

Part-1: Import neighborhood data for Toronto from Wikipedia and clean up the data so that it can be used for further analysis.

```
In [1]: import numpy as np # library to handle data in a vectorized manner

import pandas as pd # library for data analysis
pd.set_option('display.max_columns', None)
pd.set_option('display.max_rows', None)

import json # library to handle JSON files

!conda install -c conda-forge geopy --yes # uncomment this line if you
haven't completed the Foursquare API lab
from geopy.geocoders import Nominatim # convert an address into latitude
and longitude values

import requests # library to handle requests
from pandas.io.json import json_normalize # transform JSON file into a p
andas dataframe

# Matplotlib and associated plotting modules
import matplotlib.cm as cm
import matplotlib.colors as colors

# import k-means from clustering stage
from sklearn.cluster import KMeans

from bs4 import BeautifulSoup

print('Libraries imported.')

usage: conda-script.py [-h] [-V] command ...
conda-script.py: error: unrecognized arguments: # uncomment this line i
f you haven't completed the Foursquare API lab
```

Libraries imported.

```
In [2]: !conda install -c conda-forge folium=0.5.0 --yes # uncomment this line
if you haven't completed the Foursquare API lab
import folium # map rendering library
```

```
usage: conda-script.py [-h] [-V] command ...
conda-script.py: error: unrecognized arguments: # uncomment this line i
f you haven't completed the Foursquare API lab
```

```
In [3]: url_link = "https://en.wikipedia.org/wiki/List_of_postal_codes_of_Canad
a:_M"
url_source = requests.get(url_link).text
soup = BeautifulSoup(url_source, 'xml')
table=soup.find('table')
```

```
In [4]: #create a new dataframe that consists of postal code, borough and neigh
borhood columns
columnnames = ['Postalcode', 'Borough', 'Neighborhood']
Toronto_df = pd.DataFrame(columns = columnnames)
```

```
In [5]: # Search all the postcode, borough, neighborhood
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:
        Toronto_df.loc[len(Toronto_df)] = row_data

Toronto_df.head()
```

Out[5]:

	Postalcode	Borough	Neighborhood
0	M1A	Not assigned	Not assigned
1	M2A	Not assigned	Not assigned

	Postalcode	Borough	Neighborhood
2	M3A	North York	Parkwoods
3	M4A	North York	Victoria Village
4	M5A	Downtown Toronto	Regent Park, Harbourfront

```
In [6]: #Process data such that entries that have Borough = Not Assigned are not considered
Toronto_df_updated = Toronto_df[Toronto_df.Borough != 'Not assigned']
```

```
In [7]: #Combine Neighborhoods that have the same Postal Code
Toronto_df_clean = Toronto_df_updated.groupby(['Postalcode', 'Borough'],
sort = False).agg(', '.join)
Toronto_df_clean.reset_index(inplace=True)
```

```
In [8]: Toronto_df_clean['Neighborhood'] = np.where(Toronto_df_clean['Neighborhood'] == 'Not assigned', Toronto_df_clean['Borough'], Toronto_df_clean['Neighborhood'])
Toronto_df_clean.head()
```

Out[8]:

	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

```
In [9]: Toronto_df_clean.shape
```

Out[9]: (103, 3)

Part-2: Create a dataframe that consists the latitude and

longitude information for all boroughs/neighborhoods in Toronto.

```
In [10]: lat_long = pd.read_csv('https://cocl.us/Geospatial_data')
lat_long.head()
```

Out[10]:

	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

```
In [11]: lat_long.rename(columns={'Postal Code': 'Postalcode'}, inplace=True)
lat_long_merge = pd.merge(Toronto_df_clean, lat_long, on='Postalcode')
lat_long_merge.head()
```

Out[11]:

	Postalcode	Borough	Neighborhood	Latitude	Longitude
0	M3A	North York	Parkwoods	43.753259	-79.329656
1	M4A	North York	Victoria Village	43.725882	-79.315572
2	M5A	Downtown Toronto	Regent Park, Harbourfront	43.654260	-79.360636
3	M6A	North York	Lawrence Manor, Lawrence Heights	43.718518	-79.464763
4	M7A	Downtown Toronto	Queen's Park, Ontario Provincial Government	43.662301	-79.389494

Part-3: Explore and cluster neighborhoods in Toronto.



```
In [12]: Toronto_Borough_data = lat_long_merge[lat_long_merge['Borough'].str.contains("Toronto")]
Toronto_Borough_data.head()
```

Out[12]:

	Postalcode	Borough	Neighborhood	Latitude	Longitude
2	M5A	Downtown Toronto	Regent Park, Harbourfront	43.654260	-79.360636
4	M7A	Downtown Toronto	Queen's Park, Ontario Provincial Government	43.662301	-79.389494
9	M5B	Downtown Toronto	Garden District, Ryerson	43.657162	-79.378937
15	M5C	Downtown Toronto	St. James Town	43.651494	-79.375418
19	M4E	East Toronto	The Beaches	43.676357	-79.293031

```
In [13]: address = 'Toronto, Canada'

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

The geographical coordinate of Torono are 43.6534817, -79.3839347.

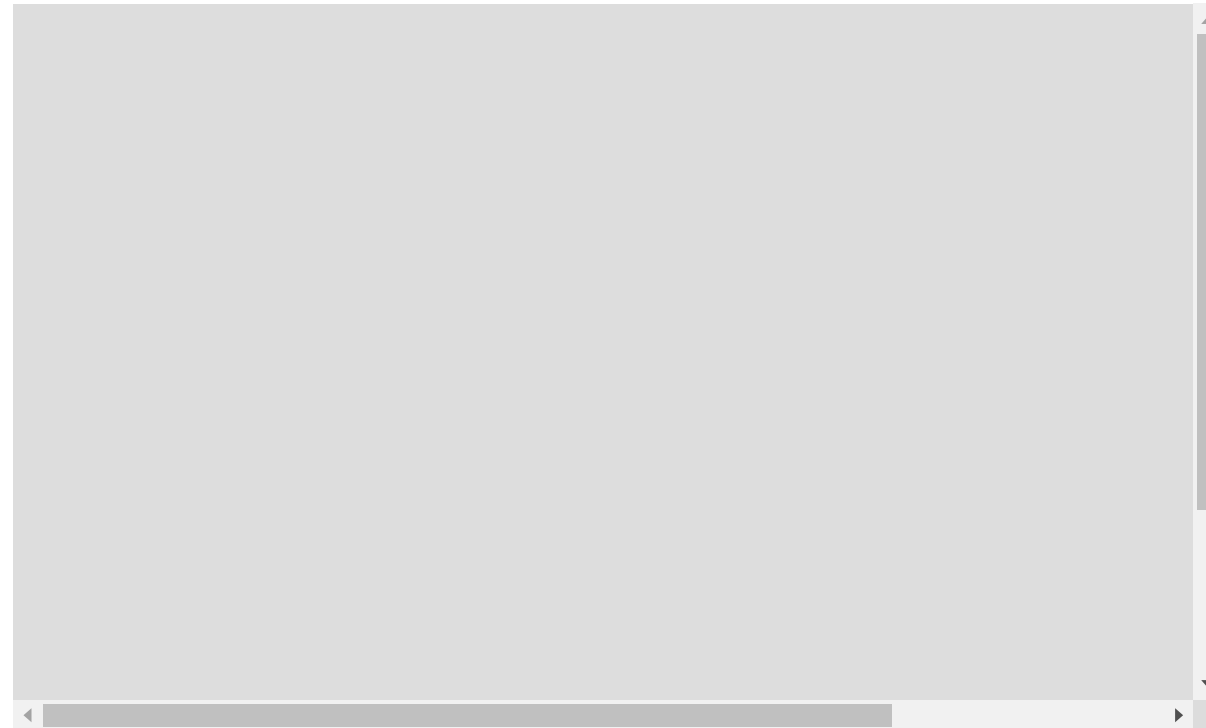
```
In [14]: # create map of Toronto using latitude and longitude values
map_Toronto = folium.Map(location=[latitude, longitude], zoom_start=11)

# add markers to map
for lat, lng, borough, neighborhood in zip(Toronto_Borough_data['Latitude'],
Toronto_Borough_data['Longitude'], Toronto_Borough_data['Borough'],
Toronto_Borough_data['Neighborhood']):
    label = '{} {}'.format(neighborhood, borough)
    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

Out[14]:



```
In [20]: CLIENT_ID = 'R250MMGCSQ3IYZWXUF30ZXT12QP2V5RHSG04141NDXQIS1C5' # your F  
          oursquare ID  
          CLIENT_SECRET = '51FXX0EJ3AV3LUFFCEJ3S00QCWYGCVBCDTY5NBFXPPDWMUZC' # yo  
          ur Foursquare Secret  
          VERSION = '20180606' # Foursquare API version
```

```
print('Your credentials:')
print('CLIENT_ID: ' + CLIENT_ID)
print('CLIENT_SECRET: ' + CLIENT_SECRET)
```

Your credentials:

CLIENT_ID: R250MMGCSQ3IYZWXUF30ZXT12QP2V5RHSG04141NDXQIS1C5

CLIENT_SECRET: 51FXX0EJ3AV3LUFFCEJ3S00QCWYGCVB CD TY5NBFXPPDWMUZC

```
In [21]: Toronto_Borough_data['Neighborhood'].iloc[6]
```

```
Out[21]: 'Central Bay Street'
```

```
In [22]: neighborhood_latitude = Toronto_Borough_data['Latitude'].iloc[6] # neighborhood latitude value
neighborhood_longitude = Toronto_Borough_data['Longitude'].iloc[6] # neighborhood longitude value

neighborhood_name = Toronto_Borough_data['Neighborhood'].iloc[6] # neighborhood name

print('Latitude and longitude values of {} are {}, {}.'.format(neighborhood_name,
                                                                neighborhood_latitude,
                                                                neighborhood_longitude))
```

Latitude and longitude values of Central Bay Street are 43.6579524, -79.3873826.

```
In [23]: LIMIT = 100
radius = 500
url = 'https://api.foursquare.com/v2/venues/explore?&client_id={}&client_secret={}&v={}&ll={},{}&radius={}&limit={}'.format(
    CLIENT_ID,
    CLIENT_SECRET,
    VERSION,
    neighborhood_latitude,
    neighborhood_longitude,
```

```
radius,  
LIMIT)
```

```
In [24]: results = requests.get(url).json()  
results
```

```
Out[24]: {'meta': {'code': 200, 'requestId': '5f3aa09e58714566399603a1'},  
  'response': {'suggestedFilters': {'header': 'Tap to show:',  
    'filters': [{'name': 'Open now', 'key': 'openNow'}]},  
    'headerLocation': 'Bay Street Corridor',  
    'headerFullLocation': 'Bay Street Corridor, Toronto',  
    'headerLocationGranularity': 'neighborhood',  
    'totalResults': 64,  
    'suggestedBounds': {'ne': {'lat': 43.6624524045, 'lng': -79.381174218  
39567},  
    'sw': {'lat': 43.6534523955, 'lng': -79.39359098160432}},  
    'groups': [{'type': 'Recommended Places',  
      'name': 'recommended',  
      'items': [{'reasons': {'count': 0,  
        'items': [{'summary': 'This spot is popular',  
          'type': 'general',  
          'reasonName': 'globalInteractionReason'}]}],  
      'venue': {'id': '537d4d6d498ec171ba22e7fe',  
        'name': "Jimmy's Coffee",  
        'location': {'address': '82 Gerrard Street W',  
          'crossStreet': 'Gerrard & LaPlante',  
          'lat': 43.65842123574496,  
          'lng': -79.38561319551111,  
          'labeledLatLngs': [{'label': 'display',  
            'lat': 43.65842123574496,  
            'lng': -79.38561319551111}]},  
        'distance': 151,  
        'postalCode': 'M5G 1Z4',  
        'cc': 'CA',  
        'city': 'Toronto',  
        'state': 'ON',  
        'country': 'Canada',  
        'formattedAddress': ['82 Gerrard Street W (Gerrard & LaPlant  
e)'],
```



```
'Toronto ON M5G 1Z4',
'Canada']]],
'categories': [{ 'id': '4bf58dd8d48988d1e0931735',
'name': 'Coffee Shop',
'pluralName': 'Coffee Shops',
'shortName': 'Coffee Shop',
'icon': { 'prefix': 'https://ss3.4sqi.net/img/categ
feeshop_',
'suffix': '.png'},
'primary': True}],
'photos': { 'count': 0, 'groups': []}],
'referralId': 'e-0-537d4d6d498ec171ba22e7fe-0'},
{ 'reasons': { 'count': 0,
'items': [{ 'summary': 'This spot is popular',
'type': 'general',
'reasonName': 'globalInteractionReason' } ] },
'venue': { 'id': '557231e3498e540f05f3083c',
'name': 'Tim Hortons',
'location': { 'address': '70 Gerrard St West',
'crossStreet': 'Bay St',
'lat': 43.658569999999976,
'lng': -79.38512341104502,
'labeledLatLngs': [{ 'label': 'display',
'lat': 43.658569999999976,
'lng': -79.38512341104502 } ] },
'distance': 194,
'postalCode': 'M5G 1J5',
'cc': 'CA',
'city': 'Toronto',
'state': 'ON',
'country': 'Canada',
'formattedAddress': [ '70 Gerrard St West (Bay St)',
'Toronto ON M5G 1J5',
'Canada' ] },
'categories': [{ 'id': '4bf58dd8d48988d1e0931735',
'name': 'Coffee Shop',
'pluralName': 'Coffee Shops',
'shortName': 'Coffee Shop',
'icon': { 'prefix': 'https://ss3.4sqi.net/img/categ
```

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d/coffeeshop_',
  'suffix': '.png'},
  'primary': True}],
  'photos': {'count': 0, 'groups': []}},
  'referralId': 'e-0-557231e3498e540f05f3083c-1'},
  {'reasons': {'count': 0,
    'items': [{'summary': 'This spot is popular',
      'type': 'general',
      'reasonName': 'globalInteractionReason'}]}],
  'venue': {'id': '4b744336f964a520d8d02de3',
    'name': "Somethin' 2 Talk About",
    'location': {'address': '78 Gerrard St W',
      'lat': 43.65839479027968,
      'lng': -79.38533765920816,
      'labeledLatLngs': [{'label': 'display',
        'lat': 43.65839479027968,
        'lng': -79.38533765920816}]},
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    'cc': 'CA',
    'city': 'Toronto',
    'state': 'ON',
    'country': 'Canada',
    'formattedAddress': ['78 Gerrard St W',
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      'Canada']},
    'categories': [{'id': '4bf58dd8d48988d115941735',
      'name': 'Middle Eastern Restaurant',
      'pluralName': 'Middle Eastern Restaurants',
      'shortName': 'Middle Eastern',
      'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/foo
d/middleeastern_',
        'suffix': '.png'},
        'primary': True}],
        'photos': {'count': 0, 'groups': []}},
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        {'reasons': {'count': 0,
          'items': [{'summary': 'This spot is popular',
            'type': 'general',

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```

      'reasonName': 'globalInteractionReason'}}}},
'venue': {'id': '5a81ae339deb7d369fa7f146',
'name': 'Hailed Coffee',
'location': {'address': '44 Gerrard St W',
'crossStreet': 'Yonge St',
'lat': 43.65883296982352,
'lng': -79.38368351986598,
'labeledLatLngs': [{'label': 'display',
'lat': 43.65883296982352,
'lng': -79.38368351986598}]},
'distance': 313,
'postalCode': 'M5G',
'cc': 'CA',
'neighborhood': 'College Park',
'city': 'Toronto',
'state': 'ON',
'country': 'Canada',
'formattedAddress': ['44 Gerrard St W (Yonge St)',
'Toronto ON M5G',
'Canada']},
'categories': [{'id': '4bf58dd8d48988d1e0931735',
'name': 'Coffee Shop',
'pluralName': 'Coffee Shops',
'shortName': 'Coffee Shop',
'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/food/coffeeshop_',
'suffix': '.png'},
'primary': True}],
'photos': {'count': 0, 'groups': []}},
'referralId': 'e-0-5a81ae339deb7d369fa7f146-3'},
{'reasons': {'count': 0,
'items': [{'summary': 'This spot is popular',
'type': 'general',
'reasonName': 'globalInteractionReason'}}}},
'venue': {'id': '5db70a0c306d6b000861ac9f',
'name': 'Neo Coffee Bar',
'location': {'address': '770 Bay Street Unit 3',
'lat': 43.66014,
'lng': -79.38587,

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'labeledLatLngs': [{ 'label': 'display',
  'lat': 43.66014,
  'lng': -79.38587}],
'distance': 272,
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'cc': 'CA',
'city': 'Toronto',
'state': 'ON',
'country': 'Canada',
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  'Toronto ON M5G 0A6',
  'Canada']],
'categories': [{ 'id': '4bf58dd8d48988d1e0931735',
  'name': 'Coffee Shop',
  'pluralName': 'Coffee Shops',
  'shortName': 'Coffee Shop',
  'icon': { 'prefix': 'https://ss3.4sqi.net/img/categories_v2/food/coffeeshop_',
    'suffix': '.png'},
  'primary': True}],
'photos': { 'count': 0, 'groups': []},
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{ 'reasons': { 'count': 0,
  'items': [{ 'summary': 'This spot is popular',
    'type': 'general',
    'reasonName': 'globalInteractionReason' } ]},
'venue': { 'id': '4ab2b0b9f964a520e56b20e3',
  'name': 'The Queen and Beaver Public House',
  'location': { 'address': '35 Elm St.',
    'crossStreet': 'at Bay St.',
    'lat': 43.65747228208784,
    'lng': -79.38352412327917,
    'labeledLatLngs': [{ 'label': 'display',
      'lat': 43.65747228208784,
      'lng': -79.38352412327917}],
    'distance': 315,
    'postalCode': 'M5G 1H1',
    'cc': 'CA',
    'city': 'Toronto',
```

```
'state': 'ON',
'country': 'Canada',
'formattedAddress': ['35 Elm St. (at Bay St.)',
'Toronto ON M5G 1H1',
'Canada']],
'categories': [{ 'id': '4bf58dd8d48988d155941735',
'name': 'Gastropub',
'pluralName': 'Gastropubs',
'shortName': 'Gastropub',
'icon': { 'prefix': 'https://ss3.4sqi.net/img/categories_v2/food/gastropub_',
'suffix': '.png'},
'primary': True}],
'photos': { 'count': 0, 'groups': []},
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{'reasons': { 'count': 0,
'items': [{ 'summary': 'This spot is popular',
'type': 'general',
'reasonName': 'globalInteractionReason'}]},
'venue': { 'id': '539c6f13498e06f4cc765165',
'name': 'The Elm Tree Restaurant',
'location': { 'address': '43 Elm St',
'crossStreet': 'Bay',
'lat': 43.65739749535259,
'lng': -79.38376054171513,
'labeledLatLngs': [{ 'label': 'display',
'lat': 43.65739749535259,
'lng': -79.38376054171513}],
'distance': 298,
'postalCode': 'M5G 1H1',
'cc': 'CA',
'city': 'Toronto',
'state': 'ON',
'country': 'Canada',
'formattedAddress': ['43 Elm St (Bay)',
'Toronto ON M5G 1H1',
'Canada']},
'categories': [{ 'id': '52e81612bcb57f1066b79f9',
'name': 'Modern European Restaurant',
```

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        'pluralName': 'Modern European Restaurants',
        'shortName': 'Modern European',
        'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/food/default_',
        'suffix': '.png'},
        'primary': True}],
        'photos': {'count': 0, 'groups': []},
        'venuePage': {'id': '88534436'}},
        'referralId': 'e-0-539c6f13498e06f4cc765165-6'},
        {'reasons': {'count': 0,
        'items': [{'summary': 'This spot is popular',
        'type': 'general',
        'reasonName': 'globalInteractionReason'}]}},
        'venue': {'id': '5a62412b1108ba191da5ba06',
        'name': 'KAKA',
        'location': {'address': '655 Bay Street',
        'crossStreet': '( Bay st & Elm st)',
        'lat': 43.65745745164475,
        'lng': -79.38419169987876,
        'labeledLatLngs': [{'label': 'display',
        'lat': 43.65745745164475,
        'lng': -79.38419169987876}]},
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        'cc': 'CA',
        'city': 'Toronto',
        'state': 'ON',
        'country': 'Canada',
        'formattedAddress': ['655 Bay Street (( Bay st & Elm st))',
        'Toronto ON M5G 1Z4',
        'Canada']},
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        'name': 'Japanese Restaurant',
        'pluralName': 'Japanese Restaurants',
        'shortName': 'Japanese',
        'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/food/japanese_',
        'suffix': '.png'},
        'primary': True}],

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    'photos': {'count': 0, 'groups': []}},
    'referralId': 'e-0-5a62412b1108ba191da5ba06-7'},
    {'reasons': {'count': 0,
    'items': [{'summary': 'This spot is popular',
    'type': 'general',
    'reasonName': 'globalInteractionReason'}]}},
    'venue': {'id': '4ae7b27df964a52068ad21e3',
    'name': 'Japango',
    'location': {'address': '122 Elizabeth St.',
    'crossStreet': 'at Dundas St. W',
    'lat': 43.65526771691681,
    'lng': -79.38516506734886,
    'labeledLatLngs': [{'label': 'display',
    'lat': 43.65526771691681,
    'lng': -79.38516506734886}]},
    'distance': 348,
    'postalCode': 'M5G 1P5',
    'cc': 'CA',
    'city': 'Toronto',
    'state': 'ON',
    'country': 'Canada',
    'formattedAddress': ['122 Elizabeth St. (at Dundas St. W)',
    'Toronto ON M5G 1P5',
    'Canada']},
    'categories': [{'id': '4bf58dd8d48988d1d2941735',
    'name': 'Sushi Restaurant',
    'pluralName': 'Sushi Restaurants',
    'shortName': 'Sushi',
    'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/foo
d/sushi_',
    'suffix': '.png'},
    'primary': True}],
    'photos': {'count': 0, 'groups': []}},
    'referralId': 'e-0-4ae7b27df964a52068ad21e3-8'},
    {'reasons': {'count': 0,
    'items': [{'summary': 'This spot is popular',
    'type': 'general',
    'reasonName': 'globalInteractionReason'}]}},
    'venue': {'id': '4e2284b11fc7c0ef9857d143',

```

```
'name': 'Chatime 日出茶太',
'location': {'address': '132 Dundas St W',
'crossStreet': 'btwn Bay & University',
'lat': 43.65554164147378,
'lng': -79.38468427043244,
'labeledLatLngs': [{'label': 'display',
'lat': 43.65554164147378,
'lng': -79.38468427043244}]},
'distance': 345,
'postalCode': 'M5G 1C3',
'cc': 'CA',
'city': 'Toronto',
'state': 'ON',
'country': 'Canada',
'formattedAddress': ['132 Dundas St W (btwn Bay & University)',
'Toronto ON M5G 1C3',
'Canada']},
'categories': [{'id': '52e81612bcbc57f1066b7a0c',
'name': 'Bubble Tea Shop',
'pluralName': 'Bubble Tea Shops',
'shortName': 'Bubble Tea',
'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/food/bubble_',
'suffix': '.png'},
'primary': True}],
'photos': {'count': 0, 'groups': []},
'referralId': 'e-0-4e2284b11fc7c0ef9857d143-9'},
'reasons': {'count': 0,
'items': [{'summary': 'This spot is popular',
'type': 'general',
'reasonName': 'globalInteractionReason'}]},
'venue': {'id': '512ce732e4b0aa0ac5f50f05',
'name': 'Bubble Bath & Spa',
'location': {'address': '736 Bay Street',
'crossStreet': 'Bay & Hayter',
'lat': 43.65904951746615,
'lng': -79.38534357912432,
'labeledLatLngs': [{'label': 'display',
'lat': 43.65904951746615,
```



```

    'lng': -79.38534357912432}],
    'distance': 204,
    'postalCode': 'M5G 2M4',
    'cc': 'CA',
    'city': 'Toronto',
    'state': 'ON',
    'country': 'Canada',
    'formattedAddress': ['736 Bay Street (Bay & Hayter)',
    'Toronto ON M5G 2M4',
    'Canada']],
    'categories': [{ 'id': '4bf58dd8d48988d1ed941735',
    'name': 'Spa',
    'pluralName': 'Spas',
    'shortName': 'Spa',
    'icon': { 'prefix': 'https://ss3.4sqi.net/img/categories_v2/sho
ps/spa_',
    'suffix': '.png'},
    'primary': True}],
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'Toronto ON M5G 1L7',
'Canada']},
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        'state': 'ON',
        'country': 'Canada',
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t.)',
        'Toronto ON M5G 1K3',
        'Canada']},
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        'pluralName': 'Yoga Studios',
        'shortName': 'Yoga Studio',

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        'primary': True}],
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                               'lat': 43.65441282740799,
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                  'state': 'ON',
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                                     'Toronto ON M5T 2W5',
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                        'shortName': 'Coffee Shop',
                        'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/food/coffeeshop_',
                                'suffix': '.png'},
                        'primary': True}],
        'photos': {'count': 0, 'groups': []}},
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    'lng': -79.38618409033066,
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  'shortName': 'Coffee Shop',
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    'lat': 43.659308,
    'lng': -79.3824621,
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      'Canada']],
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      'pluralName': 'Department Stores',
      'shortName': 'Department Store',
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      'name': 'JOEY Eaton Centre',
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        'lng': -79.38187792357716,
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    'categories': [{ 'id': '4bf58dd8d48988d157941735',
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                      'primary': True}],
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                                'lng': -79.38283826775837,
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                                'state': 'ON',
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                                                      'Canada']},
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                                    'pluralName': 'Burger Joints',
                                    'shortName': 'Burgers',
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                                              'suffix': '.png'},
                                    'primary': True}],

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& Dundas)',
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            'Canada']},
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            'shortName': 'Office',
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lding/default_',
                'suffix': '.png'},
            'primary': True}]},
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'Canada']},
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'labeledLatLngs': [{'label': 'display',

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        'lat': 43.659556180497816,
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    'Canada']],
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    'primary': True}],
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    'name': 'Arctic Bites',
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    'lng': -79.39291311374251,
    'labeledLatLngs': [{ 'label': 'display',
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    'lng': -79.39291311374251 } ]},
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    'state': 'ON',
    'country': 'Canada',
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    'pluralName': 'Ice Cream Shops',
    'shortName': 'Ice Cream',
    'icon': { 'prefix': 'https://ss3.4sqi.net/img/categories_v2/food/ice_cream_',
    'suffix': '.png'},
    'primary': True } ]}
  ],
  'reasons': { 'count': 0,
  'items': [
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    'type': 'general',
    'reasonName': 'globalInteractionReason' },
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    'type': 'general',
    'reasonName': 'globalInteractionReason' } ] }
}
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d/icecream_',
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      'lat': 43.659509,
      'lng': -79.382132,
      'labeledLatLngs': [{'label': 'display',
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        'lng': -79.382132}]},
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    'cc': 'CA',
    'city': 'Toronto',
    'state': 'ON',
    'country': 'Canada',
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      'Canada']},
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      'shortName': 'Coffee Shop',
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        'suffix': '.png'},
        'primary': True}},
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                'lng': -79.382132,
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                'state': 'ON',
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      'reasonName': 'globalInteractionReason']]],
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        'lng': -79.38297576948105,
        'labeledLatLngs': [{'label': 'display',
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          'lng': -79.38297576948105}]},
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        'city': 'Toronto',
        'state': 'ON',
        'country': 'Canada',
        'formattedAddress': ['439 Yonge Street (College)',
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          'Canada']},
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        'pluralName': 'Falafel Restaurants',
        'shortName': 'Falafel',
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          'suffix': '.png'},
        'primary': True}],
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        'location': {'address': '382 Yonge Street, Unit #6',
          'crossStreet': 'Gerrard St W',
          'lat': 43.659128249470015,
          'lng': -79.38226565563255,

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        'labeledLatLngs': [{ 'label': 'display',
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        'state': 'ON',
        'country': 'Canada',
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W)',
        'Toronto ON M5B 1S8',
        'Canada']},
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            'pluralName': 'Wine Bars',
            'shortName': 'Wine Bar',
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d/winery_',
                'suffix': '.png'},
            'primary': True}],
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            'items': [{ 'summary': 'This spot is popular',
                'type': 'general',
                'reasonName': 'globalInteractionReason'}]}},
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            'location': { 'address': '20 College St',
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                'lat': 43.661255320138636,
                'lng': -79.38389304122866,
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                    'lng': -79.38389304122866}],
                'distance': 462,
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                'cc': 'CA',

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'city': 'Toronto',
'state': 'ON',
'country': 'Canada',
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'Toronto ON M5G 1K2',
'Canada']],
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'pluralName': 'Diners',
'shortName': 'Diner',
'icon': { 'prefix': 'https://ss3.4sqi.net/img/categories_v2/food/diner_',
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'primary': True}],
'photos': { 'count': 0, 'groups': []}],
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'reasonName': 'globalInteractionReason' } ]}],
'venue': { 'id': '4e5cecc9fa76a4cf148bc565',
'name': 'Krispy Kreme Doughnut Cafe',
'location': { 'address': '162 McCaul St.',
'crossStreet': "btwn D'Arcy & Baldwin",
'lat': 43.65577205054815,
'lng': -79.391993340322,
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'city': 'Toronto',
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'Toronto ON M5T 1W3',
'Canada']],
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        'shortName': 'Donuts',
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        'primary': True}],
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    'pluralName': 'French Restaurants',

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        'primary': True}],
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        'pluralName': 'Sandwich Places',
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'Canada']},
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'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/shops/furniture_',
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                                                       'Canada']}],
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                                    'icon': { 'prefix': 'https://ss3.4sqi.net/img/categories_v2/food/coffeeshop_',
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'city': 'Toronto',
'state': 'ON',
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'Canada']},
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    'Canada']],
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    'shortName': 'Thai',
    'icon': { 'prefix': 'https://ss3.4sqi.net/img/categories_v2/food/thai_',
    'suffix': '.png'},
    'primary': True}],
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    'lat': 43.659695,
    'lng': -79.388706,
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        'icon': { 'prefix': 'https://ss3.4sqi.net/img/categories_v2/food/coffeeshop_',
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          'lng': -79.386414,
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        'pluralName': 'Italian Restaurants',
        'shortName': 'Italian',
        'icon': { 'prefix': 'https://ss3.4sqi.net/img/categories_v2/food/italian_',

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        'lat': 43.660721671691235,
        'lng': -79.38630837243234,
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        'Canada']},
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  'cc': 'CA',
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  'country': 'Canada',
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    'Canada']},
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    'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/food/korean_',
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  'referralId': 'e-0-552db032498e660b6506230c-62'},
  {'reasons': {'count': 0,
    'items': [{'summary': 'This spot is popular',
      'type': 'general',
      'reasonName': 'globalInteractionReason'}]}},
  'venue': {'id': '5ce5a5d5a5a315002cff6625',
    'name': 'Hattendo',
    'location': {'address': '13 Baldwin St',
      'lat': 43.65599648630493,
      'lng': -79.3926841020584,
      'labeledLatLngs': [{'label': 'display',
        'lat': 43.65599648630493,

```

```

        'lng': -79.3926841020584}},
        'distance': 479,
        'postalCode': 'M5T 1L1',
        'cc': 'CA',
        'city': 'Toronto',
        'state': 'ON',
        'country': 'Canada',
        'formattedAddress': ['13 Baldwin St', 'Toronto ON M5T 1L1', 'Canada']],
        'categories': [{
            'id': '4bf58dd8d48988d1d0941735',
            'name': 'Dessert Shop',
            'pluralName': 'Dessert Shops',
            'shortName': 'Desserts',
            'icon': {
                'prefix': 'https://ss3.4sqi.net/img/categories_v2/food/dessert_',
                'suffix': '.png'},
            'primary': True}],
        'photos': {'count': 0, 'groups': []}},
        'referralId': 'e-0-5ce5a5d5a5a315002cff6625-63'}}]]}}

```

```

In [25]: #borrow the get_category_type
         # function that extracts the category of the venue
         def get_category_type(row):
             try:
                 categories_list = row['categories']
             except:
                 categories_list = row['venue.categories']

             if len(categories_list) == 0:
                 return None
             else:
                 return categories_list[0]['name']

```

```

In [26]: venues = results['response']['groups'][0]['items']

         nearby_venues = json_normalize(venues) # flatten JSON

         # filter columns

```

```

filtered_columns = ['venue.name', 'venue.categories', 'venue.location.lat', 'venue.location.lng']
nearby_venues = nearby_venues.loc[:, filtered_columns]

# filter the category for each row
nearby_venues['venue.categories'] = nearby_venues.apply(get_category_type, axis=1)

# clean columns
nearby_venues.columns = [col.split(".")[1] for col in nearby_venues.columns]

nearby_venues.head()

```

```

<ipython-input-26-561c05f0fdd1>:3: FutureWarning: pandas.io.json.json_normalize is deprecated, use pandas.json_normalize instead
    nearby_venues = json_normalize(venues) # flatten JSON

```

Out[26]:

	name	categories	lat	lng
0	Jimmy's Coffee	Coffee Shop	43.658421	-79.385613
1	Tim Hortons	Coffee Shop	43.658570	-79.385123
2	Somethin' 2 Talk About	Middle Eastern Restaurant	43.658395	-79.385338
3	Hailed Coffee	Coffee Shop	43.658833	-79.383684
4	Neo Coffee Bar	Coffee Shop	43.660140	-79.385870

```

In [27]: print('{} venues were returned by Foursquare.'.format(nearby_venues.shape[0]))

```

64 venues were returned by Foursquare.

Cluster Neighborhoods - Use K-Means clustering

```

In [28]: kclusters = 5

```

```
Toronto_grouped_clustering = Toronto_Borough_data.drop(['Postalcode', 'Borough', '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]
```

Out[28]: array([0, 0, 0, 0, 1, 0, 0, 3, 0, 2])

```
In [29]: # add clustering labels
Toronto_Borough_data.insert(0, 'Cluster Labels', kmeans.labels_)

Toronto_Borough_data.head()
```

Out[29]:

	Cluster Labels	Postalcode	Borough	Neighborhood	Latitude	Longitude
2	0	M5A	Downtown Toronto	Regent Park, Harbourfront	43.654260	-79.360636
4	0	M7A	Downtown Toronto	Queen's Park, Ontario Provincial Government	43.662301	-79.389494
9	0	M5B	Downtown Toronto	Garden District, Ryerson	43.657162	-79.378937
15	0	M5C	Downtown Toronto	St. James Town	43.651494	-79.375418
19	1	M4E	East Toronto	The Beaches	43.676357	-79.293031

```
In [30]: # create map
map_clusters = folium.Map(location=[neighborhood_latitude, neighborhood_longitude], zoom_start=10)

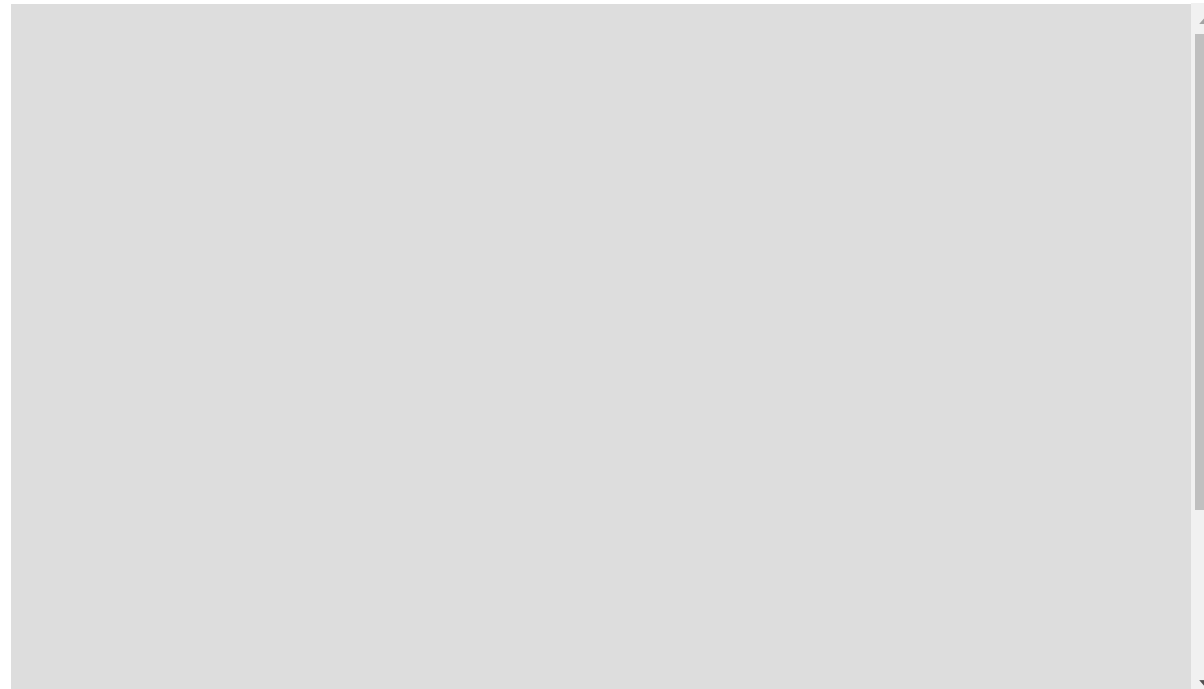
# set color scheme for the clusters
x = np.arange(kclusters)
ys = [i + x + (i*x)**2 for i in range(kclusters)]
```

```
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, neighborhood, cluster in zip(Toronto_Borough_data['Latitude'], Toronto_Borough_data['Longitude'], Toronto_Borough_data['Neighborhood'], Toronto_Borough_data['Cluster Labels']):
    label = folium.Popup(' 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
```

Out[30]:



In []:

