Capstone proj-IBM Toronto_Neighborhoods

July 8, 2020

0.1 Opening a high end steakhouse restaurant in

1 Moore park, Central Toronto

Toronto is the capital of the province of Ontario and it is a major Canadian city and it is located right next to Lake Ontario's. It's a very dynamic metropolitan area with a population of 2.7 million as of 2016. Toronto is an urban city with diverse population and it is an important destination for immigrants to Canada as well. More than 50 percent of residents belong to minority population group which are pretty much are spread out across the city. Toronto has over 200 distinct ethnic origins and while the majority of the population in the city speak English as their primary language, over 160 languages are spoken in the city. The city has 10 boroughs and about 103 neighborhoods.

```
In [196]: toronto_df.head(10)
```

```
Out[196]:
```

	Borough	Neighborhood	Latitude	Longitude
0	North York	Parkwoods	43.753259	-79.329656
1	North York	Victoria Village	43.725882	-79.315572
2	Downtown Toronto	Regent Park, Harbourfront	43.654260	-79.360636
3	North York	Lawrence Manor, Lawrence Heights	43.718518	-79.464763
4	Downtown Toronto	Queen's Park, Ontario Provincial Government	43.662301	-79.389494
5	Etobicoke	Islington Avenue, Humber Valley Village	43.667856	-79.532242
6	Scarborough	Malvern, Rouge	43.806686	-79.194353
7	North York	Don Mills	43.745906	-79.352188
8	East York	Parkview Hill, Woodbine Gardens	43.706397	-79.309937
9	Downtown Toronto	Garden District, Ryerson	43.657162	-79.378937

```
In [197]: map_toronto
```

```
Out[197]: <folium.folium.Map at 0x2af5ab7c6a0>
```

1.0.1 Business problem and Methodology

Finding the right location is a very important factor to open a restaurant. Since in this project I am targeting Toronto City I need to analyze a borough that suits best for to open a high-end steakhouse restaurant. This type of restaurant can be close to city center or suburb but in observation it is best open this type of restaurant close to shopping center, mall or city center. Since it would be a high-end restaurant it must be located in high income class neighborhood. Moore park in Central Toronto seems to be more appropriate neighborhood for this type restaurant.

```
In [198]: Central_Toronto
```

```
Out[198]:            Borough                                       Neighborhood  \
          0  Central Toronto                                     Lawrence Park
          1  Central Toronto                                          Roselawn
          2  Central Toronto                                  Davisville North
          3  Central Toronto    Forest Hill North & West, Forest Hill Road Park
          4  Central Toronto                  North Toronto West, Lawrence Park
          5  Central Toronto                The Annex, North Midtown, Yorkville
          6  Central Toronto                                         Davisville
          7  Central Toronto                       Moore Park, Summerhill East
          8  Central Toronto  Summerhill West, Rathnelly, South Hill, Forest...

              Latitude  Longitude
          0  43.728020 -79.388790
          1  43.711695 -79.416936
          2  43.712751 -79.390197
          3  43.696948 -79.411307
          4  43.715383 -79.405678
          5  43.672710 -79.405678
          6  43.704324 -79.388790
          7  43.689574 -79.383160
          8  43.686412 -79.400049
```

```
In [199]: toronto_df1.head()
```

```
Out[199]:    index           Borough   Neighborhood  Population  Average_Income  \
          0     16   Central Toronto  Lawrence Park        6653        214110.0
          1     21  Downtown Toronto       Rosedale        7672        213941.0
          2      7         East York        Leaside       13876         82670.0
          3      5      East Toronto    The Beaches       20416         67536.0
          4     20   Central Toronto     Davisville       23727         55735.0

              Latitude  Longitude
          0  43.728020 -79.388790
          1  43.679563 -79.377529
```

```
2  43.709060 -79.363452
3  43.676357 -79.293031
4  43.704324 -79.388790
```

```
In [200]: map_Central_Toronto
```

```
Out[200]: <folium.folium.Map at 0x2af5b134278>
```

1.0.2 Exploring and cleaning data sets city of Toronto

On this project I am using three data sets, the Boroughs data, Latitude and Longitude, and population data. After combining the three data sets on unique value column now we can analyze the combined data and to find where could make more sense to open a high-end steak house.

1.0.3 Result and conclusion section

Based on analysis below we can see the frequency of restaurants in Moore Park in Toronto is about 0.25 and it is a neighborhood with high income household. Additionally, on the fifth cluster we can see that the restaurants are first most common venues in the area. Thus, there would be a decent competition in this neighborhood but quality and customer happiness will win always.

```
In [201]: num_top_venues = 5
```

```
for Neighborhood in Central_Toronto_grouped['Neighborhood']:
    print("----"+Neighborhood+"----")
    temp = Central_Toronto_grouped[Central_Toronto_grouped['Neighborhood'] == Neighbo
    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_t
    print('\n')
```

```
----Davisville----
                venue  freq
0        Dessert Shop  0.10
1         Coffee Shop  0.07
2  Italian Restaurant  0.07
3      Sandwich Place  0.07
4               Café  0.07


----Davisville North----
                  venue  freq
0                 Hotel  0.12
1  Gym / Fitness Center  0.12
2      Department Store  0.12
3     Food & Drink Shop  0.12
4           Pizza Place  0.12
```

```
----Forest Hill North & West, Forest Hill Road Park----
                 venue  freq
0        Jewelry Store  0.25
1                Trail  0.25
2   Mexican Restaurant  0.25
3     Sushi Restaurant  0.25
4  American Restaurant  0.00


----Lawrence Park----
                 venue  freq
0             Bus Line  0.33
1                 Park  0.33
2          Swim School  0.33
3  American Restaurant  0.00
4   Salon / Barbershop  0.00


----Moore Park, Summerhill East----
                 venue  freq
0           Restaurant  0.25
1                Trail  0.25
2         Tennis Court  0.25
3                 Park  0.25
4  American Restaurant  0.00


----North Toronto West, Lawrence Park----
                venue  freq
0      Clothing Store  0.11
1         Coffee Shop  0.11
2         Yoga Studio  0.05
3      Cosmetics Shop  0.05
4  Mexican Restaurant  0.05


----Roselawn----
                 venue  freq
0         Home Service  0.33
1               Garden  0.33
2                 Pool  0.33
3  American Restaurant  0.00
4    Indian Restaurant  0.00


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

```
                 venue  freq
0                  Pub  0.12
1          Coffee Shop  0.12
2  American Restaurant  0.06
3          Pizza Place  0.06
4           Bagel Shop  0.06


----The Annex, North Midtown, Yorkville----
            venue  freq
0  Sandwich Place  0.14
1           Café  0.14
2     Coffee Shop  0.09
3  History Museum  0.05
4      Donut Shop  0.05
```

On the k-means cluster based anlysis we figured out that the fifth cluster of the Central which Moor Park has restuarant as most common venue and thus it the very favorable location to open our steak house house restuarant.

```
In [203]: # Fifth cluster

          Central_Toronto_merged.loc[Central_Toronto_merged['Cluster Labels'] == 4, Central_To
```

```
Out[203]:                   Neighborhood 1st Most Common Venue 2nd Most Common Venue  \
          7  Moore Park, Summerhill East            Restaurant                 Trail

            3rd Most Common Venue 4th Most Common Venue 5th Most Common Venue  \
          7                  Park          Tennis Court  Fast Food Restaurant

            6th Most Common Venue 7th Most Common Venue 8th Most Common Venue  \
          7          Dessert Shop                 Diner            Donut Shop

            9th Most Common Venue 10th Most Common Venue
          7        Farmers Market    Fried Chicken Joint
```

```
In [184]: # Loading all the necessary labraries

          import numpy as np

          import pandas as pd # library for data analsysis
          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 comp
from geopy.geocoders import Nominatim # convert an address into latitude and longitu

import requests # library to handle requests
from pandas.io.json import json_normalize # tranform JSON file into a pandas datafra

# 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

#!conda install -c conda-forge folium=0.5.0 --yes # uncomment this line if you haven
import folium # map rendering library

print('Libraries imported.')
```

```
Libraries imported.
```

In [185]:
```
# Uploading Boroughs with Postal Code

import numpy as np # library to handle data in a vectorized manner

import pandas as pd # library for data analsysis

import requests
from bs4 import BeautifulSoup

res = requests.get("https://en.wikipedia.org/wiki/List_of_postal_codes_of_Canada:_M")

soup = BeautifulSoup(res.content,'lxml')
table = soup.find_all('table')[0]
df = pd.read_html(str(table))

# Creating a dataframe object from listoftuples
df1 = pd.DataFrame(df[0])

df1.columns = df1.iloc[0]
df1 = df1[1:]
print("Shape of data", df1.shape,"\n")
df1.head(10)
```

```
Shape of data (180, 3)
```

Out[185]:

0	Postal Code	Borough	Neighborhood
1	M1A	Not assigned	Not assigned

```
2          M2A      Not assigned                                  Not assigned
3          M3A        North York                                     Parkwoods
4          M4A        North York                                Victoria Village
5          M5A  Downtown Toronto                   Regent Park, Harbourfront
6          M6A        North York             Lawrence Manor, Lawrence Heights
7          M7A  Downtown Toronto  Queen's Park, Ontario Provincial Government
8          M8A      Not assigned                                  Not assigned
9          M9A         Etobicoke      Islington Avenue, Humber Valley Village
10         M1B       Scarborough                                Malvern, Rouge
```

In [186]:
```
#Getting only assigned Boroughs from the data

df1 = df1[df1.Borough != 'Not assigned']

print("shape of the data after eliminating not assigned Boroughs", df1.shape,"\n")

df1.head(10)
```

```
shape of the data after eliminating not assigned Boroughs (103, 3)
```

Out[186]:
```
0  Postal Code           Borough                                  Neighborhood
3          M3A        North York                                     Parkwoods
4          M4A        North York                                Victoria Village
5          M5A  Downtown Toronto                   Regent Park, Harbourfront
6          M6A        North York             Lawrence Manor, Lawrence Heights
7          M7A  Downtown Toronto  Queen's Park, Ontario Provincial Government
9          M9A         Etobicoke      Islington Avenue, Humber Valley Village
10         M1B       Scarborough                                Malvern, Rouge
12         M3B        North York                                     Don Mills
13         M4B         East York             Parkview Hill, Woodbine Gardens
14         M5B  Downtown Toronto                   Garden District, Ryerson
```

In [187]:
```
#If a cell has a borough but a Not assigned neighborhood, then the neighborhood will

df1['Neighborhood'].loc[(df1['Neighborhood'] == 'Not assigned')] = df1['Borough']
df1.head()
```

Out[187]:
```
0 Postal Code           Borough                                  Neighborhood
3         M3A        North York                                     Parkwoods
4         M4A        North York                                Victoria Village
5         M5A  Downtown Toronto                   Regent Park, Harbourfront
6         M6A        North York             Lawrence Manor, Lawrence Heights
7         M7A  Downtown Toronto  Queen's Park, Ontario Provincial Government
```

In [188]:
```
#Getting the Latitute and Longitude for each postal code

import io
```

```
import requests
url_l = "https://cocl.us/Geospatial_data"
ll_df = requests.get(url_l).text
ll_df = pd.read_csv(io.StringIO(ll_df))
ll_df.head()
```

Out[188]:

	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 [195]:
```
# Combining Boroughs with Latitude and Longtitude data frames

toronto_df = pd.merge(df1,ll_df, on = "Postal Code")

toronto_df = toronto_df[['Borough','Neighborhood', 'Latitude','Longitude']]
toronto_df.head(10)
```

Out[195]:

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

In [194]:
```
# To open a high end steak house we to add Average income column and pick one of the

toronto_pop = pd.read_csv(r"C:\Users\T\Downloads\toronto_pop.csv",encoding= 'unicode_

toronto_pop =toronto_pop.rename(columns = {'Name':'Neighborhood','Average Income':'A


toronto_df1 = pd.merge(toronto_df,toronto_pop, on = "Neighborhood")
toronto_df1 = toronto_df1[['Borough','Neighborhood','Population','Average_Income','La
toronto_df1 = toronto_df1.sort_values(by = ['Average_Income' ], ascending=False, na_

toronto_df1.head()
```

Out[194]:

	index	Borough	Neighborhood	Population	Average_Income
0	16	Central Toronto	Lawrence Park	6653	214110.0

```
1     21  Downtown Toronto       Rosedale        7672        213941.0
2      7         East York        Leaside       13876         82670.0
3      5      East Toronto    The Beaches       20416         67536.0
4     20   Central Toronto     Davisville       23727         55735.0

    Latitude  Longitude
0  43.728020 -79.388790
1  43.679563 -79.377529
2  43.709060 -79.363452
3  43.676357 -79.293031
4  43.704324 -79.388790
```

In [191]:
```
print('The dataframe has {} boroughs and {} neighborhoods.'.format(
        len(toronto_df['Borough'].unique()),
        toronto_df.shape[0]
    )
)
```

```
The dataframe has 10 boroughs and 103 neighborhoods.
```

In [192]:
```
address = 'Toronto, Canada'

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

```
The geograpical coordinate of Toronto City are 43.6534817, -79.3839347.
```

In [193]:
```
# Creating map of Toronto using folium library

map_toronto = folium.Map(location=[latitude, longitude], zoom_start=10)

# add markers to map
for lat, lng, borough, neighborhood in zip(toronto_df['Latitude'], toronto_df['Longi
    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[193]: <folium.folium.Map at 0x2af5ab7c6a0>

In [168]:
```
# Exploring Central Toronto borough

b1 = 'Central Toronto'#'Central Toronto'

Central_Toronto = toronto_df[toronto_df['Borough'] == b1].reset_index(drop=True)
print(Central_Toronto.shape)
Central_Toronto
```

```
(9, 4)
```

Out[168]:

	Borough	Neighborhood	Latitude	Longitude
0	Central Toronto	Lawrence Park	43.728020	-79.388790
1	Central Toronto	Roselawn	43.711695	-79.416936
2	Central Toronto	Davisville North	43.712751	-79.390197
3	Central Toronto	Forest Hill North & West, Forest Hill Road Park	43.696948	-79.411307
4	Central Toronto	North Toronto West, Lawrence Park	43.715383	-79.405678
5	Central Toronto	The Annex, North Midtown, Yorkville	43.672710	-79.405678
6	Central Toronto	Davisville	43.704324	-79.388790
7	Central Toronto	Moore Park, Summerhill East	43.689574	-79.383160
8	Central Toronto	Summerhill West, Rathnelly, South Hill, Forest...	43.686412	-79.400049

In [129]:
```
address = b1+', Toronto, Canada'

geolocator = Nominatim(user_agent="Toronto_explorer")
location = geolocator.geocode(address)
latitude = location.latitude
longitude = location.longitude
print('The geograpical coordinate of {} are {}, {}.'.format(b1,latitude, longitude))
```

```
The geograpical coordinate of Central Toronto are 43.6534817, -79.3839347.
```

In [130]:
```
# create map of Central_Toronto using latitude and longitude values
map_Central_Toronto = folium.Map(location=[latitude, longitude], zoom_start=11)

# add markers to map
for lat, lng, label in zip(Central_Toronto['Latitude'], Central_Toronto['Longitude']
    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_Central_Toronto)

map_Central_Toronto
```

Out[130]:
```
<folium.folium.Map at 0x2af5b134278>
```

In [131]:
```
# Searching for steakhouse in the neighbothood within 1000 meter radios

search_query = 'Steakhouse'
radius = 1000
LIMIT = 30
print(search_query)
```

```
Steakhouse
```

In [132]:
```
# Credentials for Foursquare website

CLIENT_ID = 'ABRUHMRTPBLF4BTPZOHADD5SDSUGBUOSSS2SYSPSH2SYLYZU' # your Foursquare ID
CLIENT_SECRET = 'BVLKZZIDZUNVRVKUT5UZ3DJ13BV3OOPXOCARO1CREFTMI5CI' # your Foursquare
VERSION = '20180605' # Foursquare API version

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

```
Your credentails:
CLIENT_ID: ABRUHMRTPBLF4BTPZOHADD5SDSUGBUOSSS2SYSPSH2SYLYZU
CLIENT_SECRET:BVLKZZIDZUNVRVKUT5UZ3DJ13BV3OOPXOCARO1CREFTMI5CI
```

In [133]:
```
url = 'https://api.foursquare.com/v2/venues/explore?&client_id={}&client_secret={}&v
                    CLIENT_ID,
                    CLIENT_SECRET,
                    VERSION,
```

```
            lat,
            lng,
            radius,
            LIMIT)
        url
```

```
Out[133]: 'https://api.foursquare.com/v2/venues/explore?&client_id=ABRUHMRTPBLF4BTPZOHADD5SDSU
```

```
In [171]: results = requests.get(url).json()
          #results
```

```
In [135]: # 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 [136]: # Searching for near by venues


          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.lo
          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[136]:

	name	categories	lat	lng
0	The Market By Longos	Supermarket	43.686711	-79.399536
1	LCBO	Liquor Store	43.686991	-79.399238
2	The Bagel House	Bagel Shop	43.687374	-79.393696
3	Scaramouche	French Restaurant	43.681293	-79.399492
4	DAVIDsTEA	Tea Room	43.688421	-79.394385

In [180]:
```
def getNearbyVenues(names, latitudes, longitudes, radius=1000):

    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_sec
            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 venu
    nearby_venues.columns = ['Neighborhood',
                  'Neighborhood Latitude',
                  'Neighborhood Longitude',
                  'Venue',
                  'Venue Latitude',
                  'Venue Longitude',
                  'Venue Category']

    return(nearby_venues)
```

In [181]:
```
# Listing all the neighbothoods for Central Toronto

Central_Toronto_venues = getNearbyVenues(names=Central_Toronto['Neighborhood'],
                                         latitudes=Central_Toronto['Latitude'],
                                         longitudes=Central_Toronto['Longitude']
                                        )
```

```
Lawrence Park
Roselawn
```

```
Davisville North
Forest Hill North & West, Forest Hill Road Park
North Toronto West, Lawrence Park
The Annex, North Midtown, Yorkville
Davisville
Moore Park, Summerhill East
Summerhill West, Rathnelly, South Hill, Forest Hill SE, Deer Park
```

In [182]:
```
# list venues for each neighborhood for Central Toronto

print(Central_Toronto_venues.shape)
Central_Toronto_venues.head()
```

```
(238, 7)
```

Out[182]:

	Neighborhood	Neighborhood Latitude	Neighborhood Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
0	Lawrence Park	43.72802	-79.38879	Lawrence Park Ravine	43.726963	-79.394382	Park
1	Lawrence Park	43.72802	-79.38879	Granite Club	43.733043	-79.381986	Gym / Fitness Center
2	Lawrence Park	43.72802	-79.38879	Tim Hortons	43.727324	-79.379563	Coffee Shop
3	Lawrence Park	43.72802	-79.38879	Glendon Bookstore	43.727024	-79.378976	Bookstore
4	Lawrence Park	43.72802	-79.38879	Glendon Forest	43.727226	-79.378413	Trail

In [183]:
```
# Grouping the venues for each neighborhood

Central_Toronto_venues.groupby('Neighborhood').count()
```

Out[183]:

Neighborhood	Neighborhood Latitude	Neighborhood Longitude
Davisville	30	
Davisville North	30	
Forest Hill North & West, Forest Hill Road Park	30	
Lawrence Park	8	
Moore Park, Summerhill East	30	
North Toronto West, Lawrence Park	30	
Roselawn	20	
Summerhill West, Rathnelly, South Hill, Forest ...	30	
The Annex, North Midtown, Yorkville	30	

Neighborhood Longitude \

```
                                                    Neighborhood
                                                    Davisville                                                    30
                                                    Davisville North                                              30
                                                    Forest Hill North & West, Forest Hill Road Park               30
                                                    Lawrence Park                                                  8
                                                    Moore Park, Summerhill East                                   30
                                                    North Toronto West, Lawrence Park                             30
                                                    Roselawn                                                      20
                                                    Summerhill West, Rathnelly, South Hill, Forest ...            30
                                                    The Annex, North Midtown, Yorkville                           30

                                                                                                        Venue  Venue Latitude  \
                                                    Neighborhood
                                                    Davisville                                             30              30
                                                    Davisville North                                       30              30
                                                    Forest Hill North & West, Forest Hill Road Park        30              30
                                                    Lawrence Park                                           8               8
                                                    Moore Park, Summerhill East                            30              30
                                                    North Toronto West, Lawrence Park                      30              30
                                                    Roselawn                                               20              20
                                                    Summerhill West, Rathnelly, South Hill, Forest ...     30              30
                                                    The Annex, North Midtown, Yorkville                    30              30

                                                                                                        Venue Longitude  \
                                                    Neighborhood
                                                    Davisville                                                      30
                                                    Davisville North                                                30
                                                    Forest Hill North & West, Forest Hill Road Park                 30
                                                    Lawrence Park                                                   8
                                                    Moore Park, Summerhill East                                    30
                                                    North Toronto West, Lawrence Park                              30
                                                    Roselawn                                                       20
                                                    Summerhill West, Rathnelly, South Hill, Forest ...             30
                                                    The Annex, North Midtown, Yorkville                            30

                                                                                                        Venue Category
                                                    Neighborhood
                                                    Davisville                                                  30
                                                    Davisville North                                            30
                                                    Forest Hill North & West, Forest Hill Road Park             30
                                                    Lawrence Park                                                8
                                                    Moore Park, Summerhill East                                 30
                                                    North Toronto West, Lawrence Park                           30
                                                    Roselawn                                                    20
                                                    Summerhill West, Rathnelly, South Hill, Forest ...          30
                                                    The Annex, North Midtown, Yorkville                         30
```

```
In [149]: print('There are {} uniques categories.'.format(len(Central_Toronto_venues['Venue Ca
```

There are 62 uniques categories.

In [150]:
```
# one hot encoding
Central_Toronto_onehot = pd.get_dummies(Central_Toronto_venues[['Venue Category']], p

# add neighborhood column back to dataframe
Central_Toronto_onehot['Neighborhood'] = Central_Toronto_venues['Neighborhood']

# move neighborhood column to the first column


Central_Toronto_onehot = Central_Toronto_onehot.set_index('Neighborhood').reset_index
Central_Toronto_onehot.head(20)
```

Out[150]:

	Neighborhood	American Restaurant	BBQ Joint	Bagel Shop	Bank	Breakfast Spot	Brewery	Burger Joint
0	Lawrence Park	0	0	0	0	0	0	0
1	Lawrence Park	0	0	0	0	0	0	0
2	Lawrence Park	0	0	0	0	0	0	0
3	Roselawn	0	0	0	0	0	0	0
4	Roselawn	0	0	0	0	0	0	0
5	Roselawn	0	0	0	0	0	0	0
6	Davisville North	0	0	0	0	0	0	0
7	Davisville North	0	0	0	0	0	0	0
8	Davisville North	0	0	0	0	1	0	0
9	Davisville North	0	0	0	0	0	0	0
10	Davisville North	0						
11	Davisville North	0						
12	Davisville North	0						
13	Davisville North	0						
14	Forest Hill North & West, Forest Hill Road Park	0						
15	Forest Hill North & West, Forest Hill Road Park	0						
16	Forest Hill North & West, Forest Hill Road Park	0						
17	Forest Hill North & West, Forest Hill Road Park	0						
18	North Toronto West, Lawrence Park	0						
19	North Toronto West, Lawrence Park	0						

```
10          0           0     0                 0        0             0
11          0           0     0                 0        0             0
12          0           0     0                 0        0             0
13          0           0     0                 0        0             0
14          0           0     0                 0        0             0
15          0           0     0                 0        0             0
16          0           0     0                 0        0             0
17          0           0     0                 0        0             0
18          0           0     0                 0        0             0
19          0           0     0                 0        0             0

    Bus Line  Café  Cheese Shop  Chinese Restaurant  Clothing Store  \
0          0     0            0                   0               0
1          0     0            0                   0               0
2          1     0            0                   0               0
3          0     0            0                   0               0
4          0     0            0                   0               0
5          0     0            0                   0               0
6          0     0            0                   0               0
7          0     0            0                   0               0
8          0     0            0                   0               0
9          0     0            0                   0               0
10         0     0            0                   0               0
11         0     0            0                   0               0
12         0     0            0                   0               0
13         0     0            0                   0               0
14         0     0            0                   0               0
15         0     0            0                   0               0
16         0     0            0                   0               0
17         0     0            0                   0               0
18         0     0            0                   0               0
19         0     0            0                   0               0

    Coffee Shop  Convenience Store  Cosmetics Shop  Department Store  \
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
5             0                  0               0                 0
6             0                  0               0                 0
7             0                  0               0                 0
8             0                  0               0                 0
9             0                  0               0                 1
10            0                  0               0                 0
11            0                  0               0                 0
12            0                  0               0                 0
13            0                  0               0                 0
```

14	0	0	0	0
15	0	0	0	0
16	0	0	0	0
17	0	0	0	0
18	0	0	0	0
19	1	0	0	0

	Dessert Shop	Diner	Donut Shop	Farmers Market	Fast Food Restaurant	\
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	
5	0	0	0	0	0	
6	0	0	0	0	0	
7	0	0	0	0	0	
8	0	0	0	0	0	
9	0	0	0	0	0	
10	0	0	0	0	0	
11	0	0	0	0	0	
12	0	0	0	0	0	
13	0	0	0	0	0	
14	0	0	0	0	0	
15	0	0	0	0	0	
16	0	0	0	0	0	
17	0	0	0	0	0	
18	0	0	0	0	0	
19	0	0	0	0	0	

	Food & Drink Shop	Fried Chicken Joint	Garden	Gas Station	Gourmet Shop	\
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	1	0	0	
5	0	0	0	0	0	
6	0	0	0	0	0	
7	1	0	0	0	0	
8	0	0	0	0	0	
9	0	0	0	0	0	
10	0	0	0	0	0	
11	0	0	0	0	0	
12	0	0	0	0	0	
13	0	0	0	0	0	
14	0	0	0	0	0	
15	0	0	0	0	0	
16	0	0	0	0	0	
17	0	0	0	0	0	

```
18                  0                     0       0            0             0
19                  0                     0       0            0             0

    Greek Restaurant  Gym  Gym / Fitness Center  History Museum  Home Service  \
0                  0    0                     0               0             0
1                  0    0                     0               0             0
2                  0    0                     0               0             0
3                  0    0                     0               0             1
4                  0    0                     0               0             0
5                  0    0                     0               0             0
6                  0    0                     0               0             0
7                  0    0                     0               0             0
8                  0    0                     0               0             0
9                  0    0                     0               0             0
10                 0    0                     0               0             0
11                 0    0                     0               0             0
12                 0    0                     1               0             0
13                 0    0                     0               0             0
14                 0    0                     0               0             0
15                 0    0                     0               0             0
16                 0    0                     0               0             0
17                 0    0                     0               0             0
18                 0    0                     0               0             0
19                 0    0                     0               0             0

    Hotel  Indian Restaurant  Italian Restaurant  Jewelry Store  \
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
5       0                  0                   0              0
6       0                  0                   0              0
7       0                  0                   0              0
8       0                  0                   0              0
9       0                  0                   0              0
10      1                  0                   0              0
11      0                  0                   0              0
12      0                  0                   0              0
13      0                  0                   0              0
14      0                  0                   0              0
15      0                  0                   0              0
16      0                  0                   0              0
17      0                  0                   0              1
18      0                  0                   0              0
19      0                  0                   0              0

    Light Rail Station  Liquor Store  Mexican Restaurant  \
```

0	0	0	0
1	0	0	0
2	0	0	0
3	0	0	0
4	0	0	0
5	0	0	0
6	0	0	0
7	0	0	0
8	0	0	0
9	0	0	0
10	0	0	0
11	0	0	0
12	0	0	0
13	0	0	0
14	0	0	0
15	0	0	0
16	0	0	1
17	0	0	0
18	0	0	0
19	0	0	0

	Middle Eastern Restaurant	Park	Pharmacy	Pizza Place	Pool	Pub	\
0	0	1	0	0	0	0	
1	0	0	0	0	0	0	
2	0	0	0	0	0	0	
3	0	0	0	0	0	0	
4	0	0	0	0	0	0	
5	0	0	0	0	1	0	
6	0	1	0	0	0	0	
7	0	0	0	0	0	0	
8	0	0	0	0	0	0	
9	0	0	0	0	0	0	
10	0	0	0	0	0	0	
11	0	0	0	0	0	0	
12	0	0	0	0	0	0	
13	0	0	0	1	0	0	
14	0	0	0	0	0	0	
15	0	0	0	0	0	0	
16	0	0	0	0	0	0	
17	0	0	0	0	0	0	
18	0	0	0	0	0	0	
19	0	0	0	0	0	0	

	Rental Car Location	Restaurant	Salon / Barbershop	Sandwich Place	\
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
5	0	0	0	0
6	0	0	0	0
7	0	0	0	0
8	0	0	0	0
9	0	0	0	0
10	0	0	0	0
11	0	0	0	1
12	0	0	0	0
13	0	0	0	0
14	0	0	0	0
15	0	0	0	0
16	0	0	0	0
17	0	0	0	0
18	0	0	0	0
19	0	0	0	0

	Seafood Restaurant	Spa	Sporting Goods Shop	Sports Bar	Supermarket	\
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	
5	0	0	0	0	0	
6	0	0	0	0	0	
7	0	0	0	0	0	
8	0	0	0	0	0	
9	0	0	0	0	0	
10	0	0	0	0	0	
11	0	0	0	0	0	
12	0	0	0	0	0	
13	0	0	0	0	0	
14	0	0	0	0	0	
15	0	0	0	0	0	
16	0	0	0	0	0	
17	0	0	0	0	0	
18	0	0	0	0	0	
19	0	0	0	0	0	

	Sushi Restaurant	Swim School	Tennis Court	Thai Restaurant	\
0	0	0	0	0	
1	0	1	0	0	
2	0	0	0	0	
3	0	0	0	0	
4	0	0	0	0	
5	0	0	0	0	
6	0	0	0	0	
7	0	0	0	0	

```
8                   0           0             0                   0
9                   0           0             0                   0
10                  0           0             0                   0
11                  0           0             0                   0
12                  0           0             0                   0
13                  0           0             0                   0
14                  0           0             0                   0
15                  1           0             0                   0
16                  0           0             0                   0
17                  0           0             0                   0
18                  0           0             0                   0
19                  0           0             0                   0

    Toy / Game Store  Trail  Vegetarian / Vegan Restaurant  \
0                   0      0                             0
1                   0      0                             0
2                   0      0                             0
3                   0      0                             0
4                   0      0                             0
5                   0      0                             0
6                   0      0                             0
7                   0      0                             0
8                   0      0                             0
9                   0      0                             0
10                  0      0                             0
11                  0      0                             0
12                  0      0                             0
13                  0      0                             0
14                  0      1                             0
15                  0      0                             0
16                  0      0                             0
17                  0      0                             0
18                  0      0                             0
19                  0      0                             0

    Vietnamese Restaurant  Yoga Studio
0                       0            0
1                       0            0
2                       0            0
3                       0            0
4                       0            0
5                       0            0
6                       0            0
7                       0            0
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            1
19                      0            0
```

```
In [151]: Central_Toronto_onehot.shape
```

```
Out[151]: (109, 63)
```

```
In [152]: Central_Toronto_grouped = Central_Toronto_onehot.groupby('Neighborhood').mean().reset
          Central_Toronto_grouped
```

```
Out[152]:                                      Neighborhood  American Restaurant  \
0                                         Davisville               0.0000
1                                    Davisville North               0.0000
2    Forest Hill North & West, Forest Hill Road Park               0.0000
3                                     Lawrence Park               0.0000
4                          Moore Park, Summerhill East               0.0000
5                  North Toronto West, Lawrence Park               0.0000
6                                           Roselawn               0.0000
7  Summerhill West, Rathnelly, South Hill, Forest...               0.0625
8                 The Annex, North Midtown, Yorkville               0.0000

   BBQ Joint  Bagel Shop    Bank  Breakfast Spot   Brewery  Burger Joint  \
0   0.000000      0.0000  0.0000           0.000  0.033333      0.000000
1   0.000000      0.0000  0.0000           0.125  0.000000      0.000000
2   0.000000      0.0000  0.0000           0.000  0.000000      0.000000
3   0.000000      0.0000  0.0000           0.000  0.000000      0.000000
4   0.000000      0.0000  0.0000           0.000  0.000000      0.000000
5   0.000000      0.0000  0.0000           0.000  0.000000      0.000000
6   0.000000      0.0000  0.0000           0.000  0.000000      0.000000
7   0.000000      0.0625  0.0625           0.000  0.000000      0.000000
8   0.045455      0.0000  0.0000           0.000  0.000000      0.045455

   Bus Line      Café  Cheese Shop  Chinese Restaurant  Clothing Store  \
0  0.000000  0.066667     0.000000            0.000000        0.000000
1  0.000000  0.000000     0.000000            0.000000        0.000000
2  0.000000  0.000000     0.000000            0.000000        0.000000
3  0.333333  0.000000     0.000000            0.000000        0.000000
4  0.000000  0.000000     0.000000            0.000000        0.000000
5  0.000000  0.052632     0.000000            0.052632        0.105263
6  0.000000  0.000000     0.000000            0.000000        0.000000
7  0.000000  0.000000     0.000000            0.000000        0.000000
8  0.000000  0.136364     0.045455            0.000000        0.000000
```

	Coffee Shop	Convenience Store	Cosmetics Shop	Department Store	\
0	0.066667	0.000000	0.000000	0.000	
1	0.000000	0.000000	0.000000	0.125	
2	0.000000	0.000000	0.000000	0.000	
3	0.000000	0.000000	0.000000	0.000	
4	0.000000	0.000000	0.000000	0.000	
5	0.105263	0.000000	0.052632	0.000	
6	0.000000	0.000000	0.000000	0.000	
7	0.125000	0.000000	0.000000	0.000	
8	0.090909	0.045455	0.000000	0.000	

	Dessert Shop	Diner	Donut Shop	Farmers Market	Fast Food Restaurant	\
0	0.1	0.033333	0.000000	0.033333	0.000000	
1	0.0	0.000000	0.000000	0.000000	0.000000	
2	0.0	0.000000	0.000000	0.000000	0.000000	
3	0.0	0.000000	0.000000	0.000000	0.000000	
4	0.0	0.000000	0.000000	0.000000	0.000000	
5	0.0	0.052632	0.000000	0.000000	0.052632	
6	0.0	0.000000	0.000000	0.000000	0.000000	
7	0.0	0.000000	0.000000	0.000000	0.000000	
8	0.0	0.000000	0.045455	0.000000	0.000000	

	Food & Drink Shop	Fried Chicken Joint	Garden	Gas Station	\
0	0.000	0.0000	0.000000	0.033333	
1	0.125	0.0000	0.000000	0.000000	
2	0.000	0.0000	0.000000	0.000000	
3	0.000	0.0000	0.000000	0.000000	
4	0.000	0.0000	0.000000	0.000000	
5	0.000	0.0000	0.000000	0.000000	
6	0.000	0.0000	0.333333	0.000000	
7	0.000	0.0625	0.000000	0.000000	
8	0.000	0.0000	0.000000	0.000000	

	Gourmet Shop	Greek Restaurant	Gym	Gym / Fitness Center	\
0	0.033333	0.033333	0.066667	0.000000	
1	0.000000	0.000000	0.000000	0.125000	
2	0.000000	0.000000	0.000000	0.000000	
3	0.000000	0.000000	0.000000	0.000000	
4	0.000000	0.000000	0.000000	0.000000	
5	0.000000	0.000000	0.000000	0.052632	
6	0.000000	0.000000	0.000000	0.000000	
7	0.000000	0.000000	0.000000	0.000000	
8	0.000000	0.000000	0.000000	0.000000	

	History Museum	Home Service	Hotel	Indian Restaurant	Italian Restaurant	\
0	0.000000	0.000000	0.000	0.033333	0.066667	
1	0.000000	0.000000	0.125	0.000000	0.000000	
2	0.000000	0.000000	0.000	0.000000	0.000000	

```
3        0.000000      0.000000  0.000           0.000000            0.000000
4        0.000000      0.000000  0.000           0.000000            0.000000
5        0.000000      0.000000  0.000           0.000000            0.000000
6        0.000000      0.333333  0.000           0.000000            0.000000
7        0.000000      0.000000  0.000           0.000000            0.000000
8        0.045455      0.000000  0.000           0.045455            0.000000

   Jewelry Store  Light Rail Station  Liquor Store  Mexican Restaurant  \
0           0.00              0.0000      0.000000            0.000000
1           0.00              0.0000      0.000000            0.000000
2           0.25              0.0000      0.000000            0.250000
3           0.00              0.0000      0.000000            0.000000
4           0.00              0.0000      0.000000            0.000000
5           0.00              0.0000      0.000000            0.052632
6           0.00              0.0000      0.000000            0.000000
7           0.00              0.0625      0.062500            0.000000
8           0.00              0.0000      0.045455            0.000000

   Middle Eastern Restaurant      Park  Pharmacy  Pizza Place      Pool  \
0                   0.000000  0.033333  0.033333     0.066667  0.000000
1                   0.000000  0.125000  0.000000     0.125000  0.000000
2                   0.000000  0.000000  0.000000     0.000000  0.000000
3                   0.000000  0.333333  0.000000     0.000000  0.000000
4                   0.000000  0.250000  0.000000     0.000000  0.000000
5                   0.000000  0.052632  0.000000     0.000000  0.000000
6                   0.000000  0.000000  0.000000     0.000000  0.333333
7                   0.000000  0.000000  0.000000     0.062500  0.000000
8                   0.045455  0.045455  0.045455     0.045455  0.000000

        Pub  Rental Car Location  Restaurant  Salon / Barbershop  \
0  0.000000             0.000000    0.033333            0.000000
1  0.000000             0.000000    0.000000            0.000000
2  0.000000             0.000000    0.000000            0.000000
3  0.000000             0.000000    0.000000            0.000000
4  0.000000             0.000000    0.250000            0.000000
5  0.000000             0.052632    0.052632            0.052632
6  0.000000             0.000000    0.000000            0.000000
7  0.125000             0.000000    0.062500            0.000000
8  0.045455             0.000000    0.000000            0.000000

   Sandwich Place  Seafood Restaurant       Spa  Sporting Goods Shop  \
0        0.066667            0.033333  0.000000             0.000000
1        0.125000            0.000000  0.000000             0.000000
2        0.000000            0.000000  0.000000             0.000000
3        0.000000            0.000000  0.000000             0.000000
4        0.000000            0.000000  0.000000             0.000000
5        0.000000            0.052632  0.052632             0.052632
6        0.000000            0.000000  0.000000             0.000000
```

```
7        0.000000            0.000000  0.000000             0.000000
8        0.136364            0.000000  0.000000             0.000000

   Sports Bar  Supermarket  Sushi Restaurant  Swim School  Tennis Court  \
0      0.0000       0.0000          0.066667     0.000000          0.00
1      0.0000       0.0000          0.000000     0.000000          0.00
2      0.0000       0.0000          0.250000     0.000000          0.00
3      0.0000       0.0000          0.000000     0.333333          0.00
4      0.0000       0.0000          0.000000     0.000000          0.25
5      0.0000       0.0000          0.000000     0.000000          0.00
6      0.0000       0.0000          0.000000     0.000000          0.00
7      0.0625       0.0625          0.062500     0.000000          0.00
8      0.0000       0.0000          0.000000     0.000000          0.00

   Thai Restaurant  Toy / Game Store  Trail  Vegetarian / Vegan Restaurant  \
0         0.033333          0.033333   0.00                       0.000000
1         0.000000          0.000000   0.00                       0.000000
2         0.000000          0.000000   0.25                       0.000000
3         0.000000          0.000000   0.00                       0.000000
4         0.000000          0.000000   0.25                       0.000000
5         0.000000          0.000000   0.00                       0.000000
6         0.000000          0.000000   0.00                       0.000000
7         0.000000          0.000000   0.00                       0.000000
8         0.000000          0.000000   0.00                       0.045455

   Vietnamese Restaurant  Yoga Studio
0                 0.0000     0.000000
1                 0.0000     0.000000
2                 0.0000     0.000000
3                 0.0000     0.000000
4                 0.0000     0.000000
5                 0.0000     0.052632
6                 0.0000     0.000000
7                 0.0625     0.000000
8                 0.0000     0.000000
```

In [153]:
```
# On this analysis we can see the the first venue on Moore Park is restuarant so it
# a restaurant in this neighborhood

num_top_venues = 5

for Neighborhood in Central_Toronto_grouped['Neighborhood']:
    print("----"+Neighborhood+"----")
    temp = Central_Toronto_grouped[Central_Toronto_grouped['Neighborhood'] == Neighb
    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_t
            print('\n')
```

```
----Davisville----
                venue  freq
0        Dessert Shop  0.10
1         Coffee Shop  0.07
2  Italian Restaurant  0.07
3      Sandwich Place  0.07
4                Café  0.07


----Davisville North----
                  venue  freq
0                 Hotel  0.12
1  Gym / Fitness Center  0.12
2      Department Store  0.12
3     Food & Drink Shop  0.12
4           Pizza Place  0.12


----Forest Hill North & West, Forest Hill Road Park----
                 venue  freq
0        Jewelry Store  0.25
1                Trail  0.25
2   Mexican Restaurant  0.25
3     Sushi Restaurant  0.25
4  American Restaurant  0.00


----Lawrence Park----
                 venue  freq
0             Bus Line  0.33
1                 Park  0.33
2          Swim School  0.33
3  American Restaurant  0.00
4   Salon / Barbershop  0.00


----Moore Park, Summerhill East----
                 venue  freq
0           Restaurant  0.25
1                Trail  0.25
2         Tennis Court  0.25
3                 Park  0.25
4  American Restaurant  0.00
```

```
----North Toronto West, Lawrence Park----
                venue  freq
0      Clothing Store  0.11
1         Coffee Shop  0.11
2         Yoga Studio  0.05
3      Cosmetics Shop  0.05
4  Mexican Restaurant  0.05


----Roselawn----
                 venue  freq
0         Home Service  0.33
1               Garden  0.33
2                 Pool  0.33
3  American Restaurant  0.00
4    Indian Restaurant  0.00


----Summerhill West, Rathnelly, South Hill, Forest Hill SE, Deer Park----
                 venue  freq
0                  Pub  0.12
1          Coffee Shop  0.12
2  American Restaurant  0.06
3          Pizza Place  0.06
4           Bagel Shop  0.06


----The Annex, North Midtown, Yorkville----
            venue  freq
0  Sandwich Place  0.14
1           Café  0.14
2     Coffee Shop  0.09
3  History Museum  0.05
4      Donut Shop  0.05
```

```
In [154]: 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]
```

```
In [155]: 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'] = Central_Toronto_grouped['Neighborhood']

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

neighborhoods_venues_sorted.head(20)
```

Out[155]:

	Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue
0	Davisville	Dessert Shop	Coffee Shop	Gym	Italian Restaurant	Sushi Restaurant	Café	Sandwich Place
1	Davisville North	Food & Drink Shop	Park	Gym / Fitness Center	Pizza Place	Sandwich Place	Department Store	Breakfast Spot
2	Forest Hill North & West, Forest Hill Road Park	Sushi Restaurant	Trail	Jewelry Store	Mexican Restaurant	Food & Drink Shop	Diner	Donut Shop
3	Lawrence Park	Bus Line	Park	Swim School	Yoga Studio	Diner	Donut Shop	Farmers Market
4	Moore Park, Summerhill East	Restaurant	Trail	Park	Tennis Court	Fast Food Restaurant	Dessert Shop	Diner
5	North Toronto West, Lawrence Park	Coffee Shop	Clothing Store	Yoga Studio	Seafood Restaurant	Gym / Fitness Center	Fast Food Restaurant	Diner
6	Roselawn	Home Service	Garden	Pool	Department Store	Gym	Greek Restaurant	Gourmet Shop
7	Summerhill West, Rathnelly, South Hill, Forest...	Coffee Shop	Pub	Sports Bar	Fried Chicken Joint	Vietnamese Restaurant	Light Rail Station	Liquor Store
8	The Annex, North Midtown, Yorkville	Sandwich Place	Café	Coffee Shop	Pub			

```
8            Cheese Shop                   Park              Pharmacy

  8th Most Common Venue 9th Most Common Venue 10th Most Common Venue
0           Pizza Place            Restaurant           Gourmet Shop
1                 Hotel           Gas Station                 Garden
2        Farmers Market  Fast Food Restaurant            Yoga Studio
3  Fast Food Restaurant     Food & Drink Shop    Fried Chicken Joint
4            Donut Shop        Farmers Market    Fried Chicken Joint
5    Mexican Restaurant                  Park         Cosmetics Shop
6           Gas Station   Fried Chicken Joint      Food & Drink Shop
7           Pizza Place            Restaurant    American Restaurant
8           Pizza Place          Liquor Store             Donut Shop
```

In [156]:
```
# set number of clusters
kclusters = 5

Central_Toronto_grouped_clustering = Central_Toronto_grouped.drop('Neighborhood', 1)

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

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

Out[156]:
```
array([0, 0, 3, 2, 4, 0, 1, 0, 0])
```

In [160]:
```
# add clustering labels
neighborhoods_venues_sorted.insert(0, 'Cluster Labels', kmeans.labels_)

Central_Toronto_merged = Central_Toronto

# merge toronto_grouped with toronto_data to add latitude/longitude for each neighbo
Central_Toronto_merged = Central_Toronto_merged.join(neighborhoods_venues_sorted.set_

Central_Toronto_merged.head(20) # check the last columns!
```

Out[160]:
```
           Borough                                          Neighborhood  \
0  Central Toronto                                        Lawrence Park
1  Central Toronto                                             Roselawn
2  Central Toronto                                     Davisville North
3  Central Toronto    Forest Hill North & West, Forest Hill Road Park
4  Central Toronto                 North Toronto West, Lawrence Park
5  Central Toronto               The Annex, North Midtown, Yorkville
6  Central Toronto                                           Davisville
7  Central Toronto                          Moore Park, Summerhill East
8  Central Toronto  Summerhill West, Rathnelly, South Hill, Forest...

    Latitude  Longitude  Cluster Labels 1st Most Common Venue  \
0  43.728020 -79.388790               2              Bus Line
```

```
1  43.711695 -79.416936                1          Home Service
2  43.712751 -79.390197                0     Food & Drink Shop
3  43.696948 -79.411307                3      Sushi Restaurant
4  43.715383 -79.405678                0           Coffee Shop
5  43.672710 -79.405678                0        Sandwich Place
6  43.704324 -79.388790                0          Dessert Shop
7  43.689574 -79.383160                4            Restaurant
8  43.686412 -79.400049                0           Coffee Shop

  2nd Most Common Venue 3rd Most Common Venue 4th Most Common Venue  \
0                  Park           Swim School           Yoga Studio
1                Garden                  Pool      Department Store
2                  Park  Gym / Fitness Center           Pizza Place
3                 Trail         Jewelry Store    Mexican Restaurant
4       Clothing Store           Yoga Studio    Seafood Restaurant
5                 Café           Coffee Shop                   Pub
6          Coffee Shop                   Gym    Italian Restaurant
7                Trail                  Park          Tennis Court
8                  Pub           Sports Bar   Fried Chicken Joint

   5th Most Common Venue 6th Most Common Venue 7th Most Common Venue  \
0                  Diner            Donut Shop        Farmers Market
1                    Gym      Greek Restaurant          Gourmet Shop
2         Sandwich Place      Department Store        Breakfast Spot
3      Food & Drink Shop                 Diner            Donut Shop
4   Gym / Fitness Center  Fast Food Restaurant                 Diner
5           Cheese Shop                  Park              Pharmacy
6       Sushi Restaurant                 Café        Sandwich Place
7   Fast Food Restaurant          Dessert Shop                 Diner
8  Vietnamese Restaurant    Light Rail Station          Liquor Store

  8th Most Common Venue 9th Most Common Venue 10th Most Common Venue
0  Fast Food Restaurant     Food & Drink Shop    Fried Chicken Joint
1           Gas Station   Fried Chicken Joint      Food & Drink Shop
2                 Hotel           Gas Station                 Garden
3        Farmers Market  Fast Food Restaurant            Yoga Studio
4    Mexican Restaurant                  Park         Cosmetics Shop
5           Pizza Place          Liquor Store            Donut Shop
6           Pizza Place            Restaurant          Gourmet Shop
7            Donut Shop        Farmers Market    Fried Chicken Joint
8           Pizza Place            Restaurant    American Restaurant
```

In [161]:
```
# Creating map with clusters and the fifth cluster seems to have restaurant a the mo
# This location would the most appropraite location for us open this steak house res

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(Central_Toronto_merged['Latitude'], Central_Toronto
    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[161]: <folium.folium.Map at 0x2af5acf6dd8>

```
In [162]: # First cluster
          Central_Toronto_merged.loc[Central_Toronto_merged['Cluster Labels'] == 0, Central_To
```

Out[162]:

	Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue
2	Davisville North	Food & Drink Shop	Park	Gym / Fitness Center	Pizza Place
4	North Toronto West, Lawrence Park	Coffee Shop	Clothing Store	Yoga Studio	Seafood Restaurant
5	The Annex, North Midtown, Yorkville	Sandwich Place	Café	Coffee Shop	Pub
6	Davisville	Dessert Shop	Coffee Shop	Gym	Italian Restaurant
8	Summerhill West, Rathnelly, South Hill, Forest...	Coffee Shop	Pub	Sports Bar	Fried Chicken Joint

	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
2	Sandwich Place	Department Store	Breakfast Spot	Hotel	Gas Station	Garden
4	Gym / Fitness Center	Fast Food Restaurant	Diner			
5	Cheese Shop	Park	Pharmacy			
6	Sushi Restaurant	Café	Sandwich Place			
8	Vietnamese Restaurant	Light Rail Station	Liquor Store			

```
4    Mexican Restaurant                  Park         Cosmetics Shop
5          Pizza Place          Liquor Store             Donut Shop
6          Pizza Place            Restaurant           Gourmet Shop
8          Pizza Place            Restaurant    American Restaurant
```

In [163]:
```
# Second cluster
Central_Toronto_merged.loc[Central_Toronto_merged['Cluster Labels'] == 1, Central_To
```

Out[163]:
```
  Neighborhood 1st Most Common Venue 2nd Most Common Venue  \
1     Roselawn          Home Service                Garden

  3rd Most Common Venue 4th Most Common Venue 5th Most Common Venue  \
1                  Pool      Department Store                   Gym

  6th Most Common Venue 7th Most Common Venue 8th Most Common Venue  \
1      Greek Restaurant          Gourmet Shop           Gas Station

  9th Most Common Venue 10th Most Common Venue
1   Fried Chicken Joint      Food & Drink Shop
```

In [164]:
```
# Fifth cluster

Central_Toronto_merged.loc[Central_Toronto_merged['Cluster Labels'] == 4, Central_To
```

Out[164]:
```
                  Neighborhood 1st Most Common Venue 2nd Most Common Venue  \
7  Moore Park, Summerhill East            Restaurant                 Trail

  3rd Most Common Venue 4th Most Common Venue 5th Most Common Venue  \
7                  Park          Tennis Court  Fast Food Restaurant

  6th Most Common Venue 7th Most Common Venue 8th Most Common Venue  \
7          Dessert Shop                 Diner            Donut Shop

  9th Most Common Venue 10th Most Common Venue
7        Farmers Market    Fried Chicken Joint
```