
3         Coffee Shop  0.07
4      Farmers Market  0.07
----Brockton, Parkdale Village, Exhibition Place----
                   venue  freq
0             Restaurant  0.07
1     Italian Restaurant  0.07
2              Gift Shop  0.07
3  Furniture / Home Store  0.07
4            Coffee Shop  0.07


----Business reply mail Processing Centre, South Central Letter Processing
Plant Toronto----
          venue  freq
0          Café  0.10
1    Restaurant  0.07
2         Hotel  0.07
3       Theater  0.07
4  Concert Hall  0.07
```

```
----CN Tower, King and Spadina, Railway Lands, Harbourfront West, Bathurst
Quay, South Niagara, Island airport----
                      venue  freq
0      Italian Restaurant  0.10
1                    Park  0.07
2   Gym / Fitness Center  0.07
3              Restaurant  0.07
4     Seafood Restaurant  0.03


----Central Bay Street----
                            venue  freq
0                    Coffee Shop  0.13
1                          Plaza  0.07
2                Sandwich Place  0.03
3   Middle Eastern Restaurant  0.03
4   Modern European Restaurant  0.03
----Christie----
                  venue  freq
0                  Café  0.27
1         Grocery Store  0.18
2            Playground  0.09
3     Athletics & Sports  0.09
4           Candy Store  0.09


----Church and Wellesley----
                  venue  freq
0          Coffee Shop  0.10
1          Men's Store  0.07
2              Gay Bar  0.07
3   Salon / Barbershop  0.03
4             Beer Bar  0.03


----Commerce Court, Victoria Hotel----
            venue  freq
0           Café  0.13
1     Restaurant  0.10
2      Gastropub  0.07
3    Coffee Shop  0.07
4          Hotel  0.07


----Davisville----
                  venue  freq
0        Dessert Shop  0.12
1          Pizza Place  0.08
2          Coffee Shop  0.08
3   Italian Restaurant  0.08
4                 Café  0.08
----Berczy Park----
                  venue  freq
0   Seafood Restaurant  0.07
```

```
1         Cheese Shop  0.07
2       Cocktail Bar  0.07
3        Coffee Shop  0.07
4     Farmers Market  0.07
```

----Brockton, Parkdale Village, Exhibition Place----
```
                    venue  freq
0               Restaurant  0.07
1        Italian Restaurant  0.07
2                 Gift Shop  0.07
3   Furniture / Home Store  0.07
4              Coffee Shop  0.07
```

----Business reply mail Processing Centre, South Central Letter Processing Plant Toronto----
```
          venue  freq
0          Café  0.10
1    Restaurant  0.07
2         Hotel  0.07
3        Theater  0.07
4  Concert Hall  0.07
```

----CN Tower, King and Spadina, Railway Lands, Harbourfront West, Bathurst Quay, South Niagara, Island airport----
```
                  venue  freq
0     Italian Restaurant  0.10
1                   Park  0.07
2  Gym / Fitness Center  0.07
3             Restaurant  0.07
4     Seafood Restaurant  0.03
```

----Central Bay Street----
```
                        venue  freq
0                Coffee Shop  0.13
1                      Plaza  0.07
2             Sandwich Place  0.03
3   Middle Eastern Restaurant  0.03
4  Modern European Restaurant  0.03
```

----Christie----
```
              venue  freq
0              Café  0.27
1      Grocery Store  0.18
2         Playground  0.09
3  Athletics & Sports  0.09
4        Candy Store  0.09
```

----Church and Wellesley----
```

```
               venue  freq
0          Coffee Shop  0.10
1          Men's Store  0.07
2              Gay Bar  0.07
3   Salon / Barbershop  0.03
4             Beer Bar  0.03
```

----Commerce Court, Victoria Hotel----
```
          venue  freq
0          Café  0.13
1    Restaurant  0.10
2     Gastropub  0.07
3   Coffee Shop  0.07
4         Hotel  0.07
```

----Davisville----
```
                venue  freq
0        Dessert Shop  0.12
1         Pizza Place  0.08
2         Coffee Shop  0.08
3   Italian Restaurant  0.08
4                Café  0.08
```

----Davisville North----
```
                venue  freq
0      Breakfast Spot   0.2
1                Park   0.2
2               Hotel   0.2
3    Department Store   0.2
4   Food & Drink Shop   0.2
```

----Dufferin, Dovercourt Village----
```
                       venue  freq
0      Furniture / Home Store  0.13
1                        Park  0.13
2                    Pharmacy  0.07
3   Middle Eastern Restaurant  0.07
4                         Bar  0.07
```

----First Canadian Place, Underground city----
```
                    venue  freq
0                    Café  0.20
1              Restaurant  0.13
2             Coffee Shop  0.07
3       Seafood Restaurant  0.07
4    Gluten-free Restaurant  0.03
```

----Forest Hill North & West, Forest Hill Road Park----
```

```
                         venue  freq
0                         Park   1.0
1                 Yoga Studio   0.0
2  Modern European Restaurant   0.0
3                       Market   0.0
4          Martial Arts School   0.0
```
----Garden District, Ryerson----
```
               venue  freq
0               Café  0.10
1  Ramen Restaurant  0.07
2       Coffee Shop  0.07
3           Theater  0.07
4             Hotel  0.03
```


----Harbourfront East, Union Station, Toronto Islands----
```
          venue  freq
0         Hotel  0.10
1  Coffee Shop  0.10
2          Park  0.07
3      Aquarium  0.07
4         Plaza  0.07
```


----High Park, The Junction South----
```
                                     venue  freq
0                         Convenience Store  0.25
1                                      Park  0.25
2                            Sandwich Place  0.25
3  Residential Building (Apartment / Condo)  0.25
4                            Organic Grocery  0.00
```


----India Bazaar, The Beaches West----
```
                 venue  freq
0  Fast Food Restaurant  0.11
1                   Pub  0.05
2        Burrito Place  0.05
3       Sandwich Place  0.05
4                  Park  0.05
```
----Kensington Market, Chinatown, Grange Park----
```
                 venue  freq
0                  Café  0.10
1    Mexican Restaurant  0.07
2  Vietnamese Restaurant  0.07
3           Coffee Shop  0.07
4   Caribbean Restaurant  0.07
```


----Lawrence Park----
```
                 venue  freq
0             Bus Line   0.5
1          Swim School   0.5
2          Yoga Studio   0.0
```
```

```
3  Modern European Restaurant    0.0
4          Martial Arts School    0.0


----Little Portugal, Trinity----
                    venue  freq
0                     Bar  0.10
1            Cocktail Bar  0.07
2   Vietnamese Restaurant  0.07
3        Asian Restaurant  0.07
4             Yoga Studio  0.03


----Moore Park, Summerhill East----
                          venue  freq
0                           Gym  0.25
1                          Park  0.25
2                         Trail  0.25
3                  Tennis Court  0.25
4   Modern European Restaurant  0.00
----North Toronto West,  Lawrence Park----
                   venue  freq
0   Italian Restaurant  0.25
1             Gym Pool  0.25
2           Playground  0.25
3                 Park  0.25
4          Yoga Studio  0.00


----Parkdale, Roncesvalles----
                              venue  freq
0                      Coffee Shop  0.10
1                   Breakfast Spot  0.07
2                         Bookstore  0.07
3   Eastern European Restaurant  0.07
4           American Restaurant  0.07


----Queen's Park, Ontario Provincial Government----
              venue  freq
0      Coffee Shop  0.24
1   Sandwich Place  0.12
2        Gastropub  0.06
3          Theater  0.06
4             Café  0.06


----Regent Park, Harbourfront----
              venue  freq
0      Coffee Shop  0.24
1   Breakfast Spot  0.10
2      Yoga Studio  0.05
3          Theater  0.05
4   Thai Restaurant  0.05
```

```
----Richmond, Adelaide, King----
                venue  freq
0                Café  0.13
1         Coffee Shop  0.10
2                 Gym  0.07
3  American Restaurant  0.07
4          Restaurant  0.07


----Rosedale----
                           venue  freq
0                           Park  0.50
1                     Playground  0.25
2                     Bike Trail  0.25
3                    Yoga Studio  0.00
4  Modern European Restaurant  0.00


----Roselawn----
                venue  freq
0        Home Service   1.0
1         Yoga Studio   0.0
2  Monument / Landmark   0.0
3  Martial Arts School   0.0
4      Massage Studio   0.0
----Runnymede, Swansea----
              venue  freq
0       Coffee Shop  0.13
1              Café  0.10
2            Bakery  0.10
3              Bank  0.07
4   Thai Restaurant  0.03


----St. James Town----
              venue  freq
0         Gastropub  0.10
1              Café  0.10
2    Cosmetics Shop  0.07
3       Coffee Shop  0.07
4           Theater  0.07


----St. James Town, Cabbagetown----
                venue  freq
0                Café  0.07
1                Park  0.07
2          Restaurant  0.07
3         Coffee Shop  0.07
4  Italian Restaurant  0.07


----Stn A PO Boxes----
          venue   freq
```

```
0              Café  0.10
1         Restaurant  0.07
2             Hotel  0.07
3            Theater  0.07
4       Concert Hall  0.07
----Studio District----
                   venue  freq
0   Italian Restaurant  0.10
1              Brewery  0.10
2          Coffee Shop  0.07
3   Arts & Crafts Store  0.07
4                Diner  0.07


----Summerhill West, Rathnelly, South Hill, Forest Hill SE, Deer Park----
                   venue  freq
0    Light Rail Station  0.33
1           Coffee Shop  0.33
2          Liquor Store  0.17
3           Supermarket  0.17
4   Monument / Landmark  0.00


----The Annex, North Midtown, Yorkville----
              venue  freq
0   Sandwich Place  0.14
1             Café  0.09
2   History Museum  0.05
3              Pub  0.05
4     Burger Joint  0.05


----The Beaches----
                venue  freq
0   Health Food Store   0.2
1    Asian Restaurant   0.2
2               Trail   0.2
3                 Pub   0.2
4         Yoga Studio   0.0
----The Danforth West, Riverdale----
                venue  freq
0      Grocery Store  0.12
1               Park  0.12
2           Bus Line  0.12
3   Business Service  0.12
4     Ice Cream Shop  0.12


----Toronto Dominion Centre, Design Exchange----
               venue  freq
0               Café  0.17
```

```
1            Coffee Shop  0.17
2             Restaurant  0.07
3   Japanese Restaurant  0.07
4            Art Gallery  0.03
```

```
----University of Toronto, Harbord----
                venue  freq
0              Bakery  0.10
1                Café  0.10
2          Restaurant  0.07
3  Japanese Restaurant  0.07
4            Bookstore  0.07
```

```python
def return_most_common_venues(row, num_top_venues):
    row_categories = row.iloc[1:]
    row_categories_sorted = row_categories.sort_values(ascending=False)
    return row_categories_sorted.index.values[0:num_top_venues]
```

```python
import numpy as np
num_top_venues = 10
indicators = ['st', 'nd', 'rd']

columns = ['Neighborhood']
for ind in np.arange(num_top_venues):
    try:
        columns.append('{}{} Most Common Venue'.format(ind+1, indicators[ind]))
    except:
        columns.append('{}th Most Common Venue'.format(ind+1))

neighborhoods_venues_sorted = pd.DataFrame(columns=columns)
neighborhoods_venues_sorted['Neighborhood'] = toronto_grouped['Neighborhood']

for ind in np.arange(toronto_grouped.shape[0]):
    neighborhoods_venues_sorted.iloc[ind, 1:] = return_most_common_venues(toronto_grouped.iloc[ind, :], num_top_venues)

neighborhoods_venues_sorted.shape
```

```
(39, 11)
```

## 3. Clustering Neighborhoods

```
from sklearn.cluster import KMeans
import sklearn.cluster.k_means_
km = KMeans(n_clusters=3, init='k-means++', max_iter=100, n_init=1,
    verbose=True)
/home/untold/anaconda3/lib/python3.8/site-packages/sklearn/utils/deprecation.
py:143: FutureWarning: The sklearn.cluster.k_means_ module is  deprecated in
version 0.22 and will be removed in version 0.24. The corresponding classes /
functions should instead be imported from sklearn.cluster. Anything that cann
ot be imported from sklearn.cluster is now part of the private API.
    warnings.warn(message, FutureWarning)
```

```
kclusters = 10
toronto_grouped_clustering = toronto_grouped.drop('Neighborhood', 1)
kmeans = KMeans(n_clusters=kclusters, random_state=1).fit(toronto_grouped_clu
stering)
print(kmeans.labels_[0:10])
print(len(kmeans.labels_))

[0 0 3 0 0 3 0 3 0 0]
39
```

```
df.head()
```

|   | Postalcode | Borough | Neighborhood | Latitude | Longitude |
|---|---|---|---|---|---|
| **0** | M4E | East | The B | 43.6 | -79. |

| | Postalcode | Borough | Neighborhood | Latitude | Longitude |
|---|---|---|---|---|---|
| | \n | Toronto\n | eaches | 7709 | 29547 |
| 1 | M4K\n | EastToronto\n | TheDanforthWest,Rive | 43.68375 | -79.35512 |

| | Postalcode | Borough | Neighborhood | Latitude | Longitude |
|---|---|---|---|---|---|
| | | | rdale | | |
| 2 | M4L\n | East Toronto\n | India Bazaar, The Beaches We | 43.66797 | -79.31467 |

| | Postalcode | Borough | Neighborhood | Latitude | Longitude |
|---|---|---|---|---|---|
| | | | st | | |
| 3 | M4M\n | East Toronto\n | Studio District | 43.66213 | -79.334977 |
| 4 | M4N\n | Central Toro | Lawrence Pa | 43.728433 | -79.387133 |

| | Postalcode | Borough | Neighborhood | Latitude | Longitude |
|---|---|---|---|---|---|
| | | nto\n | rk | | |

In [30]:

```
neighborhoods_venues_sorted.insert(0, 'Cluster Labels', kmeans.labels_)
toronto_merged = df
toronto_merged = toronto_merged.join(neighborhoods_venues_sorted.set_index('Neighborhood'), on='Neighborhood')

toronto_merged.head() # check the last columns!
```

Out[30]:

```
map_clusters = folium.Map(location=[latitude, longitude], zoom_start=11)

x = np.arange(kclusters)
ys = [i+x+(i*x)**2 for i in range(kclusters)]
colors_array = cm.rainbow(np.linspace(0, 1, len(ys)))
rainbow = [colors.rgb2hex(i) for i in colors_array]

markers_colors = []
for lat, lon, poi, cluster in zip(toronto_merged['Latitude'], toronto_merged[
'Longitude'], toronto_merged['Neighborhood'],kmeans.labels_):
    label = folium.Popup(str(poi) + ' Cluster ' + str(cluster), parse_html=Tr
ue)
    folium.CircleMarker([lat, lon], radius=5, popup=label, color=rainbow[clus
ter-1], fill=True, fill_color=rainbow[cluster-1], fill_opacity=0.7).add_to(ma
p_clusters)
map_clusters
```

Make this Notebook Trusted to load map: File -> Trust Notebook