Exploring_Neighborhoods_in_the_city_of_Toronto

April 7, 2024

0.0.1 Explore and cluster the neighborhoods in Toronto.

Generate maps to visualize your neighborhoods and how they cluster together

[1]:
```
import pandas as pd
import numpy as np
import requests
from bs4 import BeautifulSoup
import os
from sklearn.cluster import KMeans
import folium
from geopy.geocoders import Nominatim
import matplotlib.cm as cm
import matplotlib.colors as colors


print('Libraries imported.')
```

```
Libraries imported.
```

[2]:
```
List_url='https://en.wikipedia.org/wiki/List_of_postal_codes_of_Canada:_M'
source = requests.get(List_url).text
```

[3]:
```
soup = BeautifulSoup(source, 'xml')
table=soup.find('table')
column_names=['Postalcode','Borough','Neighborhood']
df = pd.DataFrame(columns=column_names)
```

[4]:
```
for tr_cell in table.find_all('tr'):
    row_data=[]
    for td_cell in tr_cell.find_all('td'):
        row_data.append(td_cell.text.strip())
    if len(row_data)==3:
        df.loc[len(df)] = row_data
        df.head()
```

[5]:
```
df=df[df['Borough']!='Not assigned']
```

[7]:
```
df.head()
```

[7]:

	Postalcode	Borough	Neighborhood
2	M3A	North York	Parkwoods
3	M4A	North York	Victoria Village
4	M5A	Downtown Toronto	Regent Park, Harbourfront
5	M6A	North York	Lawrence Manor, Lawrence Heights
6	M7A	Downtown Toronto	Queen's Park, Ontario Provincial Government

[8]:
```
temp_df=df.groupby('Postalcode')['Neighborhood'].apply(lambda x: "%s" % ', '.
↪join(x))
temp_df=temp_df.reset_index(drop=False)
temp_df.rename(columns={'Neighborhood':'Neighborhood_joined'},inplace=True)
```

[9]:
```
df_merge = pd.merge(df, temp_df, on='Postalcode')
```

[10]:
```
df_merge.drop(['Neighborhood'],axis=1,inplace=True)
```

[11]:
```
df_merge.drop_duplicates(inplace=True)
```

[12]:
```
df_merge.rename(columns={'Neighborhood_joined':'Neighborhood'},inplace=True)
```

[13]:
```
df_merge.head()
```

[13]:

	Postalcode	Borough	Neighborhood
0	M3A	North York	Parkwoods
1	M4A	North York	Victoria Village
2	M5A	Downtown Toronto	Regent Park, Harbourfront
3	M6A	North York	Lawrence Manor, Lawrence Heights
4	M7A	Downtown Toronto	Queen's Park, Ontario Provincial Government

[14]:
```
df_merge.shape
```

[14]:
```
(103, 3)
```

[15]:
```
def get_geocode(postal_code):
    # initialize your variable to None
    lat_lng_coords = None
    while(lat_lng_coords is None):
        g = geocoder.google('{}, Toronto, Ontario'.format(postal_code))
        lat_lng_coords = g.latlng
    latitude = lat_lng_coords[0]
    longitude = lat_lng_coords[1]
    return latitude,longitude
```

[16]:
```
geo_df=pd.read_csv('http://cocl.us/Geospatial_data')
```

[17]:
```
geo_df.head()
```

[17]:
```
  Postal Code   Latitude  Longitude
0         M1B  43.806686 -79.194353
1         M1C  43.784535 -79.160497
2         M1E  43.763573 -79.188711
3         M1G  43.770992 -79.216917
4         M1H  43.773136 -79.239476
```

[18]:
```
geo_df.rename(columns={'Postal Code':'Postalcode'},inplace=True)
geo_merged = pd.merge(geo_df, df_merge, on='Postalcode')
```

[19]:
```
geo_merged.head()
```

[19]:
```
  Postalcode   Latitude  Longitude      Borough  \
0        M1B  43.806686 -79.194353  Scarborough
1        M1C  43.784535 -79.160497  Scarborough
2        M1E  43.763573 -79.188711  Scarborough
3        M1G  43.770992 -79.216917  Scarborough
4        M1H  43.773136 -79.239476  Scarborough

                          Neighborhood
0                       Malvern, Rouge
1  Rouge Hill, Port Union, Highland Creek
2       Guildwood, Morningside, West Hill
3                                Woburn
4                             Cedarbrae
```

[20]:
```
geo_data=geo_merged[['Postalcode','Borough','Neighborhood','Latitude','Longitude']]
geo_data.head()
```

[20]:
```
  Postalcode      Borough                                Neighborhood   Latitude  \
0        M1B  Scarborough                              Malvern, Rouge  43.806686
1        M1C  Scarborough  Rouge Hill, Port Union, Highland Creek  43.784535
2        M1E  Scarborough       Guildwood, Morningside, West Hill  43.763573
3        M1G  Scarborough                                  Woburn  43.770992
4        M1H  Scarborough                               Cedarbrae  43.773136

   Longitude
0 -79.194353
1 -79.160497
2 -79.188711
3 -79.216917
4 -79.239476
```

[21]:
```
toronto_data=geo_data[geo_data['Borough'].str.contains("Toronto")]
toronto_data.head()
```

[21]:
```
   Postalcode           Borough                     Neighborhood   Latitude  \
37        M4E     East Toronto                     The Beaches  43.676357
41        M4K     East Toronto  The Danforth West, Riverdale  43.679557
42        M4L     East Toronto  India Bazaar, The Beaches West  43.668999
43        M4M     East Toronto                 Studio District  43.659526
44        M4N  Central Toronto                   Lawrence Park  43.728020

    Longitude
37 -79.293031
41 -79.352188
42 -79.315572
43 -79.340923
44 -79.388790
```

[22]:
```
CLIENT_ID = 'ODW53TD40J43SX3IO5J1TO2DTHKWKJRGKWRXPEHXTAHJR33M' # your␣
↪Foursquare ID
CLIENT_SECRET = 'PCTM14K3UAVAHUEQXXYJLGKJVVY4NCYVG4MCMAT44ZZ1GXDO' # your␣
↪Foursquare Secret
VERSION = '20180604'
```

[23]:
```
def getNearbyVenues(names, latitudes, longitudes):
    radius=500
    LIMIT=100
    venues_list=[]
    for name, lat, lng in zip(names, latitudes, longitudes):
        print(name)

        # create the API request URL
        url = 'https://api.foursquare.com/v2/venues/explore?
↪&client_id={}&client_secret={}&v={}&ll={},{}&radius={}&limit={}'.format(
            CLIENT_ID,
            CLIENT_SECRET,
            VERSION,
            lat,
            lng,
            radius,
            LIMIT)

        # make the GET request
        results = requests.get(url).json()["response"]['groups'][0]['items']

        # return only relevant information for each nearby venue
        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',
                  'Neighborhood Longitude',
                  'Venue',
                  'Venue Latitude',
                  'Venue Longitude',
                  'Venue Category']

    return(nearby_venues)
```

[24]:
```
toronto_venues = getNearbyVenues(names=toronto_data['Neighborhood'],
                                 latitudes=toronto_data['Latitude'],
                                 longitudes=toronto_data['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
```

[25]:
```
toronto_venues.head()
```

[25]:
```
                  Neighborhood  Neighborhood Latitude  \
0                  The Beaches             43.676357
1                  The Beaches             43.676357
2                  The Beaches             43.676357
3                  The Beaches             43.676357
4  The Danforth West, Riverdale             43.679557

   Neighborhood Longitude                              Venue  Venue Latitude  \
0              -79.293031                  Glen Manor Ravine       43.676821
1              -79.293031  The Big Carrot Natural Food Market       43.678879
2              -79.293031                Grover Pub and Grub       43.679181
3              -79.293031                     Upper Beaches       43.680563
4              -79.352188                     MenEssentials       43.677820

   Venue Longitude     Venue Category
0       -79.293942              Trail
1       -79.297734  Health Food Store
2       -79.297215                Pub
3       -79.292869       Neighborhood
4       -79.351265     Cosmetics Shop
```

[26]:
```
toronto_venues.groupby('Neighborhood').count()
```

[26]:
```
                                                Neighborhood Latitude  \
Neighborhood
Berczy Park                                                        57
Brockton, Parkdale Village, Exhibition Place                       22
Business reply mail Processing Centre, South Ce…                   16
CN Tower, King and Spadina, Railway Lands, Harb…                   16
```

Central Bay Street	66
Christie	16
Church and Wellesley	72
Commerce Court, Victoria Hotel	100
Davisville	35
Davisville North	9
Dufferin, Dovercourt Village	16
First Canadian Place, Underground city	100
Forest Hill North & West, Forest Hill Road Park	4
Garden District, Ryerson	100
Harbourfront East, Union Station, Toronto Islands	100
High Park, The Junction South	25
India Bazaar, The Beaches West	22
Kensington Market, Chinatown, Grange Park	66
Lawrence Park	4
Little Portugal, Trinity	44
Moore Park, Summerhill East	3
North Toronto West, Lawrence Park	20
Parkdale, Roncesvalles	14
Queen's Park, Ontario Provincial Government	35
Regent Park, Harbourfront	44
Richmond, Adelaide, King	97
Rosedale	4
Roselawn	1
Runnymede, Swansea	37
St. James Town	86
St. James Town, Cabbagetown	45
Stn A PO Boxes	98
Studio District	42
Summerhill West, Rathnelly, South Hill, Forest …	16
The Annex, North Midtown, Yorkville	20
The Beaches	4
The Danforth West, Riverdale	42
Toronto Dominion Centre, Design Exchange	100
University of Toronto, Harbord	36

Neighborhood	Neighborhood Longitude	\
Berczy Park	57	
Brockton, Parkdale Village, Exhibition Place	22	
Business reply mail Processing Centre, South Ce…	16	
CN Tower, King and Spadina, Railway Lands, Harb…	16	
Central Bay Street	66	
Christie	16	
Church and Wellesley	72	
Commerce Court, Victoria Hotel	100	
Davisville	35	

Davisville North	9
Dufferin, Dovercourt Village	16
First Canadian Place, Underground city	100
Forest Hill North & West, Forest Hill Road Park	4
Garden District, Ryerson	100
Harbourfront East, Union Station, Toronto Islands	100
High Park, The Junction South	25
India Bazaar, The Beaches West	22
Kensington Market, Chinatown, Grange Park	66
Lawrence Park	4
Little Portugal, Trinity	44
Moore Park, Summerhill East	3
North Toronto West, Lawrence Park	20
Parkdale, Roncesvalles	14
Queen's Park, Ontario Provincial Government	35
Regent Park, Harbourfront	44
Richmond, Adelaide, King	97
Rosedale	4
Roselawn	1
Runnymede, Swansea	37
St. James Town	86
St. James Town, Cabbagetown	45
Stn A PO Boxes	98
Studio District	42
Summerhill West, Rathnelly, South Hill, Forest …	16
The Annex, North Midtown, Yorkville	20
The Beaches	4
The Danforth West, Riverdale	42
Toronto Dominion Centre, Design Exchange	100
University of Toronto, Harbord	36

Neighborhood	Venue	Venue Latitude	\
Berczy Park	57	57	
Brockton, Parkdale Village, Exhibition Place	22	22	
Business reply mail Processing Centre, South Ce…	16	16	
CN Tower, King and Spadina, Railway Lands, Harb…	16	16	
Central Bay Street	66	66	
Christie	16	16	
Church and Wellesley	72	72	
Commerce Court, Victoria Hotel	100	100	
Davisville	35	35	
Davisville North	9	9	
Dufferin, Dovercourt Village	16	16	
First Canadian Place, Underground city	100	100	
Forest Hill North & West, Forest Hill Road Park	4	4	
Garden District, Ryerson	100	100	

Harbourfront East, Union Station, Toronto Islands	100	100
High Park, The Junction South	25	25
India Bazaar, The Beaches West	22	22
Kensington Market, Chinatown, Grange Park	66	66
Lawrence Park	4	4
Little Portugal, Trinity	44	44
Moore Park, Summerhill East	3	3
North Toronto West, Lawrence Park	20	20
Parkdale, Roncesvalles	14	14
Queen's Park, Ontario Provincial Government	35	35
Regent Park, Harbourfront	44	44
Richmond, Adelaide, King	97	97
Rosedale	4	4
Roselawn	1	1
Runnymede, Swansea	37	37
St. James Town	86	86
St. James Town, Cabbagetown	45	45
Stn A PO Boxes	98	98
Studio District	42	42
Summerhill West, Rathnelly, South Hill, Forest …	16	16
The Annex, North Midtown, Yorkville	20	20
The Beaches	4	4
The Danforth West, Riverdale	42	42
Toronto Dominion Centre, Design Exchange	100	100
University of Toronto, Harbord	36	36

Neighborhood	Venue Longitude	\
Berczy Park	57	
Brockton, Parkdale Village, Exhibition Place	22	
Business reply mail Processing Centre, South Ce…	16	
CN Tower, King and Spadina, Railway Lands, Harb…	16	
Central Bay Street	66	
Christie	16	
Church and Wellesley	72	
Commerce Court, Victoria Hotel	100	
Davisville	35	
Davisville North	9	
Dufferin, Dovercourt Village	16	
First Canadian Place, Underground city	100	
Forest Hill North & West, Forest Hill Road Park	4	
Garden District, Ryerson	100	
Harbourfront East, Union Station, Toronto Islands	100	
High Park, The Junction South	25	
India Bazaar, The Beaches West	22	
Kensington Market, Chinatown, Grange Park	66	
Lawrence Park	4	

Little Portugal, Trinity	44
Moore Park, Summerhill East	3
North Toronto West, Lawrence Park	20
Parkdale, Roncesvalles	14
Queen's Park, Ontario Provincial Government	35
Regent Park, Harbourfront	44
Richmond, Adelaide, King	97
Rosedale	4
Roselawn	1
Runnymede, Swansea	37
St. James Town	86
St. James Town, Cabbagetown	45
Stn A PO Boxes	98
Studio District	42
Summerhill West, Rathnelly, South Hill, Forest …	16
The Annex, North Midtown, Yorkville	20
The Beaches	4
The Danforth West, Riverdale	42
Toronto Dominion Centre, Design Exchange	100
University of Toronto, Harbord	36

Neighborhood	Venue Category
Berczy Park	57
Brockton, Parkdale Village, Exhibition Place	22
Business reply mail Processing Centre, South Ce…	16
CN Tower, King and Spadina, Railway Lands, Harb…	16
Central Bay Street	66
Christie	16
Church and Wellesley	72
Commerce Court, Victoria Hotel	100
Davisville	35
Davisville North	9
Dufferin, Dovercourt Village	16
First Canadian Place, Underground city	100
Forest Hill North & West, Forest Hill Road Park	4
Garden District, Ryerson	100
Harbourfront East, Union Station, Toronto Islands	100
High Park, The Junction South	25
India Bazaar, The Beaches West	22
Kensington Market, Chinatown, Grange Park	66
Lawrence Park	4
Little Portugal, Trinity	44
Moore Park, Summerhill East	3
North Toronto West, Lawrence Park	20
Parkdale, Roncesvalles	14
Queen's Park, Ontario Provincial Government	35

```
Regent Park, Harbourfront                                  44
Richmond, Adelaide, King                                   97
Rosedale                                                    4
Roselawn                                                    1
Runnymede, Swansea                                         37
St. James Town                                             86
St. James Town, Cabbagetown                                45
Stn A PO Boxes                                             98
Studio District                                            42
Summerhill West, Rathnelly, South Hill, Forest …           16
The Annex, North Midtown, Yorkville                        20
The Beaches                                                 4
The Danforth West, Riverdale                               42
Toronto Dominion Centre, Design Exchange                  100
University of Toronto, Harbord                             36
```

[27]:
```
# one hot encoding
toronto_onehot = pd.get_dummies(toronto_venues[['Venue Category']], prefix="",␣
↪prefix_sep="")
toronto_onehot.drop(['Neighborhood'],axis=1,inplace=True)
toronto_onehot.insert(loc=0, column='Neighborhood',␣
↪value=toronto_venues['Neighborhood'] )
toronto_onehot.shape
```

[27]:
```
(1634, 234)
```

[28]:
```
toronto_grouped = toronto_onehot.groupby('Neighborhood').mean().reset_index()
toronto_grouped.head()
```

[28]:
```
                                    Neighborhood  Airport  \
0                                    Berczy Park   0.0000
1         Brockton, Parkdale Village, Exhibition Place   0.0000
2  Business reply mail Processing Centre, South C…   0.0000
3  CN Tower, King and Spadina, Railway Lands, Har…   0.0625
4                              Central Bay Street   0.0000

   Airport Food Court  Airport Lounge  Airport Service  Airport Terminal  \
0              0.0000           0.000            0.000             0.000
1              0.0000           0.000            0.000             0.000
2              0.0000           0.000            0.000             0.000
3              0.0625           0.125            0.125             0.125
4              0.0000           0.000            0.000             0.000

   American Restaurant  Antique Shop  Aquarium  Art Gallery  …  \
0                  0.0           0.0       0.0     0.017544  …
1                  0.0           0.0       0.0     0.000000  …
2                  0.0           0.0       0.0     0.000000  …
```

```
3                  0.0           0.0       0.0     0.000000  …
4                  0.0           0.0       0.0     0.000000  …

   Theme Restaurant  Toy / Game Store  Trail  Train Station  \
0               0.0               0.0    0.0            0.0
1               0.0               0.0    0.0            0.0
2               0.0               0.0    0.0            0.0
3               0.0               0.0    0.0            0.0
4               0.0               0.0    0.0            0.0

   Vegetarian / Vegan Restaurant  Video Game Store  Vietnamese Restaurant  \
0                       0.017544               0.0                    0.0
1                       0.000000               0.0                    0.0
2                       0.000000               0.0                    0.0
3                       0.000000               0.0                    0.0
4                       0.015152               0.0                    0.0

   Wine Bar  Women's Store  Yoga Studio
0  0.000000            0.0     0.000000
1  0.000000            0.0     0.000000
2  0.000000            0.0     0.000000
3  0.000000            0.0     0.000000
4  0.015152            0.0     0.015152

[5 rows x 234 columns]
```

[29]:
```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]
```

[30]:
```python
num_top_venues = 10

indicators = ['st', 'nd', 'rd']

# create columns according to number of top venues
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))

# create a new dataframe
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.head()
```

[30]:

	Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
0	Berczy Park	Coffee Shop	Cocktail Bar	Bakery	Café	Beer Bar	Cheese Shop	Farmers Market	Pharmacy	Restaurant	Seafood Restaurant
1	Brockton, Parkdale Village, Exhibition Place	Café	Breakfast Spot	Coffee Shop	Pet Store	Furniture / Home Store	Convenience Store	Stadium	Restaurant	Italian Restaurant	Intersection
2	Business reply mail Processing Centre, South C…	Light Rail Station	Comic Shop	Auto Workshop	Brewery	Burrito Place	Spa	Farmers Market	Fast Food Restaurant	Restaurant	Skate Park
3	CN Tower, King and Spadina, Railway Lands, Har…	Airport Lounge	Airport Service	Airport Terminal	Airport	Rental Car Location	Bar	Coffee Shop	Boat or Ferry	Plane	Boutique
4	Central Bay Street	Coffee Shop	Italian Restaurant	Sandwich Place	Café	Japanese Restaurant	Burger Joint	Bubble Tea Shop	Bar	Department Store	Salad Place

[31]:
```
# set number of clusters
kclusters = 5

toronto_grouped_clustering = toronto_grouped.drop('Neighborhood', 1)

# run k-means clustering
kmeans = KMeans(n_clusters=kclusters, random_state=0).
 ↪fit(toronto_grouped_clustering)

# check cluster labels generated for each row in the dataframe
kmeans.labels_[0:10]
```

[31]:
```
array([0, 0, 0, 0, 0, 0, 0, 0, 0, 0], dtype=int32)
```

[32]:
```
# add clustering labels
neighborhoods_venues_sorted.insert(0, 'Cluster Labels', kmeans.labels_)

toronto_merged = toronto_data

# merge toronto_grouped with toronto_data to add latitude/longitude for each␣
 ↪neighborhood
toronto_merged = toronto_merged.join(neighborhoods_venues_sorted.
 ↪set_index('Neighborhood'), on='Neighborhood')

toronto_merged.head()
```

[32]:

	Postalcode	Borough	Neighborhood	Latitude	Longitude	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
37	M4E	East Toronto	The Beaches	43.676357	-79.293031	0	Pub	Health Food Store	Trail	Yoga Studio	Discount Store	Distribution Center	Dog Run	Doner Restaurant	Donut Shop	Eastern European Restaurant
41	M4K	East Toronto	The Danforth West, Riverdale	43.679557	-79.352188	0	Greek Restaurant	Italian Restaurant	Coffee Shop	Furniture / Home Store	Restaurant	Ice Cream Shop	Yoga Studio	Spa	Bookstore	Juice Bar
42	M4L	East Toronto	India Bazaar, The Beaches West	43.668999	-79.315572	0	Sandwich Place	Park	Pizza Place	Sushi Restaurant	Pub	Brewery	Fast Food Restaurant	Fish & Chips Shop	Restaurant	Italian Restaurant
43	M4M	East Toronto	Studio District	43.659526	-79.340923	0	Café	Coffee Shop	American Restaurant	Bakery	Brewery	Gastropub	Yoga Studio	Food	Pet Store	Park
44	M4N	Central Toronto	Lawrence Park	43.728020	-79.388790	4	Park	Bus Line	Swim School	Yoga Studio	Discount Store	Falafel Restaurant	Event Space	Ethiopian Restaurant		

```
44     Electronics Store  Eastern European Restaurant
```

[33]:
```
neighborhoods_venues_sorted.head()
```

[33]:
```
   Cluster Labels                                       Neighborhood  \
0               0                                        Berczy Park
1               0      Brockton, Parkdale Village, Exhibition Place
2               0  Business reply mail Processing Centre, South C…
3               0  CN Tower, King and Spadina, Railway Lands, Har…
4               0                                  Central Bay Street

  1st Most Common Venue 2nd Most Common Venue 3rd Most Common Venue  \
0           Coffee Shop          Cocktail Bar                Bakery
1                 Café        Breakfast Spot           Coffee Shop
2   Light Rail Station            Comic Shop         Auto Workshop
3       Airport Lounge       Airport Service      Airport Terminal
4           Coffee Shop    Italian Restaurant        Sandwich Place

  4th Most Common Venue   5th Most Common Venue 6th Most Common Venue  \
0                 Café                Beer Bar           Cheese Shop
1            Pet Store  Furniture / Home Store     Convenience Store
2              Brewery           Burrito Place                   Spa
3              Airport     Rental Car Location                   Bar
4                 Café     Japanese Restaurant          Burger Joint

  7th Most Common Venue 8th Most Common Venue 9th Most Common Venue  \
0       Farmers Market              Pharmacy            Restaurant
1              Stadium            Restaurant    Italian Restaurant
2       Farmers Market  Fast Food Restaurant            Restaurant
3          Coffee Shop         Boat or Ferry                 Plane
4      Bubble Tea Shop                   Bar      Department Store

  10th Most Common Venue
0     Seafood Restaurant
1           Intersection
2             Skate Park
3               Boutique
4            Salad Place
```

[34]:
```
address = 'Toronto, CA'

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

The geograpical coordinate of Manhattan are 43.6534817, -79.3839347.

0.0.2 Generating Maps

[36]:
```
map_clusters = folium.Map(location=[latitude, longitude], zoom_start=11)

# set color scheme for the clusters
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]

# add markers to the map
markers_colors = []
for lat, lon, poi, cluster in zip(toronto_merged['Latitude'],␣
 ↪toronto_merged['Longitude'], toronto_merged['Neighborhood'],␣
 ↪toronto_merged['Cluster Labels']):
    label = folium.Popup(str(poi) + ' Cluster ' + str(cluster), parse_html=True)
    folium.CircleMarker(
        [lat, lon],
        radius=5,
        popup=label,
        color=rainbow[cluster-1],
        fill=True,
        fill_color=rainbow[cluster-1],
        fill_opacity=0.7).add_to(map_clusters)

map_clusters
```

[36]:
```
<folium.folium.Map at 0x7ffd0c36ca10>
```

[ ]:
```

```