

Week3Toronto03

March 27, 2019

0.0.1 This note book is for explore and cluster of the neighborhoods in Toronto. Only boroughs that contain the word Toronto are considered.

0.0.2 Import libraries

```
In [1]: import pandas as pd
import numpy as np
import urllib
import urllib.request
import os
import requests
from bs4 import BeautifulSoup
```

```
In [2]: # 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
```

```
In [3]: !conda install -c conda-forge geopy --yes
from geopy.geocoders import Nominatim # module to convert an address into latitude and l

# libraries for displaying images
from IPython.display import Image
from IPython.core.display import HTML

# transforming json file into a pandas dataframe library
from pandas.io.json import json_normalize

!conda install -c conda-forge folium=0.5.0 --yes
import folium # plotting library

print('Folium installed')
print('Libraries imported.')
```

Collecting package metadata: done
Solving environment: done

Package Plan

environment location: /home/jupyterlab/conda

added / updated specs:

- geopy

The following packages will be downloaded:

| package | build | | |
|--------------------|-------|-------|-------------|
| geographiclib-1.49 | py_0 | 32 KB | conda-forge |
| geopy-1.19.0 | py_0 | 53 KB | conda-forge |
| Total: | | 85 KB | |

The following NEW packages will be INSTALLED:

geographiclib conda-forge/noarch::geographiclib-1.49-py_0

The following packages will be UPDATED:

geopy conda-forge/linux-64::geopy-1.11.0-py~ --> conda-forge/noarch::geopy-1.19.0

Downloading and Extracting Packages

geopy-1.19.0 | 53 KB | ##### | 100%

geographiclib-1.49 | 32 KB | ##### | 100%

Preparing transaction: done

Verifying transaction: done

Executing transaction: done

Collecting package metadata: done

Solving environment: done

All requested packages already installed.

Folium installed

Libraries imported.

0.0.3 Explore the Toronto City

0.0.4 The dataframe created in the previous question namely Postcodes_Coordinates is used for Exploration and Analysis

```
In [38]: #Get the longitude and latitude of Toronto City based on the address using an agent (to
address = 'Toronto, ON'

geolocator = Nominatim(user_agent="to_explorer")
location = geolocator.geocode(address)
latitude = location.latitude
longitude = location.longitude
print('The geograpical coordinate of Toronto City are {}, {}'.format(latitude, longitude))
```

The geographical coordinate of Toronto City are 43.653963, -79.387207.

```
In [39]: # create map of Toronto using latitude and longitude values
map_Toronto = folium.Map(location=[latitude, longitude], zoom_start=10)

# add markers to map
for lat, lng, borough, neighborhood in zip(Postcodes_Coordinates['Latitude'], Postcodes_Coordinates['Longitude'],
Postcodes_Coordinates['Borough'], Postcodes_Coordinates['Neighbourhood']):
    label = '{} {}'.format(neighborhood, borough)
    popup = folium.Popup(label, parse_html=True)
    folium.CircleMarker(
        [lat, lng],
        radius=5,
        popup=popup,
        color='blue',
        fill=True,
        fill_color='red',
        fill_opacity=0.7,
        parse_html=False).add_to(map_Toronto)

map_Toronto
```

```
Out[39]: <folium.folium.Map at 0x7f8ff359f6d8>
```

0.0.5 Use only Burroughs containing the word Toronto - so slice the relevant data into a new dataframe

```
In [40]: Toronto_data = Postcodes_Coordinates[Postcodes_Coordinates['Borough'].str.contains('Toronto')]
```

```
In [41]: Toronto_data.head()
```

```
Out[41]:
```

| | Postcode | Borough | Neighbourhood | Latitude | Longitude |
|---|----------|------------------|---------------------------|-----------|------------|
| 0 | M5A | Downtown Toronto | Harbourfront, Regent Park | 43.654260 | -79.360636 |
| 1 | M5B | Downtown Toronto | Ryerson, Garden District | 43.657162 | -79.378937 |
| 2 | M5C | Downtown Toronto | St. James Town | 43.651494 | -79.375418 |
| 3 | M4E | East Toronto | The Beaches | 43.676357 | -79.293031 |
| 4 | M5E | Downtown Toronto | Berczy Park | 43.644771 | -79.373306 |

```
In [42]: #Obtain the geographical coordinates of Downtown Toronto
        address = 'Downtown Toronto, TO'

        geolocator = Nominatim(user_agent="to_explorer")
        location = geolocator.geocode(address)
        latitude = location.latitude
        longitude = location.longitude
        print('The geograpical coordinate of Downtown Toronto are {}, {}'.format(latitude, longitude))
```

The geograpical coordinate of Downtown Toronto are 43.65145205, -79.3620078930752.

0.0.6 Visualize Downtown Toronto along with the Neighbourhood

```
In [43]: # create map of downtown Toronto using latitude and longitude values
        map_downtown = folium.Map(location=[latitude, longitude], zoom_start=11)

        # add markers to map
        for lat, lng, label in zip(Toronto_data['Latitude'], Toronto_data['Longitude'], Toronto_data['Neighbourhood']):
            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_downtown)

        map_downtown
```

Out[43]: <folium.folium.Map at 0x7f8ff3353748>

0.0.7 Define FOUR SQUARE Credentials

```
In [ ]: CLIENT_ID = 'ABCDABCDABCDABCDDBAFDSFSFSDF' # your Foursquare ID
        CLIENT_SECRET = 'ABCDABCDABCDABCDDBACDBACD' # your Foursquare Secret
        VERSION = '20180605' # Foursquare API version

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

In [48]: #Explore the Toronto data
        Toronto_data.loc[0, 'Neighbourhood']
```

Out[48]: 'Harbourfront,Regent Park'

```
In [49]: #Get the longitudes and latitudes from the dataframe
neighborhood_latitude = Toronto_data.loc[0, 'Latitude'] # neighborhood latitude value
neighborhood_longitude = Toronto_data.loc[0, 'Longitude'] # neighborhood longitude value

neighborhood_name = Toronto_data.loc[0, 'Neighbourhood'] # neighborhood name

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

Latitude and longitude values of Harbourfront, Regent Park are 43.6542599, -79.3606359.

0.0.8 Get the top 10 venues which are in Harbourfront within the 500 metre radius

```
In [50]: #Define a query to search for venues in Harbourfront
radius = 500
LIMIT = 10

In [51]: #Define the corresponding URL for explore
url = 'https://api.foursquare.com/v2/venues/explore?&client_id={}&client_secret={}&v={}'
      CLIENT_ID,
      CLIENT_SECRET,
      VERSION,
      neighborhood_latitude,
      neighborhood_longitude,
      radius,
      LIMIT)
url # display URL
```

```
Out[51]: 'https://api.foursquare.com/v2/venues/explore?&client_id=UB0Q5DWG34Q0JG41SFGABZQ2Z1IAZI'
```

```
In [52]: #Send the GET results
results = requests.get(url).json()
results
```

```
Out[52]: {'meta': {'code': 200, 'requestId': '5c9ba0b2dd579725df738d1c'},
          'response': {'suggestedFilters': {'header': 'Tap to show:',
          'filters': [{'name': 'Open now', 'key': 'openNow'}]},
          'headerLocation': 'Corktown',
          'headerFullLocation': 'Corktown, Toronto',
          'headerLocationGranularity': 'neighborhood',
          'totalResults': 46,
          'suggestedBounds': {'ne': {'lat': 43.6587599045, 'lng': -79.3544279001486},
          'sw': {'lat': 43.6497598955, 'lng': -79.36684389985142}},
          'groups': [{'type': 'Recommended Places',
          'name': 'recommended',
          'items': [{'reasons': {'count': 0,
          'items': [{'summary': 'This spot is popular',
```

```

      'type': 'general',
      'reasonName': 'globalInteractionReason']]],
'venue': {'id': '54ea41ad498e9a11e9e13308',
'name': 'Roselle Desserts',
'location': {'address': '362 King St E',
'crossStreet': 'Trinity St',
'lat': 43.653446723052674,
'lng': -79.3620167174383,
'labeledLatLngs': [{'label': 'display',
'lat': 43.653446723052674,
'lng': -79.3620167174383}]},
'distance': 143,
'postalCode': 'M5A 1K9',
'cc': 'CA',
'city': 'Toronto',
'state': 'ON',
'country': 'Canada',
'formattedAddress': ['362 King St E (Trinity St)',
'Toronto ON M5A 1K9',
'Canada']},
'categories': [{'id': '4bf58dd8d48988d16a941735',
'name': 'Bakery',
'pluralName': 'Bakeries',
'shortName': 'Bakery',
'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/food/bakery_',
'suffix': '.png'},
'primary': True}],
'photos': {'count': 0, 'groups': []}},
'referralId': 'e-0-54ea41ad498e9a11e9e13308-0'},
{'reasons': {'count': 0,
'items': [{'summary': 'This spot is popular',
'type': 'general',
'reasonName': 'globalInteractionReason']]],
'venue': {'id': '53b8466a498e83df908c3f21',
'name': 'Tandem Coffee',
'location': {'address': '368 King St E',
'crossStreet': 'at Trinity St',
'lat': 43.65355870959944,
'lng': -79.36180945913513,
'labeledLatLngs': [{'label': 'display',
'lat': 43.65355870959944,
'lng': -79.36180945913513}]},
'distance': 122,
'cc': 'CA',
'city': 'Toronto',
'state': 'ON',
'country': 'Canada',
'formattedAddress': ['368 King St E (at Trinity St)',

```



```

'crossStreet': 'btwn Sackville St and Sumach St',
'lat': 43.65473505045365,
'lng': -79.35987433132891,
'labeledLatLngs': [{ 'label': 'display',
  'lat': 43.65473505045365,
  'lng': -79.35987433132891}],
'distance': 80,
'postalCode': 'M5A 1L9',
'cc': 'CA',
'city': 'Toronto',
'state': 'ON',
'country': 'Canada',
'formattedAddress': ['497 King Street East (btwn Sackville St and Sumach St)',
  'Toronto ON M5A 1L9',
  'Canada']],
'categories': [{ 'id': '4bf58dd8d48988d1ed941735',
  'name': 'Spa',
  'pluralName': 'Spas',
  'shortName': 'Spa',
  'icon': { 'prefix': 'https://ss3.4sqi.net/img/categories_v2/shops/spa_',
    'suffix': '.png'},
  'primary': True}],
'photos': { 'count': 0, 'groups': [] },
'referralId': 'e-0-50760559e4b0e8c7babe2497-3'},
{'reasons': { 'count': 0,
  'items': [{ 'summary': 'This spot is popular',
    'type': 'general',
    'reasonName': 'globalInteractionReason' } ] },
'venue': { 'id': '4ae5b91ff964a520a6a121e3',
  'name': 'Morning Glory Cafe',
  'location': { 'address': '457 King St. E',
    'crossStreet': 'Gilead Place',
    'lat': 43.653946942635294,
    'lng': -79.36114884214422,
    'labeledLatLngs': [{ 'label': 'display',
      'lat': 43.653946942635294,
      'lng': -79.36114884214422 } ],
    'distance': 54,
    'postalCode': 'M5A 1L6',
    'cc': 'CA',
    'city': 'Toronto',
    'state': 'ON',
    'country': 'Canada',
    'formattedAddress': ['457 King St. E (Gilead Place)',
      'Toronto ON M5A 1L6',
      'Canada' ] },
  'categories': [{ 'id': '4bf58dd8d48988d143941735',
    'name': 'Breakfast Spot',

```



```

    'pluralName': 'Breakfast Spots',
    'shortName': 'Breakfast',
    'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/food/breakfast_',
      'suffix': '.png'},
    'primary': True}],
    'photos': {'count': 0, 'groups': []},
    'venuePage': {'id': '39686393'}},
    'referralId': 'e-0-4ae5b91ff964a520a6a121e3-4'},
    {'reasons': {'count': 0,
      'items': [{'summary': 'This spot is popular',
        'type': 'general',
        'reasonName': 'globalInteractionReason'}]},
      'venue': {'id': '5612b1cc498e3dd742af0dc8',
        'name': 'Impact Kitchen',
        'location': {'address': '573 King St E',
          'crossStreet': 'at St Lawrence St',
          'lat': 43.65636850543279,
          'lng': -79.35697968750694,
          'labeledLatLngs': [{'label': 'display',
            'lat': 43.65636850543279,
            'lng': -79.35697968750694}]},
          'distance': 376,
          'postalCode': 'M5A 4L3',
          'cc': 'CA',
          'city': 'Toronto',
          'state': 'ON',
          'country': 'Canada',
          'formattedAddress': ['573 King St E (at St Lawrence St)',
            'Toronto ON M5A 4L3',
            'Canada']},
          'categories': [{'id': '4bf58dd8d48988d1c4941735',
            'name': 'Restaurant',
            'pluralName': 'Restaurants',
            'shortName': 'Restaurant',
            'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/food/default_',
              'suffix': '.png'},
            'primary': True}],
            'photos': {'count': 0, 'groups': []}},
            'referralId': 'e-0-5612b1cc498e3dd742af0dc8-5'},
            {'reasons': {'count': 0,
              'items': [{'summary': 'This spot is popular',
                'type': 'general',
                'reasonName': 'globalInteractionReason'}]},
                'venue': {'id': '4af59046f964a520e0f921e3',
                  'name': 'Figs Breakfast & Lunch',
                  'location': {'address': '344 Queen St. E.',
                    'crossStreet': 'at Parliament St.',
                    'lat': 43.65567455427388,

```

```

'lng': -79.3645032892494,
'labeledLatLngs': [{ 'label': 'display',
  'lat': 43.65567455427388,
  'lng': -79.3645032892494}],
'distance': 349,
'postalCode': 'M5A 1S8',
'cc': 'CA',
'city': 'Toronto',
'state': 'ON',
'country': 'Canada',
'formattedAddress': ['344 Queen St. E. (at Parliament St.)',
  'Toronto ON M5A 1S8',
  'Canada']],
'categories': [{ 'id': '4bf58dd8d48988d143941735',
  'name': 'Breakfast Spot',
  'pluralName': 'Breakfast Spots',
  'shortName': 'Breakfast',
  'icon': { 'prefix': 'https://ss3.4sqi.net/img/categories_v2/food/breakfast_',
    'suffix': '.png'},
  'primary': True}],
'photos': { 'count': 0, 'groups': []}],
'referralId': 'e-0-4af59046f964a520e0f921e3-6'},
{'reasons': { 'count': 0,
  'items': [{ 'summary': 'This spot is popular',
    'type': 'general',
    'reasonName': 'globalInteractionReason'}]},
'venue': { 'id': '566e1294498e3f6629006bc3',
  'name': 'Dominion Pub and Kitchen',
  'location': { 'address': '500 Queen Street East',
    'lat': 43.65691857501867,
    'lng': -79.35896684476664,
    'labeledLatLngs': [{ 'label': 'display',
      'lat': 43.65691857501867,
      'lng': -79.35896684476664}],
    'distance': 325,
    'postalCode': 'M5A 1T9',
    'cc': 'CA',
    'city': 'Toronto',
    'state': 'ON',
    'country': 'Canada',
    'formattedAddress': ['500 Queen Street East',
      'Toronto ON M5A 1T9',
      'Canada']}],
'categories': [{ 'id': '4bf58dd8d48988d11b941735',
  'name': 'Pub',
  'pluralName': 'Pubs',
  'shortName': 'Pub',
  'icon': { 'prefix': 'https://ss3.4sqi.net/img/categories_v2/nightlife/pub_',

```

```

        'suffix': '.png'},
        'primary': True]],
        'photos': {'count': 0, 'groups': []}},
        'referralId': 'e-0-566e1294498e3f6629006bc3-7'},
        {'reasons': {'count': 0,
            'items': [{'summary': 'This spot is popular',
                'type': 'general',
                'reasonName': 'globalInteractionReason'}]}],
        'venue': {'id': '51ccc048498ec7792efc955e',
            'name': 'Corktown Common',
            'location': {'lat': 43.655617799749734,
                'lng': -79.3562113397429,
                'labeledLatLngs': [{'label': 'display',
                    'lat': 43.655617799749734,
                    'lng': -79.3562113397429}]},
            'distance': 387,
            'cc': 'CA',
            'country': 'Canada',
            'formattedAddress': ['Canada']},
            'categories': [{'id': '4bf58dd8d48988d163941735',
                'name': 'Park',
                'pluralName': 'Parks',
                'shortName': 'Park',
                'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/parks_outdoors/park',
                    'suffix': '.png'},
                'primary': True}]},
            'photos': {'count': 0, 'groups': []}},
            'referralId': 'e-0-51ccc048498ec7792efc955e-8'},
            {'reasons': {'count': 0,
                'items': [{'summary': 'This spot is popular',
                    'type': 'general',
                    'reasonName': 'globalInteractionReason'}]}],
                'venue': {'id': '4ad4c05ef964a520bff620e3',
                    'name': 'The Distillery Historic District',
                    'location': {'address': 'btwn Front, Cherry, Gardiner & Parliament',
                        'lat': 43.65024435658077,
                        'lng': -79.35932278633118,
                        'labeledLatLngs': [{'label': 'display',
                            'lat': 43.65024435658077,
                            'lng': -79.35932278633118}]},
                        'distance': 459,
                        'postalCode': 'M5A 3C4',
                        'cc': 'CA',
                        'city': 'Toronto',
                        'state': 'ON',
                        'country': 'Canada',
                        'formattedAddress': ['btwn Front, Cherry, Gardiner & Parliament',
                            'Toronto ON M5A 3C4'],

```

```

        'Canada']},
        'categories': [{'id': '4deefb944765f83613cdba6e',
                        'name': 'Historic Site',
                        'pluralName': 'Historic Sites',
                        'shortName': 'Historic Site',
                        'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/arts_entertainment/',
                                'suffix': '.png'},
                        'primary': True}],
        'photos': {'count': 0, 'groups': []}},
        'referralId': 'e-0-4ad4c05ef964a520bff620e3-9']]]]]}

```

0.0.9 Explore the categories which contains Bakeries, Coffee shops, Historic sties etc.

In [53]: *# 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 [56]: *#Clean the JSON and store in a Pandas dataframe*

```

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()

```

Out[56]:

| | name | categories \ |
|---|---|----------------------|
| 0 | Roselle Desserts | Bakery |
| 1 | Tandem Coffee | Coffee Shop |
| 2 | Toronto Cooper Koo Family Cherry St YMCA Centre | Gym / Fitness Center |
| 3 | Body Blitz Spa East | Spa |
| 4 | Morning Glory Cafe | Breakfast Spot |

```

        lat      lng
0  43.653447 -79.362017
1  43.653559 -79.361809
2  43.653191 -79.357947
3  43.654735 -79.359874
4  43.653947 -79.361149

```

```

In [57]: #Number of venues
         print('{} venues were returned by Foursquare.'.format(nearby_venues.shape[0]))

10 venues were returned by Foursquare.

```

0.0.10 Explore neighbourhoods in Toronto

***Create a function to repeat the same process to all the neighborhoods for Toronto

```

In [58]: def getNearbyVenues(names, latitudes, longitudes, radius=500):

        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={}&lat={}&lng={}&radius={}&limit={}&nearby_types={}'
            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)

```

0.0.11 Run the above function on each neighborhood and create a new dataframe called Toronto_venues

```

In [59]: Toronto_venues = getNearbyVenues(names=Toronto_data['Neighbourhood'],
                                           latitudes=Toronto_data['Latitude'],
                                           longitudes=Toronto_data['Longitude']
                                           )

```

```

Harbourfront,Regent Park
Ryerson,Garden District
St. James Town
The Beaches
Berczy Park
Central Bay Street
Christie
Adelaide,King,Richmond
Dovercourt Village,Dufferin
Harbourfront East,Toronto Islands,Union Station
Little Portugal,Trinity
The Danforth West,Riverdale
Design Exchange,Toronto Dominion Centre
Brockton,Exhibition Place,Parkdale Village
The Beaches West,India Bazaar
Commerce Court,Victoria Hotel
Studio District
Lawrence Park
Roselawn
Davisville North
Forest Hill North,Forest Hill West
High Park,The Junction South
North Toronto West
The Annex,North Midtown,Yorkville
Parkdale,Roncesvalles
Davisville
Harbord,University of Toronto
Runnymede,Swansea
Moore Park,Summerhill East
Chinatown,Grange Park,Kensington Market
Deer Park,Forest Hill SE,Rathnelly,South Hill,Summerhill West

```

CN Tower,Bathurst Quay,Island airport,Harbourfront West,King and Spadina,Railway Lands,South Nias
 Rosedale
 Stn A PO Boxes 25 The Esplanade
 Cabbagetown,St. James Town
 First Canadian Place,Underground city
 Church and Wellesley
 Business Reply Mail Processing Centre 969 Eastern

```
In [61]: #Check the size of the resulting dataframe
print(Toronto_venues.shape)
Toronto_venues.head()
```

(341, 7)

```
Out[61]:
```

| | Neighborhood | Neighborhood | Latitude | Neighborhood | Longitude | \ |
|---|--------------------------|--------------|----------|--------------|------------|---|
| 0 | Harbourfront,Regent Park | | 43.65426 | | -79.360636 | |
| 1 | Harbourfront,Regent Park | | 43.65426 | | -79.360636 | |
| 2 | Harbourfront,Regent Park | | 43.65426 | | -79.360636 | |
| 3 | Harbourfront,Regent Park | | 43.65426 | | -79.360636 | |
| 4 | Harbourfront,Regent Park | | 43.65426 | | -79.360636 | |

| | Venue | Venue | Latitude | \ |
|---|---|-------|-----------|---|
| 0 | Roselle Desserts | | 43.653447 | |
| 1 | Tandem Coffee | | 43.653559 | |
| 2 | Toronto Cooper Koo Family Cherry St YMCA Centre | | 43.653191 | |
| 3 | Body Blitz Spa East | | 43.654735 | |
| 4 | Morning Glory Cafe | | 43.653947 | |

| | Venue | Longitude | Venue | Category |
|---|-------|------------|---------------|----------------|
| 0 | | -79.362017 | | Bakery |
| 1 | | -79.361809 | | Coffee Shop |
| 2 | | -79.357947 | Gym / Fitness | Center |
| 3 | | -79.359874 | | Spa |
| 4 | | -79.361149 | | Breakfast Spot |

```
In [62]: # Check the number of venues returned for each Neighbourhood
Toronto_venues.groupby('Neighborhood').count()
```

```
Out[62]:
```

| | Neighborhood | Latitude | \ |
|--|--|----------|----|
| | Adelaide,King,Richmond | | 10 |
| | Berczy Park | | 10 |
| | Brockton,Exhibition Place,Parkdale Village | | 10 |
| | Business Reply Mail Processing Centre 969 Eastern | | 10 |
| | CN Tower,Bathurst Quay,Island airport,Harbourfr... | | 10 |
| | Cabbagetown,St. James Town | | 10 |
| | Central Bay Street | | 10 |

| | |
|--|----|
| Chinatown,Grange Park,Kensington Market | 10 |
| Christie | 10 |
| Church and Wellesley | 10 |
| Commerce Court,Victoria Hotel | 10 |
| Davisville | 10 |
| Davisville North | 9 |
| Deer Park,Forest Hill SE,Rathnelly,South Hill,S... | 10 |
| Design Exchange,Toronto Dominion Centre | 10 |
| Dovercourt Village,Dufferin | 10 |
| First Canadian Place,Underground city | 10 |
| Forest Hill North,Forest Hill West | 5 |
| Harbord,University of Toronto | 10 |
| Harbourfront East,Toronto Islands,Union Station | 10 |
| Harbourfront,Regent Park | 10 |
| High Park,The Junction South | 10 |
| Lawrence Park | 3 |
| Little Portugal,Trinity | 10 |
| Moore Park,Summerhill East | 3 |
| North Toronto West | 10 |
| Parkdale,Roncesvalles | 10 |
| Rosedale | 4 |
| Roselawn | 3 |
| Runnymede,Swansea | 10 |
| Ryerson,Garden District | 10 |
| St. James Town | 10 |
| Stn A P0 Boxes 25 The Esplanade | 10 |
| Studio District | 10 |
| The Annex,North Midtown,Yorkville | 10 |
| The Beaches | 4 |
| The Beaches West,India Bazaar | 10 |
| The Danforth West,Riverdale | 10 |

Neighborhood Longitude \

| | |
|--|----|
| Neighborhood | |
| Adelaide,King,Richmond | 10 |
| Berczy Park | 10 |
| Brockton,Exhibition Place,Parkdale Village | 10 |
| Business Reply Mail Processing Centre 969 Eastern | 10 |
| CN Tower,Bathurst Quay,Island airport,Harbourfr... | 10 |
| Cabbagetown,St. James Town | 10 |
| Central Bay Street | 10 |
| Chinatown,Grange Park,Kensington Market | 10 |
| Christie | 10 |
| Church and Wellesley | 10 |
| Commerce Court,Victoria Hotel | 10 |
| Davisville | 10 |
| Davisville North | 9 |
| Deer Park,Forest Hill SE,Rathnelly,South Hill,S... | 10 |

| | |
|---|----|
| Design Exchange,Toronto Dominion Centre | 10 |
| Dovercourt Village,Dufferin | 10 |
| First Canadian Place,Underground city | 10 |
| Forest Hill North,Forest Hill West | 5 |
| Harbord,University of Toronto | 10 |
| Harbourfront East,Toronto Islands,Union Station | 10 |
| Harbourfront,Regent Park | 10 |
| High Park,The Junction South | 10 |
| Lawrence Park | 3 |
| Little Portugal,Trinity | 10 |
| Moore Park,Summerhill East | 3 |
| North Toronto West | 10 |
| Parkdale,Roncesvalles | 10 |
| Rosedale | 4 |
| Roselawn | 3 |
| Runnymede,Swansea | 10 |
| Ryerson,Garden District | 10 |
| St. James Town | 10 |
| Stn A PO Boxes 25 The Esplanade | 10 |
| Studio District | 10 |
| The Annex,North Midtown,Yorkville | 10 |
| The Beaches | 4 |
| The Beaches West,India Bazaar | 10 |
| The Danforth West,Riverdale | 10 |

| | Venue | Venue Latitude \ |
|--|-------|------------------|
| Neighborhood | | |
| Adelaide,King,Richmond | 10 | 10 |
| Berczy Park | 10 | 10 |
| Brockton,Exhibition Place,Parkdale Village | 10 | 10 |
| Business Reply Mail Processing Centre 969 Eastern | 10 | 10 |
| CN Tower,Bathurst Quay,Island airport,Harbourfr... | 10 | 10 |
| Cabbagetown,St. James Town | 10 | 10 |
| Central Bay Street | 10 | 10 |
| Chinatown,Grange Park,Kensington Market | 10 | 10 |
| Christie | 10 | 10 |
| Church and Wellesley | 10 | 10 |
| Commerce Court,Victoria Hotel | 10 | 10 |
| Davisville | 10 | 10 |
| Davisville North | 9 | 9 |
| Deer Park,Forest Hill SE,Rathnelly,South Hill,S... | 10 | 10 |
| Design Exchange,Toronto Dominion Centre | 10 | 10 |
| Dovercourt Village,Dufferin | 10 | 10 |
| First Canadian Place,Underground city | 10 | 10 |
| Forest Hill North,Forest Hill West | 5 | 5 |
| Harbord,University of Toronto | 10 | 10 |
| Harbourfront East,Toronto Islands,Union Station | 10 | 10 |
| Harbourfront,Regent Park | 10 | 10 |

| | | |
|-----------------------------------|----|----|
| High Park,The Junction South | 10 | 10 |
| Lawrence Park | 3 | 3 |
| Little Portugal,Trinity | 10 | 10 |
| Moore Park,Summerhill East | 3 | 3 |
| North Toronto West | 10 | 10 |
| Parkdale,Roncesvalles | 10 | 10 |
| Rosedale | 4 | 4 |
| Roselawn | 3 | 3 |
| Runnymede,Swansea | 10 | 10 |
| Ryerson,Garden District | 10 | 10 |
| St. James Town | 10 | 10 |
| Stn A PO Boxes 25 The Esplanade | 10 | 10 |
| Studio District | 10 | 10 |
| The Annex,North Midtown,Yorkville | 10 | 10 |
| The Beaches | 4 | 4 |
| The Beaches West,India Bazaar | 10 | 10 |
| The Danforth West,Riverdale | 10 | 10 |

Venue Longitude \

| | |
|--|----|
| Neighborhood | |
| Adelaide,King,Richmond | 10 |
| Berczy Park | 10 |
| Brockton,Exhibition Place,Parkdale Village | 10 |
| Business Reply Mail Processing Centre 969 Eastern | 10 |
| CN Tower,Bathurst Quay,Island airport,Harbourfr... | 10 |
| Cabbagetown,St. James Town | 10 |
| Central Bay Street | 10 |
| Chinatown,Grange Park,Kensington Market | 10 |
| Christie | 10 |
| Church and Wellesley | 10 |
| Commerce Court,Victoria Hotel | 10 |
| Davisville | 10 |
| Davisville North | 9 |
| Deer Park,Forest Hill SE,Rathnelly,South Hill,S... | 10 |
| Design Exchange,Toronto Dominion Centre | 10 |
| Dovercourt Village,Dufferin | 10 |
| First Canadian Place,Underground city | 10 |
| Forest Hill North,Forest Hill West | 5 |
| Harbord,University of Toronto | 10 |
| Harbourfront East,Toronto Islands,Union Station | 10 |
| Harbourfront,Regent Park | 10 |
| High Park,The Junction South | 10 |
| Lawrence Park | 3 |
| Little Portugal,Trinity | 10 |
| Moore Park,Summerhill East | 3 |
| North Toronto West | 10 |
| Parkdale,Roncesvalles | 10 |
| Rosedale | 4 |

| | |
|-------------------------------------|----|
| Roselawn | 3 |
| Runnymede, Swansea | 10 |
| Ryerson, Garden District | 10 |
| St. James Town | 10 |
| Stn A PO Boxes 25 The Esplanade | 10 |
| Studio District | 10 |
| The Annex, North Midtown, Yorkville | 10 |
| The Beaches | 4 |
| The Beaches West, India Bazaar | 10 |
| The Danforth West, Riverdale | 10 |

Venue Category

| | |
|--|----|
| Neighborhood | |
| Adelaide, King, Richmond | 10 |
| Berczy Park | 10 |
| Brockton, Exhibition Place, Parkdale Village | 10 |
| Business Reply Mail Processing Centre 969 Eastern | 10 |
| CN Tower, Bathurst Quay, Island airport, Harbourfr... | 10 |
| Cabbagetown, St. James Town | 10 |
| Central Bay Street | 10 |
| Chinatown, Grange Park, Kensington Market | 10 |
| Christie | 10 |
| Church and Wellesley | 10 |
| Commerce Court, Victoria Hotel | 10 |
| Davisville | 10 |
| Davisville North | 9 |
| Deer Park, Forest Hill SE, Rathnelly, South Hill, S... | 10 |
| Design Exchange, Toronto Dominion Centre | 10 |
| Dovercourt Village, Dufferin | 10 |
| First Canadian Place, Underground city | 10 |
| Forest Hill North, Forest Hill West | 5 |
| Harbord, University of Toronto | 10 |
| Harbourfront East, Toronto Islands, Union Station | 10 |
| Harbourfront, Regent Park | 10 |
| High Park, The Junction South | 10 |
| Lawrence Park | 3 |
| Little Portugal, Trinity | 10 |
| Moore Park, Summerhill East | 3 |
| North Toronto West | 10 |
| Parkdale, Roncesvalles | 10 |
| Rosedale | 4 |
| Roselawn | 3 |
| Runnymede, Swansea | 10 |
| Ryerson, Garden District | 10 |
| St. James Town | 10 |
| Stn A PO Boxes 25 The Esplanade | 10 |
| Studio District | 10 |
| The Annex, North Midtown, Yorkville | 10 |

| | |
|-------------------------------|----|
| The Beaches | 4 |
| The Beaches West,India Bazaar | 10 |
| The Danforth West,Riverdale | 10 |

0.0.12 Check how many unique values can be curated from the returned values

```
In [63]: print('There are {} uniques categories.'.format(len(Toronto_venues['Venue Category']).unique()))
```

There are 116 uniques categories.

0.0.13 Analyze Each Neighborhood

```
In [64]: # one hot encoding
Toronto_onehot = pd.get_dummies(Toronto_venues[['Venue Category']], prefix="", prefix_suf=)

# add neighborhood column back to dataframe
Toronto_onehot['Neighborhood'] = Toronto_venues['Neighborhood']
Toronto_onehot.shape
# move neighborhood column to the first column
fixed_columns = [Toronto_onehot.columns[-1]] + list(Toronto_onehot.columns[:-1])
Toronto_onehot = Toronto_onehot[fixed_columns]
```

```
Toronto_onehot.head()
```

```
Out[64]:
```

| | Yoga Studio | Airport | Airport Food Court | Airport Gate | Airport Lounge | \ |
|---|-------------|---------|--------------------|--------------|----------------|---|
| 0 | 0 | 0 | 0 | 0 | 0 | |
| 1 | 0 | 0 | 0 | 0 | 0 | |
| 2 | 0 | 0 | 0 | 0 | 0 | |
| 3 | 0 | 0 | 0 | 0 | 0 | |
| 4 | 0 | 0 | 0 | 0 | 0 | |

| | Airport Service | Airport Terminal | American Restaurant | Art Gallery | \ |
|---|-----------------|------------------|---------------------|-------------|---|
| 0 | 0 | 0 | 0 | 0 | |
| 1 | 0 | 0 | 0 | 0 | |
| 2 | 0 | 0 | 0 | 0 | |
| 3 | 0 | 0 | 0 | 0 | |
| 4 | 0 | 0 | 0 | 0 | |

| | Arts & Crafts Store | ... | Supermarket | Sushi Restaurant | Swim School | \ |
|---|---------------------|-----|-------------|------------------|-------------|---|
| 0 | 0 | ... | 0 | 0 | 0 | |
| 1 | 0 | ... | 0 | 0 | 0 | |
| 2 | 0 | ... | 0 | 0 | 0 | |
| 3 | 0 | ... | 0 | 0 | 0 | |
| 4 | 0 | ... | 0 | 0 | 0 | |

| | Tea Room | Thai Restaurant | Theater | Theme Restaurant | Trail | \ |
|---|----------|-----------------|---------|------------------|-------|---|
| 0 | 0 | 0 | 0 | 0 | 0 | |
| 1 | 0 | 0 | 0 | 0 | 0 | |

```

2      0      0      0      0      0
3      0      0      0      0      0
4      0      0      0      0      0

```

```

      Vegetarian / Vegan Restaurant  Vietnamese Restaurant
0                                0                        0
1                                0                        0
2                                0                        0
3                                0                        0
4                                0                        0

```

```
[5 rows x 116 columns]
```

```
In [65]: Toronto_onehot.shape
```

```
Out[65]: (341, 116)
```

```
In [66]: # Next, let's group rows by neighborhood and by taking the mean of the frequency of occ
Toronto_grouped = Toronto_onehot.groupby('Neighborhood').mean().reset_index()
Toronto_grouped
```

```
Out[66]:
```

| | Neighborhood | Yoga Studio | Airport \ |
|----|---|-------------|-----------|
| 0 | Adelaide,King,Richmond | 0.0 | 0.0 |
| 1 | Berczy Park | 0.0 | 0.0 |
| 2 | Brockton,Exhibition Place,Parkdale Village | 0.0 | 0.0 |
| 3 | Business Reply Mail Processing Centre 969 Eastern | 0.0 | 0.0 |
| 4 | CN Tower,Bathurst Quay,Island airport,Harbourf... | 0.0 | 0.1 |
| 5 | Cabbagetown,St. James Town | 0.0 | 0.0 |
| 6 | Central Bay Street | 0.0 | 0.0 |
| 7 | Chinatown,Grange Park,Kensington Market | 0.0 | 0.0 |
| 8 | Christie | 0.0 | 0.0 |
| 9 | Church and Wellesley | 0.0 | 0.0 |
| 10 | Commerce Court,Victoria Hotel | 0.0 | 0.0 |
| 11 | Davisville | 0.0 | 0.0 |
| 12 | Davisville North | 0.0 | 0.0 |
| 13 | Deer Park,Forest Hill SE,Rathnelly,South Hill,... | 0.0 | 0.0 |
| 14 | Design Exchange,Toronto Dominion Centre | 0.0 | 0.0 |
| 15 | Dovercourt Village,Dufferin | 0.0 | 0.0 |
| 16 | First Canadian Place,Underground city | 0.0 | 0.0 |
| 17 | Forest Hill North,Forest Hill West | 0.0 | 0.0 |
| 18 | Harbord,University of Toronto | 0.0 | 0.0 |
| 19 | Harbourfront East,Toronto Islands,Union Station | 0.0 | 0.0 |
| 20 | Harbourfront,Regent Park | 0.0 | 0.0 |
| 21 | High Park,The Junction South | 0.0 | 0.0 |
| 22 | Lawrence Park | 0.0 | 0.0 |
| 23 | Little Portugal,Trinity | 0.0 | 0.0 |
| 24 | Moore Park,Summerhill East | 0.0 | 0.0 |
| 25 | North Toronto West | 0.1 | 0.0 |
| 26 | Parkdale,Roncesvalles | 0.0 | 0.0 |

| | | | |
|----|-------------------------------------|-----|-----|
| 27 | Rosedale | 0.0 | 0.0 |
| 28 | Roselawn | 0.0 | 0.0 |
| 29 | Runnymede, Swansea | 0.0 | 0.0 |
| 30 | Ryerson, Garden District | 0.0 | 0.0 |
| 31 | St. James Town | 0.0 | 0.0 |
| 32 | Stn A PO Boxes 25 The Esplanade | 0.0 | 0.0 |
| 33 | Studio District | 0.0 | 0.0 |
| 34 | The Annex, North Midtown, Yorkville | 0.0 | 0.0 |
| 35 | The Beaches | 0.0 | 0.0 |
| 36 | The Beaches West, India Bazaar | 0.0 | 0.0 |
| 37 | The Danforth West, Riverdale | 0.1 | 0.0 |

| | Airport Food Court | Airport Gate | Airport Lounge | Airport Service \ |
|----|--------------------|--------------|----------------|-------------------|
| 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 | 0.1 | 0.1 | 0.2 | 0.1 |
| 5 | 0.0 | 0.0 | 0.0 | 0.0 |
| 6 | 0.0 | 0.0 | 0.0 | 0.0 |
| 7 | 0.0 | 0.0 | 0.0 | 0.0 |
| 8 | 0.0 | 0.0 | 0.0 | 0.0 |
| 9 | 0.0 | 0.0 | 0.0 | 0.0 |
| 10 | 0.0 | 0.0 | 0.0 | 0.0 |
| 11 | 0.0 | 0.0 | 0.0 | 0.0 |
| 12 | 0.0 | 0.0 | 0.0 | 0.0 |
| 13 | 0.0 | 0.0 | 0.0 | 0.0 |
| 14 | 0.0 | 0.0 | 0.0 | 0.0 |
| 15 | 0.0 | 0.0 | 0.0 | 0.0 |
| 16 | 0.0 | 0.0 | 0.0 | 0.0 |
| 17 | 0.0 | 0.0 | 0.0 | 0.0 |
| 18 | 0.0 | 0.0 | 0.0 | 0.0 |
| 19 | 0.0 | 0.0 | 0.0 | 0.0 |
| 20 | 0.0 | 0.0 | 0.0 | 0.0 |
| 21 | 0.0 | 0.0 | 0.0 | 0.0 |
| 22 | 0.0 | 0.0 | 0.0 | 0.0 |
| 23 | 0.0 | 0.0 | 0.0 | 0.0 |
| 24 | 0.0 | 0.0 | 0.0 | 0.0 |
| 25 | 0.0 | 0.0 | 0.0 | 0.0 |
| 26 | 0.0 | 0.0 | 0.0 | 0.0 |
| 27 | 0.0 | 0.0 | 0.0 | 0.0 |
| 28 | 0.0 | 0.0 | 0.0 | 0.0 |
| 29 | 0.0 | 0.0 | 0.0 | 0.0 |
| 30 | 0.0 | 0.0 | 0.0 | 0.0 |
| 31 | 0.0 | 0.0 | 0.0 | 0.0 |
| 32 | 0.0 | 0.0 | 0.0 | 0.0 |
| 33 | 0.0 | 0.0 | 0.0 | 0.0 |
| 34 | 0.0 | 0.0 | 0.0 | 0.0 |

| | | | | |
|----|-----|-----|-----|-----|
| 35 | 0.0 | 0.0 | 0.0 | 0.0 |
| 36 | 0.0 | 0.0 | 0.0 | 0.0 |
| 37 | 0.0 | 0.0 | 0.0 | 0.0 |

| | Airport Terminal | American Restaurant | Art Gallery | ... | Supermarket | \ |
|----|------------------|---------------------|-------------|-----|-------------|---|
| 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 | 0.2 | 0.0 | 0.0 | ... | 0.0 | |
| 5 | 0.0 | 0.0 | 0.0 | ... | 0.0 | |
| 6 | 0.0 | 0.0 | 0.0 | ... | 0.0 | |
| 7 | 0.0 | 0.0 | 0.0 | ... | 0.0 | |
| 8 | 0.0 | 0.0 | 0.0 | ... | 0.0 | |
| 9 | 0.0 | 0.0 | 0.0 | ... | 0.0 | |
| 10 | 0.0 | 0.0 | 0.0 | ... | 0.0 | |
| 11 | 0.0 | 0.0 | 0.0 | ... | 0.0 | |
| 12 | 0.0 | 0.0 | 0.0 | ... | 0.0 | |
| 13 | 0.0 | 0.1 | 0.0 | ... | 0.1 | |
| 14 | 0.0 | 0.0 | 0.1 | ... | 0.0 | |
| 15 | 0.0 | 0.0 | 0.0 | ... | 0.1 | |
| 16 | 0.0 | 0.1 | 0.1 | ... | 0.0 | |
| 17 | 0.0 | 0.0 | 0.0 | ... | 0.0 | |
| 18 | 0.0 | 0.0 | 0.0 | ... | 0.0 | |
| 19 | 0.0 | 0.0 | 0.0 | ... | 0.1 | |
| 20 | 0.0 | 0.0 | 0.0 | ... | 0.0 | |
| 21 | 0.0 | 0.0 | 0.0 | ... | 0.0 | |
| 22 | 0.0 | 0.0 | 0.0 | ... | 0.0 | |
| 23 | 0.0 | 0.0 | 0.0 | ... | 0.0 | |
| 24 | 0.0 | 0.0 | 0.0 | ... | 0.0 | |
| 25 | 0.0 | 0.0 | 0.0 | ... | 0.0 | |
| 26 | 0.0 | 0.0 | 0.0 | ... | 0.0 | |
| 27 | 0.0 | 0.0 | 0.0 | ... | 0.0 | |
| 28 | 0.0 | 0.0 | 0.0 | ... | 0.0 | |
| 29 | 0.0 | 0.0 | 0.0 | ... | 0.0 | |
| 30 | 0.0 | 0.0 | 0.0 | ... | 0.0 | |
| 31 | 0.0 | 0.0 | 0.0 | ... | 0.0 | |
| 32 | 0.0 | 0.0 | 0.0 | ... | 0.0 | |
| 33 | 0.0 | 0.0 | 0.0 | ... | 0.0 | |
| 34 | 0.0 | 0.1 | 0.0 | ... | 0.0 | |
| 35 | 0.0 | 0.0 | 0.0 | ... | 0.0 | |
| 36 | 0.0 | 0.0 | 0.0 | ... | 0.0 | |
| 37 | 0.0 | 0.0 | 0.0 | ... | 0.0 | |

| | Sushi Restaurant | Swim School | Tea Room | Thai Restaurant | Theater | \ |
|---|------------------|-------------|----------|-----------------|---------|---|
| 0 | 0.0 | 0.000000 | 0.0 | 0.0 | 0.0 | |
| 1 | 0.0 | 0.000000 | 0.0 | 0.1 | 0.0 | |
| 2 | 0.0 | 0.000000 | 0.0 | 0.0 | 0.0 | |

| | | | | | |
|----|-----|----------|-----|-----|-----|
| 3 | 0.0 | 0.000000 | 0.0 | 0.0 | 0.0 |
| 4 | 0.0 | 0.000000 | 0.0 | 0.0 | 0.0 |
| 5 | 0.0 | 0.000000 | 0.0 | 0.0 | 0.0 |
| 6 | 0.1 | 0.000000 | 0.0 | 0.0 | 0.0 |
| 7 | 0.0 | 0.000000 | 0.0 | 0.0 | 0.0 |
| 8 | 0.0 | 0.000000 | 0.0 | 0.0 | 0.0 |
| 9 | 0.0 | 0.000000 | 0.1 | 0.0 | 0.0 |
| 10 | 0.0 | 0.000000 | 0.0 | 0.0 | 0.0 |
| 11 | 0.1 | 0.000000 | 0.0 | 0.0 | 0.0 |
| 12 | 0.0 | 0.000000 | 0.0 | 0.0 | 0.0 |
| 13 | 0.1 | 0.000000 | 0.0 | 0.0 | 0.0 |
| 14 | 0.0 | 0.000000 | 0.0 | 0.0 | 0.0 |
| 15 | 0.0 | 0.000000 | 0.0 | 0.0 | 0.0 |
| 16 | 0.0 | 0.000000 | 0.0 | 0.0 | 0.0 |
| 17 | 0.2 | 0.000000 | 0.0 | 0.0 | 0.0 |
| 18 | 0.0 | 0.000000 | 0.0 | 0.0 | 0.0 |
| 19 | 0.0 | 0.000000 | 0.0 | 0.0 | 0.0 |
| 20 | 0.0 | 0.000000 | 0.0 | 0.0 | 0.0 |
| 21 | 0.0 | 0.000000 | 0.0 | 0.0 | 0.0 |
| 22 | 0.0 | 0.333333 | 0.0 | 0.0 | 0.0 |
| 23 | 0.0 | 0.000000 | 0.0 | 0.0 | 0.0 |
| 24 | 0.0 | 0.000000 | 0.0 | 0.0 | 0.0 |
| 25 | 0.0 | 0.000000 | 0.0 | 0.0 | 0.0 |
| 26 | 0.0 | 0.000000 | 0.0 | 0.0 | 0.0 |
| 27 | 0.0 | 0.000000 | 0.0 | 0.0 | 0.0 |
| 28 | 0.0 | 0.000000 | 0.0 | 0.0 | 0.0 |
| 29 | 0.2 | 0.000000 | 0.1 | 0.0 | 0.0 |
| 30 | 0.0 | 0.000000 | 0.0 | 0.1 | 0.1 |
| 31 | 0.0 | 0.000000 | 0.0 | 0.0 | 0.0 |
| 32 | 0.0 | 0.000000 | 0.1 | 0.1 | 0.0 |
| 33 | 0.0 | 0.000000 | 0.0 | 0.0 | 0.0 |
| 34 | 0.0 | 0.000000 | 0.0 | 0.0 | 0.0 |
| 35 | 0.0 | 0.000000 | 0.0 | 0.0 | 0.0 |
| 36 | 0.0 | 0.000000 | 0.0 | 0.0 | 0.0 |
| 37 | 0.0 | 0.000000 | 0.0 | 0.0 | 0.0 |

| | Theme Restaurant | Trail | Vegetarian / Vegan Restaurant \ |
|----|------------------|-------|---------------------------------|
| 0 | 0.0 | 0.00 | 0.1 |
| 1 | 0.0 | 0.00 | 0.1 |
| 2 | 0.0 | 0.00 | 0.0 |
| 3 | 0.0 | 0.00 | 0.0 |
| 4 | 0.0 | 0.00 | 0.0 |
| 5 | 0.0 | 0.00 | 0.0 |
| 6 | 0.0 | 0.00 | 0.0 |
| 7 | 0.0 | 0.00 | 0.0 |
| 8 | 0.0 | 0.00 | 0.0 |
| 9 | 0.1 | 0.00 | 0.0 |
| 10 | 0.0 | 0.00 | 0.0 |

| | | | |
|----|-----|------|-----|
| 11 | 0.0 | 0.00 | 0.0 |
| 12 | 0.0 | 0.00 | 0.0 |
| 13 | 0.0 | 0.00 | 0.0 |
| 14 | 0.0 | 0.00 | 0.0 |
| 15 | 0.0 | 0.00 | 0.0 |
| 16 | 0.0 | 0.00 | 0.0 |
| 17 | 0.0 | 0.20 | 0.0 |
| 18 | 0.0 | 0.00 | 0.0 |
| 19 | 0.0 | 0.00 | 0.0 |
| 20 | 0.0 | 0.00 | 0.0 |
| 21 | 0.0 | 0.00 | 0.0 |
| 22 | 0.0 | 0.00 | 0.0 |
| 23 | 0.0 | 0.00 | 0.0 |
| 24 | 0.0 | 0.00 | 0.0 |
| 25 | 0.0 | 0.00 | 0.0 |
| 26 | 0.0 | 0.00 | 0.0 |
| 27 | 0.0 | 0.25 | 0.0 |
| 28 | 0.0 | 0.00 | 0.0 |
| 29 | 0.0 | 0.00 | 0.0 |
| 30 | 0.0 | 0.00 | 0.0 |
| 31 | 0.0 | 0.00 | 0.0 |
| 32 | 0.0 | 0.00 | 0.1 |
| 33 | 0.0 | 0.00 | 0.0 |
| 34 | 0.0 | 0.00 | 0.1 |
| 35 | 0.0 | 0.00 | 0.0 |
| 36 | 0.0 | 0.00 | 0.0 |
| 37 | 0.0 | 0.00 | 0.0 |

Vietnamese Restaurant

| | |
|----|-----|
| 0 | 0.0 |
| 1 | 0.0 |
| 2 | 0.0 |
| 3 | 0.0 |
| 4 | 0.0 |
| 5 | 0.0 |
| 6 | 0.0 |
| 7 | 0.1 |
| 8 | 0.0 |
| 9 | 0.0 |
| 10 | 0.0 |
| 11 | 0.0 |
| 12 | 0.0 |
| 13 | 0.0 |
| 14 | 0.0 |
| 15 | 0.0 |
| 16 | 0.0 |
| 17 | 0.0 |
| 18 | 0.0 |

```

19          0.0
20          0.0
21          0.0
22          0.0
23          0.1
24          0.0
25          0.0
26          0.0
27          0.0
28          0.0
29          0.0
30          0.0
31          0.0
32          0.0
33          0.0
34          0.0
35          0.0
36          0.0
37          0.0

```

```
[38 rows x 116 columns]
```

```
In [67]: Toronto_grouped.shape
```

```
Out[67]: (38, 116)
```

0.0.14 Print each neighborhood along with the top 5 most common venues

```
In [68]: num_top_venues = 5
```

```

for hood in Toronto_grouped['Neighborhood']:
    print("----"+hood+"----")
    temp = Toronto_grouped[Toronto_grouped['Neighborhood'] == hood].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')

```

```
----Adelaide,King,Richmond----
```

| | venue | freq |
|---|-------------------------------|------|
| 0 | Steakhouse | 0.2 |
| 1 | Vegetarian / Vegan Restaurant | 0.1 |
| 2 | Greek Restaurant | 0.1 |
| 3 | Concert Hall | 0.1 |
| 4 | Coffee Shop | 0.1 |

----Berczy Park----

| | venue | freq |
|---|-----------------|------|
| 0 | Cocktail Bar | 0.1 |
| 1 | Thai Restaurant | 0.1 |
| 2 | Liquor Store | 0.1 |
| 3 | Steakhouse | 0.1 |
| 4 | Farmers Market | 0.1 |

----Brockton,Exhibition Place,Parkdale Village----

| | venue | freq |
|---|----------------------|------|
| 0 | Coffee Shop | 0.2 |
| 1 | Bar | 0.1 |
| 2 | Italian Restaurant | 0.1 |
| 3 | Caribbean Restaurant | 0.1 |
| 4 | Café | 0.1 |

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

| | venue | freq |
|---|----------------------|------|
| 0 | Garden Center | 0.1 |
| 1 | Auto Workshop | 0.1 |
| 2 | Fast Food Restaurant | 0.1 |
| 3 | Farmers Market | 0.1 |
| 4 | Comic Shop | 0.1 |

----CN Tower,Bathurst Quay,Island airport,Harbourfront West,King and Spadina,Railway Lands,South

| | venue | freq |
|---|------------------|------|
| 0 | Airport Terminal | 0.2 |
| 1 | Airport Lounge | 0.2 |
| 2 | Harbor / Marina | 0.1 |
| 3 | Airport Service | 0.1 |
| 4 | Airport | 0.1 |

----Cabbagetown,St. James Town----

| | venue | freq |
|---|---------------------|------|
| 0 | Café | 0.2 |
| 1 | Japanese Restaurant | 0.1 |
| 2 | Diner | 0.1 |
| 3 | Bakery | 0.1 |
| 4 | Italian Restaurant | 0.1 |

----Central Bay Street----

| | venue | freq |
|---|-------------|------|
| 0 | Coffee Shop | 0.4 |

| | | |
|---|----------------------------|-----|
| 1 | Sushi Restaurant | 0.1 |
| 2 | Gastropub | 0.1 |
| 3 | Pizza Place | 0.1 |
| 4 | Modern European Restaurant | 0.1 |

----Chinatown,Grange Park,Kensington Market----

| | venue | freq |
|---|-----------------------|------|
| 0 | Café | 0.3 |
| 1 | Vietnamese Restaurant | 0.1 |
| 2 | Arts & Crafts Store | 0.1 |
| 3 | Organic Grocery | 0.1 |
| 4 | Mexican Restaurant | 0.1 |

----Christie----

| | venue | freq |
|---|--------------------|------|
| 0 | Café | 0.3 |
| 1 | Grocery Store | 0.2 |
| 2 | Coffee Shop | 0.1 |
| 3 | Baby Store | 0.1 |
| 4 | Italian Restaurant | 0.1 |

----Church and Wellesley----

| | venue | freq |
|---|--------------------|------|
| 0 | Dance Studio | 0.1 |
| 1 | Tea Room | 0.1 |
| 2 | Breakfast Spot | 0.1 |
| 3 | Bubble Tea Shop | 0.1 |
| 4 | Salon / Barbershop | 0.1 |

----Commerce Court,Victoria Hotel----

| | venue | freq |
|---|----------------------|------|
| 0 | Café | 0.2 |
| 1 | Gastropub | 0.1 |
| 2 | Gym / Fitness Center | 0.1 |
| 3 | Bakery | 0.1 |
| 4 | Restaurant | 0.1 |

----Davisville----

| | venue | freq |
|---|--------------------|------|
| 0 | Dessert Shop | 0.2 |
| 1 | Park | 0.1 |
| 2 | Seafood Restaurant | 0.1 |
| 3 | Coffee Shop | 0.1 |

4 Italian Restaurant 0.1

----Davisville North----

| | venue | freq |
|---|-------------------|------|
| 0 | Clothing Store | 0.11 |
| 1 | Food & Drink Shop | 0.11 |
| 2 | Burger Joint | 0.11 |
| 3 | Dance Studio | 0.11 |
| 4 | Breakfast Spot | 0.11 |

----Deer Park,Forest Hill SE,Rathnelly,South Hill,Summerhill West----

| | venue | freq |
|---|---------------------|------|
| 0 | Pub | 0.2 |
| 1 | Coffee Shop | 0.2 |
| 2 | Convenience Store | 0.1 |
| 3 | Fried Chicken Joint | 0.1 |
| 4 | American Restaurant | 0.1 |

----Design Exchange,Toronto Dominion Centre----

| | venue | freq |
|---|-------------|------|
| 0 | Café | 0.2 |
| 1 | Gastropub | 0.1 |
| 2 | Art Gallery | 0.1 |
| 3 | Pub | 0.1 |
| 4 | Restaurant | 0.1 |

----Dovercourt Village,Dufferin----

| | venue | freq |
|---|---------------------------|------|
| 0 | Bakery | 0.2 |
| 1 | Bar | 0.1 |
| 2 | Middle Eastern Restaurant | 0.1 |
| 3 | Brewery | 0.1 |
| 4 | Bank | 0.1 |

----First Canadian Place,Underground city----

| | venue | freq |
|---|----------------------|------|
| 0 | Café | 0.2 |
| 1 | Steakhouse | 0.1 |
| 2 | Gastropub | 0.1 |
| 3 | Gym | 0.1 |
| 4 | Gym / Fitness Center | 0.1 |

----Forest Hill North,Forest Hill West----

| | venue | freq |
|---|------------------|------|
| 0 | Trail | 0.2 |
| 1 | Bus Line | 0.2 |
| 2 | Sushi Restaurant | 0.2 |
| 3 | Jewelry Store | 0.2 |
| 4 | Park | 0.2 |

----Harbord,University of Toronto----

| | venue | freq |
|---|-------------------|------|
| 0 | Bar | 0.1 |
| 1 | French Restaurant | 0.1 |
| 2 | Bookstore | 0.1 |
| 3 | Beer Bar | 0.1 |
| 4 | College Gym | 0.1 |

----Harbourfront East,Toronto Islands,Union Station----

| | venue | freq |
|---|---------------------|------|
| 0 | Park | 0.1 |
| 1 | Supermarket | 0.1 |
| 2 | Bakery | 0.1 |
| 3 | Sporting Goods Shop | 0.1 |
| 4 | Hotel | 0.1 |

----Harbourfront,Regent Park----

| | venue | freq |
|---|----------------|------|
| 0 | Breakfast Spot | 0.2 |
| 1 | Spa | 0.1 |
| 2 | Historic Site | 0.1 |
| 3 | Pub | 0.1 |
| 4 | Restaurant | 0.1 |

----High Park,The Junction South----

| | venue | freq |
|---|--------------------|------|
| 0 | Speakeasy | 0.1 |
| 1 | Mexican Restaurant | 0.1 |
| 2 | Bar | 0.1 |
| 3 | Park | 0.1 |
| 4 | Flea Market | 0.1 |

----Lawrence Park----

| | venue | freq |
|---|-------|------|
| 0 | Park | 0.33 |

| | | |
|---|---------------------|------|
| 1 | Bus Line | 0.33 |
| 2 | Swim School | 0.33 |
| 3 | Japanese Restaurant | 0.00 |
| 4 | Organic Grocery | 0.00 |

----Little Portugal,Trinity----

| | venue | freq |
|---|-----------------------|------|
| 0 | Bar | 0.2 |
| 1 | Vietnamese Restaurant | 0.1 |
| 2 | Asian Restaurant | 0.1 |
| 3 | Ice Cream Shop | 0.1 |
| 4 | Korean Restaurant | 0.1 |

----Moore Park,Summerhill East----

| | venue | freq |
|---|---------------------|------|
| 0 | Park | 0.33 |
| 1 | Playground | 0.33 |
| 2 | Gym | 0.33 |
| 3 | Japanese Restaurant | 0.00 |
| 4 | Organic Grocery | 0.00 |

----North Toronto West----

| | venue | freq |
|---|---------------------|------|
| 0 | Yoga Studio | 0.1 |
| 1 | Sporting Goods Shop | 0.1 |
| 2 | Chinese Restaurant | 0.1 |
| 3 | Mexican Restaurant | 0.1 |
| 4 | Dessert Shop | 0.1 |

----Parkdale,Roncesvalles----

| | venue | freq |
|---|-----------------------------|------|
| 0 | Gift Shop | 0.1 |
| 1 | Cuban Restaurant | 0.1 |
| 2 | Coffee Shop | 0.1 |
| 3 | Eastern European Restaurant | 0.1 |
| 4 | Dog Run | 0.1 |

----Rosedale----

| | venue | freq |
|---|-------------|------|
| 0 | Park | 0.50 |
| 1 | Trail | 0.25 |
| 2 | Playground | 0.25 |
| 3 | Yoga Studio | 0.00 |

4 Japanese Restaurant 0.00

----Roselawn----

| | venue | freq |
|---|---------------------|------|
| 0 | Garden | 0.33 |
| 1 | Music Venue | 0.33 |
| 2 | Home Service | 0.33 |
| 3 | Yoga Studio | 0.00 |
| 4 | Japanese Restaurant | 0.00 |

----Runnymede, Swansea----

| | venue | freq |
|---|-------------------|------|
| 0 | Sushi Restaurant | 0.2 |
| 1 | Tea Room | 0.1 |
| 2 | Fish & Chips Shop | 0.1 |
| 3 | Food | 0.1 |
| 4 | Burrito Place | 0.1 |

----Ryerson, Garden District----

| | venue | freq |
|---|------------------|------|
| 0 | Clothing Store | 0.1 |
| 1 | Plaza | 0.1 |
| 2 | Comic Shop | 0.1 |
| 3 | Diner | 0.1 |
| 4 | Ramen Restaurant | 0.1 |

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

| | venue | freq |
|---|---------------------|------|
| 0 | Japanese Restaurant | 0.1 |
| 1 | Food Truck | 0.1 |
| 2 | Cosmetics Shop | 0.1 |
| 3 | Creperie | 0.1 |
| 4 | Restaurant | 0.1 |

----Stn A P0 Boxes 25 The Esplanade----

| | venue | freq |
|---|-----------------|------|
| 0 | Park | 0.1 |
| 1 | Thai Restaurant | 0.1 |
| 2 | Beer Bar | 0.1 |
| 3 | Steakhouse | 0.1 |
| 4 | Museum | 0.1 |

----Studio District----

| | venue | freq |
|---|--------------------|------|
| 0 | Coffee Shop | 0.2 |
| 1 | Sandwich Place | 0.1 |
| 2 | Chinese Restaurant | 0.1 |
| 3 | Cheese Shop | 0.1 |
| 4 | Café | 0.1 |

----The Annex,North Midtown,Yorkville----

| | venue | freq |
|---|---------------------|------|
| 0 | Café | 0.2 |
| 1 | American Restaurant | 0.1 |
| 2 | Indian Restaurant | 0.1 |
| 3 | Burger Joint | 0.1 |
| 4 | BBQ Joint | 0.1 |

----The Beaches----

| | venue | freq |
|---|---------------------|------|
| 0 | Coffee Shop | 0.25 |
| 1 | Pub | 0.25 |
| 2 | Health Food Store | 0.25 |
| 3 | Yoga Studio | 0.00 |
| 4 | Japanese Restaurant | 0.00 |

----The Beaches West,India Bazaar----

| | venue | freq |
|---|--------------------|------|
| 0 | Italian Restaurant | 0.1 |
| 1 | Steakhouse | 0.1 |
| 2 | Liquor Store | 0.1 |
| 3 | Park | 0.1 |
| 4 | Brewery | 0.1 |

----The Danforth West,Riverdale----

| | venue | freq |
|---|--------------------|------|
| 0 | Greek Restaurant | 0.4 |
| 1 | Italian Restaurant | 0.2 |
| 2 | Yoga Studio | 0.1 |
| 3 | Cosmetics Shop | 0.1 |
| 4 | Brewery | 0.1 |

0.0.15 Define a function

```
In [69]: 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]
```

0.0.16 Create the new dataframe and display the top 10 venues for each neighborhood.

```
In [70]: 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()
```

```
Out[70]:
```

| | Neighborhood | 1st Most Common Venue | \ |
|---|---|-----------------------|-------------------------------|
| 0 | Adelaide,King,Richmond | Steakhouse | |
| 1 | Berczy Park | French Restaurant | |
| 2 | Brockton,Exhibition Place,Parkdale Village | Coffee Shop | |
| 3 | Business Reply Mail Processing Centre 969 Eastern | Garden Center | |
| 4 | CN Tower,Bathurst Quay,Island airport,Harbourf... | Airport Lounge | |
| | 2nd Most Common Venue | 3rd Most Common Venue | 4th Most Common Venue \ |
| 0 | Concert Hall | Greek Restaurant | Speakeasy |
| 1 | Farmers Market | Beer Bar | Vegetarian / Vegan Restaurant |
| 2 | Caribbean Restaurant | Bar | Furniture / Home Store |
| 3 | Fast Food Restaurant | Burrito Place | Pizza Place |
| 4 | Airport Terminal | Airport | Airport Food Court |
| | 5th Most Common Venue | 6th Most Common Venue | 7th Most Common Venue \ |
| 0 | Asian Restaurant | Plaza | Hotel |
| 1 | Cocktail Bar | Thai Restaurant | Museum |
| 2 | Café | Pet Store | Gym |

| | | | |
|---|--------------|-----------------|------------|
| 3 | Comic Shop | Brewery | Restaurant |
| 4 | Airport Gate | Airport Service | Boutique |

| | 8th Most Common Venue | 9th Most Common Venue | 10th Most Common Venue |
|---|-----------------------|-------------------------------|------------------------|
| 0 | Coffee Shop | Vegetarian / Vegan Restaurant | College Gym |
| 1 | Liquor Store | Steakhouse | Concert Hall |
| 2 | Breakfast Spot | Italian Restaurant | College Gym |
| 3 | Auto Workshop | Farmers Market | Skate Park |
| 4 | Harbor / Marina | Vietnamese Restaurant | Cuban Restaurant |

0.0.17 Cluster Neighbourhoods

```
In [71]: #Run k-means to cluster the neighborhood into 5 clusters.
# 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]
```

```
Out[71]: array([0, 0, 0, 0, 0, 2, 3, 2, 2, 0], dtype=int32)
```

```
In [72]: # Create a new dataframe that includes the cluster as well as the top 10 venues for each
#add clustering labels
neighborhoods_venues_sorted.insert(0, 'Cluster Labels', kmeans.labels_)
```

```
In [73]: 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', 1))
```

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

```
Out[73]:
```

| | Postcode | Borough | Neighbourhood | Latitude | Longitude | \ |
|---|----------|------------------|---------------------------|-----------|------------|---|
| 0 | M5A | Downtown Toronto | Harbourfront, Regent Park | 43.654260 | -79.360636 | |
| 1 | M5B | Downtown Toronto | Ryerson, Garden District | 43.657162 | -79.378937 | |
| 2 | M5C | Downtown Toronto | St. James Town | 43.651494 | -79.375418 | |
| 3 | M4E | East Toronto | The Beaches | 43.676357 | -79.293031 | |
| 4 | M5E | Downtown Toronto | Berczy Park | 43.644771 | -79.373306 | |

| | Cluster Labels | 1st Most Common Venue | 2nd Most Common Venue | \ |
|---|----------------|-----------------------|-----------------------|---|
| 0 | 0 | Breakfast Spot | Gym / Fitness Center | |
| 1 | 0 | Burrito Place | Diner | |
| 2 | 0 | Creperie | Cosmetics Shop | |
| 3 | 3 | Coffee Shop | Pub | |

| | | | |
|---|---|-------------------|----------------|
| 4 | 0 | French Restaurant | Farmers Market |
|---|---|-------------------|----------------|

| | | | |
|---|-----------------------|-------------------------------|-------------------------|
| | 3rd Most Common Venue | 4th Most Common Venue | 5th Most Common Venue \ |
| 0 | Restaurant | Spa | Historic Site |
| 1 | Clothing Store | Pizza Place | Plaza |
| 2 | Food Truck | Italian Restaurant | Gastropub |
| 3 | Health Food Store | Vietnamese Restaurant | Dessert Shop |
| 4 | Beer Bar | Vegetarian / Vegan Restaurant | Cocktail Bar |

| | | | |
|---|-----------------------|---------------------------|-------------------------|
| | 6th Most Common Venue | 7th Most Common Venue | 8th Most Common Venue \ |
| 0 | Pub | Bakery | Coffee Shop |
| 1 | Comic Shop | Ramen Restaurant | Café |
| 2 | Coffee Shop | Middle Eastern Restaurant | Japanese Restaurant |
| 3 | Clothing Store | Cocktail Bar | College Gym |
| 4 | Thai Restaurant | Museum | Liquor Store |

| | | |
|---|-----------------------|------------------------|
| | 9th Most Common Venue | 10th Most Common Venue |
| 0 | Park | Comic Shop |
| 1 | Theater | Thai Restaurant |
| 2 | BBQ Joint | Restaurant |
| 3 | Comic Shop | Concert Hall |
| 4 | Steakhouse | Concert Hall |

```
In [74]: #Visualize the resulting clusters
# create map
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'],
    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

Out[74]: <folium.folium.Map at 0x7f8ff1a6b5f8>
```

```
In [ ]:
```

```
In [ ]:
```

```
In [ ]:
```

```
In [ ]:
```