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Capstone Project - The Battle of Neighborhoods (Week 2)

0.0.1 Applied Data Science Capstone by IBM/Coursera

0.0.2 Author: Ying

0.1 Table of Content

0.2 Introduction: Business Problem

Toronto is the provincial capital of Ontario and the most populous city in Canada. Toronto is an international centre of business, finance, arts, and culture, and is recognized as one of the most multicultural and cosmopolitan cities in the world. The diverse population of Toronto reflects its current and historical role as an important destination for immigrants to Canada. More than 50 percent of residents belong to a visible minority population group, and over 200 distinct ethnic origins are represented among its inhabitants. While the majority of Torontonians speak English as their primary language, over 160 languages are spoken in the city. The insights derived from analysis will give good understanding of the business environment which help in strategically targeting the market. This will help in reduction of risk of starting a new business. And the Return on Investment will be reasonable.

0.3 Business Problem

The cuisine of Toronto reflects Toronto's size and multicultural diversity. Let's say one of my friends, Lily, wants to open a sushi restaurant in Toront. Starting a sushi restaurant can be a great business opportunity. New sushi bar should be open in an area that inadequate neighborhood in this way the bar can attract more customers. Therefore, this analysis necessary to ensure that we have enough customers and that we are not so close to other sushi places.

0.4 Data

Neighborhood has a total of 10 boroughs and 103 neighborhoods. In order to segement the neighborhoods and explore them, we will essentially need a dataset that contains the 5 boroughs and

the neighborhoods that exist in each borough as well as the the latitude and logitude coordinates of each neighborhood. The data is from our week3 assignment, I will export the data as csv file for future analysis.

Now once we got the neighborhood's latitude and longitude, let's use Foursquare Location to get the Mission District Neighborhood's all restaurant details. The restaurant details can be retrieved using search endpoint. For our project we need only Sushi restaurant data, and in search endpoint there is a attribute called category id, i.e for each category(like Indian or Italian or Mexican Restaurant) foursquare has a defined categoryid which will help us to get the desired data. Sushi category Id 4bf58dd8d48988d1d2941735 is used for retrieving data from Foursquare API.

0.5 Analysis

0.5.1 Import Libraries

In this section we import the libraries that will be required to process the data.

The first library is Pandas. Pandas is an open source, BSD-licensed library, providing high-performance, easy-to-use data structures and data analysis tools for the Python programming language.

```
[3]: pip install beautifulsoup4
```

```
Collecting beautifulsoup4
  Downloading https://files.pythonhosted.org/packages/e8/b5/7bb03a696f2c9b
7af792a8f51b82974e51c268f15e925fc834876a4efa0b/beautifulsoup4-4.9.0-py3-none-
any.whl (109kB)
     |                          | 112kB 10.5MB/s eta 0:00:01
Collecting soupsieve>1.2 (from beautifulsoup4)
  Downloading https://files.pythonhosted.org/packages/05/cf/ea245e52f55823f19992
447b008bcbb7f78efc5960d77f6c34b5b45b36dd/soupsieve-2.0-py2.py3-none-any.whl
Installing collected packages: soupsieve, beautifulsoup4
Successfully installed beautifulsoup4-4.9.0 soupsieve-2.0
Note: you may need to restart the kernel to use updated packages.
```

```python
[4]: import numpy as np
     import pandas as pd
     pd.set_option('display.max_columns', None)
     pd.set_option('display.max_rows', None)

     !conda install -c conda-forge geopy --yes
     from geopy.geocoders import Nominatim
     import urllib.request
     import json
     from bs4 import BeautifulSoup
     from urllib.request import urlopen
     import requests
     from pandas.io.json import json_normalize
```

```
import matplotlib.cm as cm
import matplotlib.colors as colors
# Matplotlib and associated plotting modules
import matplotlib.cm as cm
import matplotlib.pyplot as plt
import matplotlib.colors as colors
%matplotlib inline
from sklearn.cluster import KMeans

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

print('Libraries imported.')
```

```
Collecting package metadata (current_repodata.json): done
Solving environment: done

# All requested packages already installed.

Libraries imported.
```

Tranform the data into a *pandas* dataframe   Download and Explore Dataset Neighborhood has a total of 10 boroughs and 103 neighborhoods. In order to segement the neighborhoods and explore them, we will essentially need a dataset that contains the 5 boroughs and the neighborhoods that exist in each borough as well as the the latitude and logitude coordinates of each neighborhood.

This is the assignment for capstone week3 projects. For convenience, we load the cleaned data directly from week3 results.So let's go ahead and do that.

[5]:
```
data = pd.read_csv("Toront data.csv",header=0,index_col=0)

print('Data downloaded!')

data.head(5)
```

```
Data downloaded!
```

[5]:
```
   Postcode      Borough                            Neighbourhood   Latitude  \
0      M1B   Scarborough                            Malvern, Rouge  43.806686
1      M1C   Scarborough  Rouge Hill, Port Union, Highland Creek  43.784535
2      M1E   Scarborough       Guildwood, Morningside, West Hill  43.763573
3      M1G   Scarborough                                   Woburn  43.770992
4      M1H   Scarborough                                 Cedarbrae  43.773136

    Longitude
0  -79.194353
1  -79.160497
2  -79.188711
```

```
3 -79.216917
4 -79.239476
```

[74]: `data.shape`

[74]: (103, 5)

Use geopy library to get the latitude and longitude values of Toronto City. In order to define an instance of the geocoder, we need to define a user_agent. We will name our agent ny_explorer, as shown below.

[6]:
```python
address = 'Toronto, CA'

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

The geograpical coordinate of Toronto are 43.6534817, -79.3839347.

Create a map of Toronto with neighborhoods superimposed on top.

[7]:
```python
import folium
# create map of New York using latitude and longitude values
map_toronto = folium.Map(location=[latitude, longitude], zoom_start=10)

# add markers to map
for lat, lng, borough, Neighbourhood in zip(data['Latitude'],
 ↪data['Longitude'], data['Borough'], data['Neighbourhood']):
    label = '{}, {}'.format(Neighbourhood, 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
```

[7]: <folium.folium.Map at 0x7fc35be63cc0>

0.6 Foursquare venues

```python
[8]: import urllib
     def getNearbyVenues(names, latitudes, longitudes, radius=5000, categoryIds=''):
         try:
             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/search?
      ↪&client_id={}&client_secret={}&v={}&ll={},{}&radius={}&limit={}'.
      ↪format(CLIENT_ID, CLIENT_SECRET, VERSION, lat, lng, radius, LIMIT)

                 if (categoryIds != ''):
                     url = url + '&categoryId={}'
                     url = url.format(categoryIds)

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

                 # return only relevant information for each nearby venue
                 for v in results:
                     success = False
                     try:
                         category = v['categories'][0]['name']
                         success = True
                     except:
                         pass

                     if success:
                         venues_list.append([(
                             name,
                             lat,
                             lng,
                             v['name'],
                             v['location']['lat'],
                             v['location']['lng'],
                             v['categories'][0]['name']
                         )])

             nearby_venues = pd.DataFrame([item for venue_list in venues_list for
      ↪item in venue_list])
             nearby_venues.columns = ['Neighbourhood',
                         'Neighbourhood Latitude',
                         'Neighbourhood Longitude',
```

```
                    'Venue',
                    'Venue Latitude',
                    'Venue Longitude',
                    'Venue Category']

    except:
        print(url)
        print(response)
        print(results)
        print(nearby_venues)

    return(nearby_venues)
```

[9]:
```
LIMIT = 500
radius = 5000
CLIENT_ID = 'hide'
CLIENT_SECRET = 'hide'
VERSION = '20181020'
```

[10]:
```
#https://developer.foursquare.com/docs/resources/categories
#Sushi = 4bf58dd8d48988d1d2941735
Toronto_venues_sushi = getNearbyVenues(names=data['Neighbourhood'],␣
 ↪latitudes=data['Latitude'], longitudes=data['Longitude'], radius=1000,␣
 ↪categoryIds='4bf58dd8d48988d1d2941735')
Toronto_venues_sushi.head()
```

[10]:
```
                                       Neighbourhood  Neighbourhood Latitude  \
0                                          Cedarbrae                43.773136
1                                          Cedarbrae                43.773136
2        Kennedy Park, Ionview, East Birchmount Park                43.727929
3  Dorset Park, Wexford Heights, Scarborough Town…                43.757410
4                                          Agincourt                43.794200

   Neighbourhood Longitude            Venue  Venue Latitude  Venue Longitude  \
0              -79.239476  HO Sushi Express       43.780965       -79.247445
1              -79.239476    Fukuoka Sushi       43.780679       -79.247320
2              -79.262029       Ikki sushi       43.733489       -79.257644
3              -79.273304      Shiro Sushi       43.756228       -79.266965
4              -79.262029     Sushi Legend       43.796602       -79.270292

        Venue Category
0     Sushi Restaurant
1     Sushi Restaurant
2     Sushi Restaurant
3  Japanese Restaurant
4     Sushi Restaurant
```

```
[11]: Toronto_venues_sushi.to_csv("Toronto_venues_sushi.csv")
```

```
[12]: Toronto_venues_sushi.shape
```

```
[12]: (778, 7)
```

```
[13]: def addToMap(df, color, existingMap):
          for lat, lng, local, venue, venueCat in zip(df['Venue Latitude'], df['Venue␣
       ↪Longitude'], df['Neighbourhood'], df['Venue'], df['Venue Category']):
              label = '{} ({}) - {}'.format(venue, venueCat, local)
              label = folium.Popup(label, parse_html=True)
              folium.CircleMarker(
                  [lat, lng],
                  radius=5,
                  popup=label,
                  color=color,
                  fill=True,
                  fill_color=color,
                  fill_opacity=0.7).add_to(existingMap)
```

```
[14]: map_toronto_sushi = folium.Map(location=[latitude, longitude], zoom_start=10)
      addToMap(Toronto_venues_sushi, 'red', map_toronto_sushi)

      map_toronto_sushi
```

```
[14]: <folium.folium.Map at 0x7fc35a3de080>
```

```
[15]: def addColumn(startDf, columnTitle, dataDf):
          grouped = dataDf.groupby('Neighborhood').count()

          for n in startDf['Neighborhood']:
              try:
                  startDf.loc[startDf['Neighborhood'] == n,columnTitle] = grouped.
       ↪loc[n, 'Venue']
              except:
                  startDf.loc[startDf['Neighborhood'] == n,columnTitle] = 0
```

```
[16]: toronto_grouped = Toronto_venues_sushi.groupby('Neighbourhood').count()

      print('There are {} uniques categories.'.format(len(Toronto_venues_sushi['Venue␣
       ↪Category'].unique())))

      toronto_grouped
```

There are 10 uniques categories.

```
[16]:                                                   Neighbourhood Latitude  \
       Neighbourhood
       Agincourt                                                         1
       Bathurst Manor, Wilson Heights, Downsview North                   1
       Bayview Village                                                   2
       Bedford Park, Lawrence Manor East                                 4
       Berczy Park                                                      30
       Brockton, Parkdale Village, Exhibition Place                      3
       Business reply mail Processing CentrE                             3
       CN Tower, King and Spadina, Railway Lands, Harb…                  1
       Canada Post Gateway Processing Centre                             2
       Cedarbrae                                                         2
       Central Bay Street                                               49
       Christie                                                          1
       Church and Wellesley                                             32
       Clarks Corners, Tam O'Shanter, Sullivan                           2
       Commerce Court, Victoria Hotel                                   50
       Davisville                                                       11
       Davisville North                                                  7
       Del Ray, Mount Dennis, Keelsdale and Silverthorn                  1
       Don Mills                                                         6
       Dorset Park, Wexford Heights, Scarborough Town …                  1
       Dufferin, Dovercourt Village                                      5
       East Toronto                                                      4
       Fairview, Henry Farm, Oriole                                      5
       First Canadian Place, Underground city                           50
       Forest Hill North & West                                          6
       Garden District, Ryerson                                         44
       Glencairn                                                         2
       Harbourfront East, Union Station, Toronto Islands                30
       High Park, The Junction South                                     6
       Hillcrest Village                                                 1
       Humewood-Cedarvale                                                3
       India Bazaar, The Beaches West                                    1
       Kennedy Park, Ionview, East Birchmount Park                       1
       Kensington Market, Chinatown, Grange Park                        23
       Lawrence Manor, Lawrence Heights                                  3
       Lawrence Park                                                     2
       Leaside                                                           6
       Little Portugal, Trinity                                         10
       Milliken, Agincourt North, Steeles East, L'Amor…                  1
       Mimico NW, The Queensway West, South of Bloor, …                  4
       Moore Park, Summerhill East                                       5
       New Toronto, Mimico South, Humber Bay Shores                      2
       North Toronto West                                                3
       Northwood Park, York University                                   2
       Parkdale, Roncesvalles                                            8
```

```
Queen's Park, Ontario Provincial Government            44
Regent Park, Harbourfront                              9
Richmond, Adelaide, King                              50
Rosedale                                               2
Roselawn                                               5
Runnymede, Swansea                                     9
St. James Town                                        49
St. James Town, Cabbagetown                            4
Stn A PO Boxes                                        37
Studio District                                        7
Summerhill West, Rathnelly, South Hill, Forest …       8
The Annex, North Midtown, Yorkville                   11
The Beaches                                             3
The Danforth West, Riverdale                           5
The Kingsway, Montgomery Road , Old Mill North         3
Thorncliffe Park                                       2
Toronto Dominion Centre, Design Exchange              50
University of Toronto, Harbord                         19
Westmount                                              1
Willowdale                                            15
Willowdale, Newtonbrook                                3
Woodbine Heights                                       3
York Mills West                                        3


                                        Neighbourhood Longitude  \
Neighbourhood
Agincourt                                              1
Bathurst Manor, Wilson Heights, Downsview North        1
Bayview Village                                        2
Bedford Park, Lawrence Manor East                      4
Berczy Park                                           30
Brockton, Parkdale Village, Exhibition Place           3
Business reply mail Processing CentrE                  3
CN Tower, King and Spadina, Railway Lands, Harb…       1
Canada Post Gateway Processing Centre                  2
Cedarbrae                                              2
Central Bay Street                                    49
Christie                                               1
Church and Wellesley                                  32
Clarks Corners, Tam O'Shanter, Sullivan                2
Commerce Court, Victoria Hotel                        50
Davisville                                            11
Davisville North                                       7
Del Ray, Mount Dennis, Keelsdale and Silverthorn       1
Don Mills                                              6
Dorset Park, Wexford Heights, Scarborough Town …       1
Dufferin, Dovercourt Village                           5
```

East Toronto	4
Fairview, Henry Farm, Oriole	5
First Canadian Place, Underground city	50
Forest Hill North & West	6
Garden District, Ryerson	44
Glencairn	2
Harbourfront East, Union Station, Toronto Islands	30
High Park, The Junction South	6
Hillcrest Village	1
Humewood-Cedarvale	3
India Bazaar, The Beaches West	1
Kennedy Park, Ionview, East Birchmount Park	1
Kensington Market, Chinatown, Grange Park	23
Lawrence Manor, Lawrence Heights	3
Lawrence Park	2
Leaside	6
Little Portugal, Trinity	10
Milliken, Agincourt North, Steeles East, L'Amor…	1
Mimico NW, The Queensway West, South of Bloor, …	4
Moore Park, Summerhill East	5
New Toronto, Mimico South, Humber Bay Shores	2
North Toronto West	3
Northwood Park, York University	2
Parkdale, Roncesvalles	8
Queen's Park, Ontario Provincial Government	44
Regent Park, Harbourfront	9
Richmond, Adelaide, King	50
Rosedale	2
Roselawn	5
Runnymede, Swansea	9
St. James Town	49
St. James Town, Cabbagetown	4
Stn A PO Boxes	37
Studio District	7
Summerhill West, Rathnelly, South Hill, Forest …	8
The Annex, North Midtown, Yorkville	11
The Beaches	3
The Danforth West, Riverdale	5
The Kingsway, Montgomery Road , Old Mill North	3
Thorncliffe Park	2
Toronto Dominion Centre, Design Exchange	50
University of Toronto, Harbord	19
Westmount	1
Willowdale	15
Willowdale, Newtonbrook	3
Woodbine Heights	3
York Mills West	3

Neighbourhood	Venue	Venue Latitude
Agincourt	1	1
Bathurst Manor, Wilson Heights, Downsview North	1	1
Bayview Village	2	2
Bedford Park, Lawrence Manor East	4	4
Berczy Park	30	30
Brockton, Parkdale Village, Exhibition Place	3	3
Business reply mail Processing CentrE	3	3
CN Tower, King and Spadina, Railway Lands, Harb…	1	1
Canada Post Gateway Processing Centre	2	2
Cedarbrae	2	2
Central Bay Street	49	49
Christie	1	1
Church and Wellesley	32	32
Clarks Corners, Tam O'Shanter, Sullivan	2	2
Commerce Court, Victoria Hotel	50	50
Davisville	11	11
Davisville North	7	7
Del Ray, Mount Dennis, Keelsdale and Silverthorn	1	1
Don Mills	6	6
Dorset Park, Wexford Heights, Scarborough Town …	1	1
Dufferin, Dovercourt Village	5	5
East Toronto	4	4
Fairview, Henry Farm, Oriole	5	5
First Canadian Place, Underground city	50	50
Forest Hill North & West	6	6
Garden District, Ryerson	44	44
Glencairn	2	2
Harbourfront East, Union Station, Toronto Islands	30	30
High Park, The Junction South	6	6
Hillcrest Village	1	1
Humewood-Cedarvale	3	3
India Bazaar, The Beaches West	1	1
Kennedy Park, Ionview, East Birchmount Park	1	1
Kensington Market, Chinatown, Grange Park	23	23
Lawrence Manor, Lawrence Heights	3	3
Lawrence Park	2	2
Leaside	6	6
Little Portugal, Trinity	10	10
Milliken, Agincourt North, Steeles East, L'Amor…	1	1
Mimico NW, The Queensway West, South of Bloor, …	4	4
Moore Park, Summerhill East	5	5
New Toronto, Mimico South, Humber Bay Shores	2	2
North Toronto West	3	3
Northwood Park, York University	2	2

```
Parkdale, Roncesvalles                                   8              8
Queen's Park, Ontario Provincial Government             44             44
Regent Park, Harbourfront                                9              9
Richmond, Adelaide, King                                50             50
Rosedale                                                 2              2
Roselawn                                                 5              5
Runnymede, Swansea                                       9              9
St. James Town                                          49             49
St. James Town, Cabbagetown                              4              4
Stn A PO Boxes                                          37             37
Studio District                                          7              7
Summerhill West, Rathnelly, South Hill, Forest …         8              8
The Annex, North Midtown, Yorkville                     11             11
The Beaches                                              3              3
The Danforth West, Riverdale                             5              5
The Kingsway, Montgomery Road , Old Mill North           3              3
Thorncliffe Park                                         2              2
Toronto Dominion Centre, Design Exchange                50             50
University of Toronto, Harbord                           19             19
Westmount                                                1              1
Willowdale                                              15             15
Willowdale, Newtonbrook                                  3              3
Woodbine Heights                                         3              3
York Mills West                                          3              3


                                                  Venue Longitude  \
Neighbourhood
Agincourt                                                        1
Bathurst Manor, Wilson Heights, Downsview North                  1
Bayview Village                                                  2
Bedford Park, Lawrence Manor East                               4
Berczy Park                                                     30
Brockton, Parkdale Village, Exhibition Place                    3
Business reply mail Processing CentrE                           3
CN Tower, King and Spadina, Railway Lands, Harb…                1
Canada Post Gateway Processing Centre                           2
Cedarbrae                                                       2
Central Bay Street                                             49
Christie                                                        1
Church and Wellesley                                           32
Clarks Corners, Tam O'Shanter, Sullivan                         2
Commerce Court, Victoria Hotel                                 50
Davisville                                                     11
Davisville North                                                7
Del Ray, Mount Dennis, Keelsdale and Silverthorn                1
Don Mills                                                       6
Dorset Park, Wexford Heights, Scarborough Town …                1
```

```
Dufferin, Dovercourt Village                                5
East Toronto                                                4
Fairview, Henry Farm, Oriole                                5
First Canadian Place, Underground city                     50
Forest Hill North & West                                    6
Garden District, Ryerson                                   44
Glencairn                                                   2
Harbourfront East, Union Station, Toronto Islands          30
High Park, The Junction South                               6
Hillcrest Village                                           1
Humewood-Cedarvale                                          3
India Bazaar, The Beaches West                              1
Kennedy Park, Ionview, East Birchmount Park                 1
Kensington Market, Chinatown, Grange Park                  23
Lawrence Manor, Lawrence Heights                            3
Lawrence Park                                               2
Leaside                                                     6
Little Portugal, Trinity                                   10
Milliken, Agincourt North, Steeles East, L'Amor…           1
Mimico NW, The Queensway West, South of Bloor, …           4
Moore Park, Summerhill East                                 5
New Toronto, Mimico South, Humber Bay Shores                2
North Toronto West                                          3
Northwood Park, York University                             2
Parkdale, Roncesvalles                                      8
Queen's Park, Ontario Provincial Government                44
Regent Park, Harbourfront                                   9
Richmond, Adelaide, King                                   50
Rosedale                                                    2
Roselawn                                                    5
Runnymede, Swansea                                          9
St. James Town                                             49
St. James Town, Cabbagetown                                 4
Stn A PO Boxes                                             37
Studio District                                             7
Summerhill West, Rathnelly, South Hill, Forest …           8
The Annex, North Midtown, Yorkville                        11
The Beaches                                                 3
The Danforth West, Riverdale                                5
The Kingsway, Montgomery Road , Old Mill North              3
Thorncliffe Park                                            2
Toronto Dominion Centre, Design Exchange                   50
University of Toronto, Harbord                             19
Westmount                                                   1
Willowdale                                                 15
Willowdale, Newtonbrook                                     3
Woodbine Heights                                            3
```

York Mills West   3

	Venue Category
Neighbourhood	
Agincourt	1
Bathurst Manor, Wilson Heights, Downsview North	1
Bayview Village	2
Bedford Park, Lawrence Manor East	4
Berczy Park	30
Brockton, Parkdale Village, Exhibition Place	3
Business reply mail Processing CentrE	3
CN Tower, King and Spadina, Railway Lands, Harb…	1
Canada Post Gateway Processing Centre	2
Cedarbrae	2
Central Bay Street	49
Christie	1
Church and Wellesley	32
Clarks Corners, Tam O'Shanter, Sullivan	2
Commerce Court, Victoria Hotel	50
Davisville	11
Davisville North	7
Del Ray, Mount Dennis, Keelsdale and Silverthorn	1
Don Mills	6
Dorset Park, Wexford Heights, Scarborough Town …	1
Dufferin, Dovercourt Village	5
East Toronto	4
Fairview, Henry Farm, Oriole	5
First Canadian Place, Underground city	50
Forest Hill North & West	6
Garden District, Ryerson	44
Glencairn	2
Harbourfront East, Union Station, Toronto Islands	30
High Park, The Junction South	6
Hillcrest Village	1
Humewood-Cedarvale	3
India Bazaar, The Beaches West	1
Kennedy Park, Ionview, East Birchmount Park	1
Kensington Market, Chinatown, Grange Park	23
Lawrence Manor, Lawrence Heights	3
Lawrence Park	2
Leaside	6
Little Portugal, Trinity	10
Milliken, Agincourt North, Steeles East, L'Amor…	1
Mimico NW, The Queensway West, South of Bloor, …	4
Moore Park, Summerhill East	5
New Toronto, Mimico South, Humber Bay Shores	2
North Toronto West	3

```
Northwood Park, York University                              2
Parkdale, Roncesvalles                                       8
Queen's Park, Ontario Provincial Government                 44
Regent Park, Harbourfront                                    9
Richmond, Adelaide, King                                    50
Rosedale                                                     2
Roselawn                                                     5
Runnymede, Swansea                                           9
St. James Town                                              49
St. James Town, Cabbagetown                                  4
Stn A PO Boxes                                              37
Studio District                                              7
Summerhill West, Rathnelly, South Hill, Forest …            8
The Annex, North Midtown, Yorkville                         11
The Beaches                                                  3
The Danforth West, Riverdale                                 5
The Kingsway, Montgomery Road , Old Mill North               3
Thorncliffe Park                                             2
Toronto Dominion Centre, Design Exchange                    50
University of Toronto, Harbord                               19
Westmount                                                    1
Willowdale                                                  15
Willowdale, Newtonbrook                                      3
Woodbine Heights                                             3
York Mills West                                              3
```

0.7   3. Analyze Each Neighborhood

```python
# one hot encoding
onehot = pd.get_dummies(Toronto_venues_sushi[['Venue Category']], prefix="",
 ↪prefix_sep="")

# add neighborhood column back to dataframe
onehot['Neighbourhood'] = Toronto_venues_sushi['Neighbourhood']

# move neighborhood column to the first column
fixed_columns = [onehot.columns[-1]] + list(onehot.columns[:-1])

onehot = onehot[fixed_columns]

print(onehot.shape)
onehot.head()
```

```
(778, 11)
```

[17]:   Neighbourhood Asian Restaurant \
     0   Cedarbrae   0

```
1                                    Cedarbrae                 0
2             Kennedy Park, Ionview, East Birchmount Park        0
3  Dorset Park, Wexford Heights, Scarborough Town…            0
4                                    Agincourt                 0
```

```
   Fast Food Restaurant  Grocery Store  Hawaiian Restaurant  \
0                     0              0                    0
1                     0              0                    0
2                     0              0                    0
3                     0              0                    0
4                     0              0                    0
```

```
   Japanese Restaurant  Korean Restaurant  Restaurant  Seafood Restaurant  \
0                    0                  0           0                   0
1                    0                  0           0                   0
2                    0                  0           0                   0
3                    1                  0           0                   0
4                    0                  0           0                   0
```

```
   Sushi Restaurant  Thai Restaurant
0                 1                0
1                 1                0
2                 1                0
3                 0                0
4                 1                0
```

[18]:
```python
onehot_grouped = onehot.groupby('Neighbourhood').mean().reset_index()
print(onehot_grouped.shape)
onehot_grouped
```

```
(68, 11)
```

[18]:
```
                                      Neighbourhood  Asian Restaurant  \
0                                          Agincourt          0.000000
1      Bathurst Manor, Wilson Heights, Downsview North          0.000000
2                                     Bayview Village          0.000000
3                     Bedford Park, Lawrence Manor East          0.000000
4                                         Berczy Park          0.033333
5          Brockton, Parkdale Village, Exhibition Place          0.000000
6                 Business reply mail Processing CentrE          0.000000
7    CN Tower, King and Spadina, Railway Lands, Har…          0.000000
8                 Canada Post Gateway Processing Centre          0.000000
9                                           Cedarbrae          0.000000
10                                  Central Bay Street          0.020408
11                                            Christie          0.000000
12                                  Church and Wellesley          0.031250
13              Clarks Corners, Tam O'Shanter, Sullivan          0.000000
```

14	Commerce Court, Victoria Hotel	0.020000
15	Davisville	0.000000
16	Davisville North	0.000000
17	Del Ray, Mount Dennis, Keelsdale and Silverthorn	0.000000
18	Don Mills	0.000000
19	Dorset Park, Wexford Heights, Scarborough Town…	0.000000
20	Dufferin, Dovercourt Village	0.000000
21	East Toronto	0.000000
22	Fairview, Henry Farm, Oriole	0.200000
23	First Canadian Place, Underground city	0.020000
24	Forest Hill North & West	0.000000
25	Garden District, Ryerson	0.022727
26	Glencairn	0.000000
27	Harbourfront East, Union Station, Toronto Islands	0.000000
28	High Park, The Junction South	0.000000
29	Hillcrest Village	0.000000
30	Humewood-Cedarvale	0.000000
31	India Bazaar, The Beaches West	0.000000
32	Kennedy Park, Ionview, East Birchmount Park	0.000000
33	Kensington Market, Chinatown, Grange Park	0.000000
34	Lawrence Manor, Lawrence Heights	0.000000
35	Lawrence Park	0.000000
36	Leaside	0.000000
37	Little Portugal, Trinity	0.000000
38	Milliken, Agincourt North, Steeles East, L'Amo…	0.000000
39	Mimico NW, The Queensway West, South of Bloor,…	0.250000
40	Moore Park, Summerhill East	0.000000
41	New Toronto, Mimico South, Humber Bay Shores	0.000000
42	North Toronto West	0.000000
43	Northwood Park, York University	0.000000
44	Parkdale, Roncesvalles	0.000000
45	Queen's Park, Ontario Provincial Government	0.022727
46	Regent Park, Harbourfront	0.000000
47	Richmond, Adelaide, King	0.020000
48	Rosedale	0.000000
49	Roselawn	0.000000
50	Runnymede, Swansea	0.000000
51	St. James Town	0.020408
52	St. James Town, Cabbagetown	0.000000
53	Stn A PO Boxes	0.027027
54	Studio District	0.000000
55	Summerhill West, Rathnelly, South Hill, Forest…	0.000000
56	The Annex, North Midtown, Yorkville	0.000000
57	The Beaches	0.000000
58	The Danforth West, Riverdale	0.000000
59	The Kingsway, Montgomery Road , Old Mill North	0.000000
60	Thorncliffe Park	0.000000

61	Toronto Dominion Centre, Design Exchange	0.020000
62	University of Toronto, Harbord	0.000000
63	Westmount	0.000000
64	Willowdale	0.000000
65	Willowdale, Newtonbrook	0.000000
66	Woodbine Heights	0.000000
67	York Mills West	0.000000

	Fast Food Restaurant	Grocery Store	Hawaiian Restaurant	\
0	0.000000	0.000000	0.000000	
1	0.000000	0.000000	0.000000	
2	0.000000	0.000000	0.000000	
3	0.000000	0.000000	0.000000	
4	0.000000	0.000000	0.000000	
5	0.000000	0.000000	0.000000	
6	0.000000	0.000000	0.000000	
7	0.000000	0.000000	0.000000	
8	0.000000	0.000000	0.000000	
9	0.000000	0.000000	0.000000	
10	0.020408	0.020408	0.000000	
11	0.000000	0.000000	0.000000	
12	0.031250	0.000000	0.000000	
13	0.000000	0.000000	0.000000	
14	0.000000	0.020000	0.000000	
15	0.000000	0.000000	0.000000	
16	0.000000	0.000000	0.000000	
17	0.000000	0.000000	0.000000	
18	0.000000	0.000000	0.000000	
19	0.000000	0.000000	0.000000	
20	0.000000	0.000000	0.000000	
21	0.000000	0.000000	0.000000	
22	0.000000	0.000000	0.000000	
23	0.000000	0.020000	0.000000	
24	0.000000	0.000000	0.000000	
25	0.022727	0.000000	0.000000	
26	0.000000	0.000000	0.000000	
27	0.000000	0.000000	0.000000	
28	0.000000	0.000000	0.000000	
29	0.000000	0.000000	0.000000	
30	0.000000	0.000000	0.000000	
31	0.000000	0.000000	0.000000	
32	0.000000	0.000000	0.000000	
33	0.000000	0.000000	0.043478	
34	0.000000	0.000000	0.000000	
35	0.000000	0.000000	0.000000	
36	0.000000	0.000000	0.000000	
37	0.000000	0.000000	0.000000	

38	0.000000	0.000000	0.000000
39	0.000000	0.000000	0.000000
40	0.000000	0.000000	0.000000
41	0.000000	0.000000	0.000000
42	0.000000	0.000000	0.000000
43	0.000000	0.000000	0.000000
44	0.000000	0.000000	0.000000
45	0.022727	0.000000	0.000000
46	0.000000	0.000000	0.000000
47	0.000000	0.020000	0.000000
48	0.000000	0.000000	0.000000
49	0.000000	0.000000	0.000000
50	0.000000	0.000000	0.000000
51	0.000000	0.020408	0.000000
52	0.000000	0.000000	0.000000
53	0.000000	0.000000	0.000000
54	0.000000	0.000000	0.000000
55	0.000000	0.000000	0.000000
56	0.000000	0.000000	0.000000
57	0.000000	0.000000	0.000000
58	0.000000	0.000000	0.000000
59	0.000000	0.000000	0.000000
60	0.000000	0.000000	0.000000
61	0.000000	0.020000	0.000000
62	0.000000	0.000000	0.000000
63	0.000000	0.000000	0.000000
64	0.000000	0.000000	0.000000
65	0.000000	0.000000	0.000000
66	0.000000	0.000000	0.000000
67	0.000000	0.000000	0.000000

	Japanese Restaurant	Korean Restaurant	Restaurant	Seafood Restaurant \
0	0.000000	0.00000	0.000000	0.000000
1	0.000000	0.00000	0.000000	0.000000
2	0.000000	0.00000	0.000000	0.000000
3	0.000000	0.00000	0.000000	0.000000
4	0.133333	0.00000	0.200000	0.000000
5	0.333333	0.00000	0.000000	0.000000
6	0.000000	0.00000	0.000000	0.000000
7	0.000000	0.00000	0.000000	0.000000
8	0.000000	0.00000	0.000000	0.000000
9	0.000000	0.00000	0.000000	0.000000
10	0.081633	0.00000	0.000000	0.000000
11	1.000000	0.00000	0.000000	0.000000
12	0.093750	0.03125	0.031250	0.000000
13	0.000000	0.00000	0.000000	0.000000
14	0.140000	0.00000	0.080000	0.000000

15	0.000000	0.00000	0.000000	0.000000
16	0.000000	0.00000	0.142857	0.000000
17	0.000000	0.00000	0.000000	0.000000
18	0.333333	0.00000	0.000000	0.000000
19	1.000000	0.00000	0.000000	0.000000
20	0.000000	0.00000	0.000000	0.000000
21	0.000000	0.00000	0.000000	0.000000
22	0.400000	0.00000	0.200000	0.000000
23	0.140000	0.00000	0.080000	0.000000
24	0.166667	0.00000	0.000000	0.000000
25	0.113636	0.00000	0.000000	0.000000
26	0.000000	0.00000	0.000000	0.000000
27	0.133333	0.00000	0.200000	0.000000
28	0.000000	0.00000	0.000000	0.000000
29	0.000000	0.00000	0.000000	0.000000
30	0.000000	0.00000	0.000000	0.000000
31	0.000000	0.00000	0.000000	0.000000
32	0.000000	0.00000	0.000000	0.000000
33	0.043478	0.00000	0.000000	0.043478
34	0.000000	0.00000	0.000000	0.000000
35	0.000000	0.00000	0.000000	0.000000
36	0.166667	0.00000	0.000000	0.000000
37	0.100000	0.00000	0.000000	0.000000
38	0.000000	0.00000	0.000000	0.000000
39	0.000000	0.00000	0.000000	0.000000
40	0.200000	0.00000	0.000000	0.000000
41	0.000000	0.00000	0.000000	0.000000
42	0.000000	0.00000	0.333333	0.000000
43	0.000000	0.00000	0.500000	0.000000
44	0.000000	0.00000	0.000000	0.000000
45	0.090909	0.00000	0.000000	0.000000
46	0.000000	0.00000	0.000000	0.000000
47	0.120000	0.00000	0.040000	0.000000
48	0.000000	0.50000	0.000000	0.000000
49	0.200000	0.00000	0.000000	0.000000
50	0.000000	0.00000	0.000000	0.000000
51	0.102041	0.00000	0.102041	0.000000
52	0.000000	0.25000	0.000000	0.000000
53	0.135135	0.00000	0.162162	0.000000
54	0.000000	0.00000	0.000000	0.000000
55	0.125000	0.00000	0.000000	0.000000
56	0.000000	0.00000	0.000000	0.000000
57	0.333333	0.00000	0.000000	0.000000
58	0.000000	0.00000	0.000000	0.000000
59	0.000000	0.00000	0.000000	0.000000
60	0.000000	0.00000	0.000000	0.000000
61	0.140000	0.00000	0.100000	0.000000

62	0.000000	0.00000	0.000000	0.000000
63	0.000000	0.00000	0.000000	0.000000
64	0.066667	0.00000	0.000000	0.000000
65	0.000000	0.00000	0.000000	0.000000
66	0.000000	0.00000	0.000000	0.000000
67	0.000000	0.00000	0.000000	0.000000

	Sushi Restaurant	Thai Restaurant
0	1.000000	0.000000
1	1.000000	0.000000
2	1.000000	0.000000
3	1.000000	0.000000
4	0.633333	0.000000
5	0.666667	0.000000
6	1.000000	0.000000
7	1.000000	0.000000
8	1.000000	0.000000
9	1.000000	0.000000
10	0.857143	0.000000
11	0.000000	0.000000
12	0.781250	0.000000
13	1.000000	0.000000
14	0.740000	0.000000
15	1.000000	0.000000
16	0.857143	0.000000
17	1.000000	0.000000
18	0.666667	0.000000
19	0.000000	0.000000
20	1.000000	0.000000
21	1.000000	0.000000
22	0.200000	0.000000
23	0.740000	0.000000
24	0.833333	0.000000
25	0.840909	0.000000
26	1.000000	0.000000
27	0.666667	0.000000
28	1.000000	0.000000
29	1.000000	0.000000
30	1.000000	0.000000
31	1.000000	0.000000
32	1.000000	0.000000
33	0.826087	0.043478
34	1.000000	0.000000
35	1.000000	0.000000
36	0.833333	0.000000
37	0.900000	0.000000
38	1.000000	0.000000

```
39        0.750000        0.000000
40        0.800000        0.000000
41        1.000000        0.000000
42        0.666667        0.000000
43        0.500000        0.000000
44        1.000000        0.000000
45        0.863636        0.000000
46        1.000000        0.000000
47        0.800000        0.000000
48        0.500000        0.000000
49        0.800000        0.000000
50        1.000000        0.000000
51        0.755102        0.000000
52        0.750000        0.000000
53        0.675676        0.000000
54        1.000000        0.000000
55        0.875000        0.000000
56        1.000000        0.000000
57        0.666667        0.000000
58        1.000000        0.000000
59        1.000000        0.000000
60        1.000000        0.000000
61        0.720000        0.000000
62        1.000000        0.000000
63        1.000000        0.000000
64        0.933333        0.000000
65        1.000000        0.000000
66        1.000000        0.000000
67        1.000000        0.000000
```

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

          return row_categories_sorted.index.values[0:num_top_venues]
```

```python
[36]: num_top_venues = 10

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

      # create columns according to number of top venues
      columns = ['Neighbourhood']
      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['Neighbourhood'] = onehot_grouped['Neighbourhood']

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

neighborhoods_venues_sorted.head()
```

[36]:

	Neighbourhood	1st Most Common Venue
0	Agincourt	Sushi Restaurant
1	Bathurst Manor, Wilson Heights, Downsview North	Sushi Restaurant
2	Bayview Village	Sushi Restaurant
3	Bedford Park, Lawrence Manor East	Sushi Restaurant
4	Berczy Park	Sushi Restaurant

	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue
0	Thai Restaurant	Seafood Restaurant	Restaurant
1	Thai Restaurant	Seafood Restaurant	Restaurant
2	Thai Restaurant	Seafood Restaurant	Restaurant
3	Thai Restaurant	Seafood Restaurant	Restaurant
4	Restaurant	Japanese Restaurant	Asian Restaurant

	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue
0	Korean Restaurant	Japanese Restaurant	Hawaiian Restaurant
1	Korean Restaurant	Japanese Restaurant	Hawaiian Restaurant
2	Korean Restaurant	Japanese Restaurant	Hawaiian Restaurant
3	Korean Restaurant	Japanese Restaurant	Hawaiian Restaurant
4	Thai Restaurant	Seafood Restaurant	Korean Restaurant

	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
0	Grocery Store	Fast Food Restaurant	Asian Restaurant
1	Grocery Store	Fast Food Restaurant	Asian Restaurant
2	Grocery Store	Fast Food Restaurant	Asian Restaurant
3	Grocery Store	Fast Food Restaurant	Asian Restaurant
4	Hawaiian Restaurant	Grocery Store	Fast Food Restaurant

Cluster Neighborhoods

[63]:
```
# set number of clusters
kclusters = 5

toronto_grouped_clustering = onehot_grouped.drop('Neighbourhood', 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]
```

[63]: array([1, 1, 1, 1, 2, 3, 1, 1, 1, 1], dtype=int32)

[64]: `neighborhoods_venues_sorted.columns`

[64]: Index(['Cluster Labels', 'Neighbourhood', '1st Most Common Venue',
           '2nd Most Common Venue', '3rd Most Common Venue',
           '4th Most Common Venue', '5th Most Common Venue',
           '6th Most Common Venue', '7th Most Common Venue',
           '8th Most Common Venue', '9th Most Common Venue',
           '10th Most Common Venue'],
          dtype='object')

[65]:
```
# add clustering labels

if 'Cluster Labels' in neighborhoods_venues_sorted.columns:
    print("neighborhoods_venues_sorted has Cluster Labels columns")
else:
    neighborhoods_venues_sorted.insert(0, 'Cluster Labels', kmeans.labels_)

toronto_merged = data
toronto_merged = toronto_merged.join(neighborhoods_venues_sorted.
 ↪set_index('Neighbourhood'), on='Neighbourhood')
toronto_merged.fillna(0,inplace=True)
toronto_merged[['Cluster Labels']] = toronto_merged[['Cluster Labels']].
 ↪astype(int)
toronto_merged
```

neighborhoods_venues_sorted has Cluster Labels columns

[65]:   Postcode   Borough \
        0   M1B   Scarborough
        1   M1C   Scarborough
        2   M1E   Scarborough
        3   M1G   Scarborough
        4   M1H   Scarborough
        5   M1J   Scarborough
        6   M1K   Scarborough
        7   M1L   Scarborough
        8   M1M   Scarborough
        9   M1N   Scarborough
        10   M1P   Scarborough

```
11      M1R          Scarborough
12      M1S          Scarborough
13      M1T          Scarborough
14      M1V          Scarborough
15      M1W          Scarborough
16      M1X          Scarborough
17      M2H           North York
18      M2J           North York
19      M2K           North York
20      M2L           North York
21      M2M           North York
22      M2N           North York
23      M2P           North York
24      M2R           North York
25      M3A           North York
26      M3B           North York
27      M3C           North York
28      M3H           North York
29      M3J           North York
30      M3K           North York
31      M3L           North York
32      M3M           North York
33      M3N           North York
34      M4A           North York
35      M4B            East York
36      M4C            East York
37      M4E         East Toronto
38      M4G            East York
39      M4H            East York
40      M4J            East York
41      M4K         East Toronto
42      M4L         East Toronto
43      M4M         East Toronto
44      M4N      Central Toronto
45      M4P      Central Toronto
46      M4R      Central Toronto
47      M4S      Central Toronto
48      M4T      Central Toronto
49      M4V      Central Toronto
50      M4W     Downtown Toronto
51      M4X     Downtown Toronto
52      M4Y     Downtown Toronto
53      M5A     Downtown Toronto
54      M5B     Downtown Toronto
55      M5C     Downtown Toronto
56      M5E     Downtown Toronto
57      M5G     Downtown Toronto
```

```
58   M5H  Downtown Toronto
59   M5J  Downtown Toronto
60   M5K  Downtown Toronto
61   M5L  Downtown Toronto
62   M5M         North York
63   M5N   Central Toronto
64   M5P   Central Toronto
65   M5R   Central Toronto
66   M5S  Downtown Toronto
67   M5T  Downtown Toronto
68   M5V  Downtown Toronto
69   M5W  Downtown Toronto
70   M5X  Downtown Toronto
71   M6A         North York
72   M6B         North York
73   M6C              York
74   M6E              York
75   M6G  Downtown Toronto
76   M6H      West Toronto
77   M6J      West Toronto
78   M6K      West Toronto
79   M6L         North York
80   M6M              York
81   M6N              York
82   M6P      West Toronto
83   M6R      West Toronto
84   M6S      West Toronto
85   M7A  Downtown Toronto
86   M7R        Mississauga
87   M7Y      East Toronto
88   M8V         Etobicoke
89   M8W         Etobicoke
90   M8X         Etobicoke
91   M8Y         Etobicoke
92   M8Z         Etobicoke
93   M9A         Etobicoke
94   M9B         Etobicoke
95   M9C         Etobicoke
96   M9L         North York
97   M9M         North York
98   M9N              York
99   M9P         Etobicoke
100  M9R         Etobicoke
101  M9V         Etobicoke
102  M9W         Etobicoke

                    Neighbourhood   Latitude   Longitude  \
```

0	Malvern, Rouge	43.806686	-79.194353
1	Rouge Hill, Port Union, Highland Creek	43.784535	-79.160497
2	Guildwood, Morningside, West Hill	43.763573	-79.188711
3	Woburn	43.770992	-79.216917
4	Cedarbrae	43.773136	-79.239476
5	Scarborough Village	43.744734	-79.239476
6	Kennedy Park, Ionview, East Birchmount Park	43.727929	-79.262029
7	Golden Mile, Clairlea, Oakridge	43.711112	-79.284577
8	Cliffside, Cliffcrest, Scarborough Village West	43.716316	-79.239476
9	Birch Cliff, Cliffside West	43.692657	-79.264848
10	Dorset Park, Wexford Heights, Scarborough Town…	43.757410	-79.273304
11	Wexford, Maryvale	43.750071	-79.295849
12	Agincourt	43.794200	-79.262029
13	Clarks Corners, Tam O'Shanter, Sullivan	43.781638	-79.304302
14	Milliken, Agincourt North, Steeles East, L'Amo…	43.815252	-79.284577
15	Steeles West, L'Amoreaux West	43.799525	-79.318389
16	Upper Rouge	43.836125	-79.205636
17	Hillcrest Village	43.803762	-79.363452
18	Fairview, Henry Farm, Oriole	43.778517	-79.346556
19	Bayview Village	43.786947	-79.385975
20	York Mills, Silver Hills	43.757490	-79.374714
21	Willowdale, Newtonbrook	43.789053	-79.408493
22	Willowdale	43.770120	-79.408493
23	York Mills West	43.752758	-79.400049
24	Willowdale	43.782736	-79.442259
25	Parkwoods	43.753259	-79.329656
26	Don Mills	43.745906	-79.352188
27	Don Mills	43.725900	-79.340923
28	Bathurst Manor, Wilson Heights, Downsview North	43.754328	-79.442259
29	Northwood Park, York University	43.767980	-79.487262
30	Downsview	43.737473	-79.464763
31	Downsview	43.739015	-79.506944
32	Downsview	43.728496	-79.495697
33	Downsview	43.761631	-79.520999
34	Victoria Village	43.725882	-79.315572
35	Parkview Hill, Woodbine Gardens	43.706397	-79.309937
36	Woodbine Heights	43.695344	-79.318389
37	The Beaches	43.676357	-79.293031
38	Leaside	43.709060	-79.363452
39	Thorncliffe Park	43.705369	-79.349372
40	East Toronto	43.685347	-79.338106
41	The Danforth West, Riverdale	43.679557	-79.352188
42	India Bazaar, The Beaches West	43.668999	-79.315572
43	Studio District	43.659526	-79.340923
44	Lawrence Park	43.728020	-79.388790
45	Davisville North	43.712751	-79.390197
46	North Toronto West	43.715383	-79.405678

```
47                                              Davisville  43.704324 -79.388790
48                            Moore Park, Summerhill East  43.689574 -79.383160
49   Summerhill West, Rathnelly, South Hill, Forest…  43.686412 -79.400049
50                                              Rosedale  43.679563 -79.377529
51                         St. James Town, Cabbagetown  43.667967 -79.367675
52                                 Church and Wellesley  43.665860 -79.383160
53                          Regent Park, Harbourfront  43.654260 -79.360636
54                            Garden District, Ryerson  43.657162 -79.378937
55                                     St. James Town  43.651494 -79.375418
56                                       Berczy Park  43.644771 -79.373306
57                                 Central Bay Street  43.657952 -79.387383
58                           Richmond, Adelaide, King  43.650571 -79.384568
59   Harbourfront East, Union Station, Toronto Islands  43.640816 -79.381752
60         Toronto Dominion Centre, Design Exchange  43.647177 -79.381576
61                     Commerce Court, Victoria Hotel  43.648198 -79.379817
62             Bedford Park, Lawrence Manor East  43.733283 -79.419750
63                                         Roselawn  43.711695 -79.416936
64                         Forest Hill North & West  43.696948 -79.411307
65             The Annex, North Midtown, Yorkville  43.672710 -79.405678
66                 University of Toronto, Harbord  43.662696 -79.400049
67       Kensington Market, Chinatown, Grange Park  43.653206 -79.400049
68   CN Tower, King and Spadina, Railway Lands, Har…  43.628947 -79.394420
69                                   Stn A PO Boxes  43.646435 -79.374846
70         First Canadian Place, Underground city  43.648429 -79.382280
71             Lawrence Manor, Lawrence Heights  43.718518 -79.464763
72                                       Glencairn  43.709577 -79.445073
73                              Humewood-Cedarvale  43.693781 -79.428191
74                             Caledonia-Fairbanks  43.689026 -79.453512
75                                         Christie  43.669542 -79.422564
76                     Dufferin, Dovercourt Village  43.669005 -79.442259
77                         Little Portugal, Trinity  43.647927 -79.419750
78       Brockton, Parkdale Village, Exhibition Place  43.636847 -79.428191
79         North Park, Maple Leaf Park, Upwood Park  43.713756 -79.490074
80   Del Ray, Mount Dennis, Keelsdale and Silverthorn  43.691116 -79.476013
81                 Runnymede, The Junction North  43.673185 -79.487262
82                   High Park, The Junction South  43.661608 -79.464763
83                         Parkdale, Roncesvalles  43.648960 -79.456325
84                             Runnymede, Swansea  43.651571 -79.484450
85       Queen's Park, Ontario Provincial Government  43.662301 -79.389494
86             Canada Post Gateway Processing Centre  43.636966 -79.615819
87             Business reply mail Processing CentrE  43.662744 -79.321558
88     New Toronto, Mimico South, Humber Bay Shores  43.605647 -79.501321
89                             Alderwood, Long Branch  43.602414 -79.543484
90     The Kingsway, Montgomery Road , Old Mill North  43.653654 -79.506944
91   Old Mill South, King's Mill Park, Sunnylea, Hu…  43.636258 -79.498509
92   Mimico NW, The Queensway West, South of Bloor,…  43.628841 -79.520999
93                                 Islington Avenue  43.667856 -79.532242
```

```
94    West Deane Park, Princess Gardens, Martin Grov…  43.650943 -79.554724
95    Eringate, Bloordale Gardens, Old Burnhamthorpe…  43.643515 -79.577201
96                                     Humber Summit   43.756303 -79.565963
97                                   Humberlea, Emery  43.724766 -79.532242
98                                            Weston   43.706876 -79.518188
99                                         Westmount   43.696319 -79.532242
100  Kingsview Village, St. Phillips, Martin Grove …  43.688905 -79.554724
101  South Steeles, Silverstone, Humbergate, Jamest…  43.739416 -79.588437
102                                        Northwest   43.706748 -79.594054
```

	Cluster Labels	1st Most Common Venue	2nd Most Common Venue
0	0	0	0
1	0	0	0
2	0	0	0
3	0	0	0
4	0	Sushi Restaurant	Thai Restaurant
5	0	0	0
6	0	Sushi Restaurant	Thai Restaurant
7	0	0	0
8	0	0	0
9	0	0	0
10	4	Japanese Restaurant	Thai Restaurant
11	0	0	0
12	0	Sushi Restaurant	Thai Restaurant
13	0	Sushi Restaurant	Thai Restaurant
14	0	Sushi Restaurant	Thai Restaurant
15	0	0	0
16	0	0	0
17	0	Sushi Restaurant	Thai Restaurant
18	1	Japanese Restaurant	Sushi Restaurant
19	0	Sushi Restaurant	Thai Restaurant
20	0	0	0
21	0	Sushi Restaurant	Thai Restaurant
22	0	Sushi Restaurant	Japanese Restaurant
23	0	Sushi Restaurant	Thai Restaurant
24	0	Sushi Restaurant	Japanese Restaurant
25	0	0	0
26	2	Sushi Restaurant	Japanese Restaurant
27	2	Sushi Restaurant	Japanese Restaurant
28	0	Sushi Restaurant	Thai Restaurant
29	3	Sushi Restaurant	Restaurant
30	0	0	0
31	0	0	0
32	0	0	0
33	0	0	0
34	0	0	0
35	0	0	0

36	0	Sushi Restaurant	Thai Restaurant
37	2	Sushi Restaurant	Japanese Restaurant
38	2	Sushi Restaurant	Japanese Restaurant
39	0	Sushi Restaurant	Thai Restaurant
40	0	Sushi Restaurant	Thai Restaurant
41	0	Sushi Restaurant	Thai Restaurant
42	0	Sushi Restaurant	Thai Restaurant
43	0	Sushi Restaurant	Thai Restaurant
44	0	Sushi Restaurant	Thai Restaurant
45	0	Sushi Restaurant	Restaurant
46	3	Sushi Restaurant	Restaurant
47	0	Sushi Restaurant	Thai Restaurant
48	2	Sushi Restaurant	Japanese Restaurant
49	2	Sushi Restaurant	Japanese Restaurant
50	5	Sushi Restaurant	Korean Restaurant
51	2	Sushi Restaurant	Korean Restaurant
52	2	Sushi Restaurant	Japanese Restaurant
53	0	Sushi Restaurant	Thai Restaurant
54	2	Sushi Restaurant	Japanese Restaurant
55	2	Sushi Restaurant	Restaurant
56	3	Sushi Restaurant	Restaurant
57	2	Sushi Restaurant	Japanese Restaurant
58	2	Sushi Restaurant	Japanese Restaurant
59	3	Sushi Restaurant	Restaurant
60	2	Sushi Restaurant	Japanese Restaurant
61	2	Sushi Restaurant	Japanese Restaurant
62	0	Sushi Restaurant	Thai Restaurant
63	2	Sushi Restaurant	Japanese Restaurant
64	2	Sushi Restaurant	Japanese Restaurant
65	0	Sushi Restaurant	Thai Restaurant
66	0	Sushi Restaurant	Thai Restaurant
67	2	Sushi Restaurant	Thai Restaurant
68	0	Sushi Restaurant	Thai Restaurant
69	3	Sushi Restaurant	Restaurant
70	2	Sushi Restaurant	Japanese Restaurant
71	0	Sushi Restaurant	Thai Restaurant
72	0	Sushi Restaurant	Thai Restaurant
73	0	Sushi Restaurant	Thai Restaurant
74	0	0	0
75	4	Japanese Restaurant	Thai Restaurant
76	0	Sushi Restaurant	Thai Restaurant
77	2	Sushi Restaurant	Japanese Restaurant
78	2	Sushi Restaurant	Japanese Restaurant
79	0	0	0
80	0	Sushi Restaurant	Thai Restaurant
81	0	0	0
82	0	Sushi Restaurant	Thai Restaurant

83	0	Sushi Restaurant	Thai Restaurant
84	0	Sushi Restaurant	Thai Restaurant
85	2	Sushi Restaurant	Japanese Restaurant
86	0	Sushi Restaurant	Thai Restaurant
87	0	Sushi Restaurant	Thai Restaurant
88	0	Sushi Restaurant	Thai Restaurant
89	0	0	0
90	0	Sushi Restaurant	Thai Restaurant
91	0	0	0
92	2	Sushi Restaurant	Asian Restaurant
93	0	0	0
94	0	0	0
95	0	0	0
96	0	0	0
97	0	0	0
98	0	0	0
99	0	Sushi Restaurant	Thai Restaurant
100	0	0	0
101	0	0	0
102	0	0	0

	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue \
0	0	0	0
1	0	0	0
2	0	0	0
3	0	0	0
4	Seafood Restaurant	Restaurant	Korean Restaurant
5	0	0	0
6	Seafood Restaurant	Restaurant	Korean Restaurant
7	0	0	0
8	0	0	0
9	0	0	0
10	Sushi Restaurant	Seafood Restaurant	Restaurant
11	0	0	0
12	Seafood Restaurant	Restaurant	Korean Restaurant
13	Seafood Restaurant	Restaurant	Korean Restaurant
14	Seafood Restaurant	Restaurant	Korean Restaurant
15	0	0	0
16	0	0	0
17	Seafood Restaurant	Restaurant	Korean Restaurant
18	Restaurant	Asian Restaurant	Thai Restaurant
19	Seafood Restaurant	Restaurant	Korean Restaurant
20	0	0	0
21	Seafood Restaurant	Restaurant	Korean Restaurant
22	Thai Restaurant	Seafood Restaurant	Restaurant
23	Seafood Restaurant	Restaurant	Korean Restaurant
24	Thai Restaurant	Seafood Restaurant	Restaurant

25	0	0	0
26	Thai Restaurant	Seafood Restaurant	Restaurant
27	Thai Restaurant	Seafood Restaurant	Restaurant
28	Seafood Restaurant	Restaurant	Korean Restaurant
29	Thai Restaurant	Seafood Restaurant	Korean Restaurant
30	0	0	0
31	0	0	0
32	0	0	0
33	0	0	0
34	0	0	0
35	0	0	0
36	Seafood Restaurant	Restaurant	Korean Restaurant
37	Thai Restaurant	Seafood Restaurant	Restaurant
38	Thai Restaurant	Seafood Restaurant	Restaurant
39	Seafood Restaurant	Restaurant	Korean Restaurant
40	Seafood Restaurant	Restaurant	Korean Restaurant
41	Seafood Restaurant	Restaurant	Korean Restaurant
42	Seafood Restaurant	Restaurant	Korean Restaurant
43	Seafood Restaurant	Restaurant	Korean Restaurant
44	Seafood Restaurant	Restaurant	Korean Restaurant
45	Thai Restaurant	Seafood Restaurant	Korean Restaurant
46	Thai Restaurant	Seafood Restaurant	Korean Restaurant
47	Seafood Restaurant	Restaurant	Korean Restaurant
48	Thai Restaurant	Seafood Restaurant	Restaurant
49	Thai Restaurant	Seafood Restaurant	Restaurant
50	Thai Restaurant	Seafood Restaurant	Restaurant
51	Thai Restaurant	Seafood Restaurant	Restaurant
52	Restaurant	Korean Restaurant	Fast Food Restaurant
53	Seafood Restaurant	Restaurant	Korean Restaurant
54	Fast Food Restaurant	Asian Restaurant	Thai Restaurant
55	Japanese Restaurant	Grocery Store	Asian Restaurant
56	Japanese Restaurant	Asian Restaurant	Thai Restaurant
57	Grocery Store	Fast Food Restaurant	Asian Restaurant
58	Restaurant	Grocery Store	Asian Restaurant
59	Japanese Restaurant	Thai Restaurant	Seafood Restaurant
60	Restaurant	Grocery Store	Asian Restaurant
61	Restaurant	Grocery Store	Asian Restaurant
62	Seafood Restaurant	Restaurant	Korean Restaurant
63	Thai Restaurant	Seafood Restaurant	Restaurant
64	Thai Restaurant	Seafood Restaurant	Restaurant
65	Seafood Restaurant	Restaurant	Korean Restaurant
66	Seafood Restaurant	Restaurant	Korean Restaurant
67	Seafood Restaurant	Japanese Restaurant	Hawaiian Restaurant
68	Seafood Restaurant	Restaurant	Korean Restaurant
69	Japanese Restaurant	Asian Restaurant	Thai Restaurant
70	Restaurant	Grocery Store	Asian Restaurant
71	Seafood Restaurant	Restaurant	Korean Restaurant

72	Seafood Restaurant	Restaurant	Korean Restaurant
73	Seafood Restaurant	Restaurant	Korean Restaurant
74	0	0	0
75	Sushi Restaurant	Seafood Restaurant	Restaurant
76	Seafood Restaurant	Restaurant	Korean Restaurant
77	Thai Restaurant	Seafood Restaurant	Restaurant
78	Thai Restaurant	Seafood Restaurant	Restaurant
79	0	0	0
80	Seafood Restaurant	Restaurant	Korean Restaurant
81	0	0	0
82	Seafood Restaurant	Restaurant	Korean Restaurant
83	Seafood Restaurant	Restaurant	Korean Restaurant
84	Seafood Restaurant	Restaurant	Korean Restaurant
85	Fast Food Restaurant	Asian Restaurant	Thai Restaurant
86	Seafood Restaurant	Restaurant	Korean Restaurant
87	Seafood Restaurant	Restaurant	Korean Restaurant
88	Seafood Restaurant	Restaurant	Korean Restaurant
89	0	0	0
90	Seafood Restaurant	Restaurant	Korean Restaurant
91	0	0	0
92	Thai Restaurant	Seafood Restaurant	Restaurant
93	0	0	0
94	0	0	0
95	0	0	0
96	0	0	0
97	0	0	0
98	0	0	0
99	Seafood Restaurant	Restaurant	Korean Restaurant
100	0	0	0
101	0	0	0
102	0	0	0

	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue \
0	0	0	0
1	0	0	0
2	0	0	0
3	0	0	0
4	Japanese Restaurant	Hawaiian Restaurant	Grocery Store
5	0	0	0
6	Japanese Restaurant	Hawaiian Restaurant	Grocery Store
7	0	0	0
8	0	0	0
9	0	0	0
10	Korean Restaurant	Hawaiian Restaurant	Grocery Store
11	0	0	0
12	Japanese Restaurant	Hawaiian Restaurant	Grocery Store
13	Japanese Restaurant	Hawaiian Restaurant	Grocery Store

14	Japanese Restaurant	Hawaiian Restaurant	Grocery Store
15	0	0	0
16	0	0	0
17	Japanese Restaurant	Hawaiian Restaurant	Grocery Store
18	Seafood Restaurant	Korean Restaurant	Hawaiian Restaurant
19	Japanese Restaurant	Hawaiian Restaurant	Grocery Store
20	0	0	0
21	Japanese Restaurant	Hawaiian Restaurant	Grocery Store
22	Korean Restaurant	Hawaiian Restaurant	Grocery Store
23	Japanese Restaurant	Hawaiian Restaurant	Grocery Store
24	Korean Restaurant	Hawaiian Restaurant	Grocery Store
25	0	0	0
26	Korean Restaurant	Hawaiian Restaurant	Grocery Store
27	Korean Restaurant	Hawaiian Restaurant	Grocery Store
28	Japanese Restaurant	Hawaiian Restaurant	Grocery Store
29	Japanese Restaurant	Hawaiian Restaurant	Grocery Store
30	0	0	0
31	0	0	0
32	0	0	0
33	0	0	0
34	0	0	0
35	0	0	0
36	Japanese Restaurant	Hawaiian Restaurant	Grocery Store
37	Korean Restaurant	Hawaiian Restaurant	Grocery Store
38	Korean Restaurant	Hawaiian Restaurant	Grocery Store
39	Japanese Restaurant	Hawaiian Restaurant	Grocery Store
40	Japanese Restaurant	Hawaiian Restaurant	Grocery Store
41	Japanese Restaurant	Hawaiian Restaurant	Grocery Store
42	Japanese Restaurant	Hawaiian Restaurant	Grocery Store
43	Japanese Restaurant	Hawaiian Restaurant	Grocery Store
44	Japanese Restaurant	Hawaiian Restaurant	Grocery Store
45	Japanese Restaurant	Hawaiian Restaurant	Grocery Store
46	Japanese Restaurant	Hawaiian Restaurant	Grocery Store
47	Japanese Restaurant	Hawaiian Restaurant	Grocery Store
48	Korean Restaurant	Hawaiian Restaurant	Grocery Store
49	Korean Restaurant	Hawaiian Restaurant	Grocery Store
50	Japanese Restaurant	Hawaiian Restaurant	Grocery Store
51	Japanese Restaurant	Hawaiian Restaurant	Grocery Store
52	Asian Restaurant	Thai Restaurant	Seafood Restaurant
53	Japanese Restaurant	Hawaiian Restaurant	Grocery Store
54	Seafood Restaurant	Restaurant	Korean Restaurant
55	Thai Restaurant	Seafood Restaurant	Korean Restaurant
56	Seafood Restaurant	Korean Restaurant	Hawaiian Restaurant
57	Thai Restaurant	Seafood Restaurant	Restaurant
58	Thai Restaurant	Seafood Restaurant	Korean Restaurant
59	Korean Restaurant	Hawaiian Restaurant	Grocery Store
60	Thai Restaurant	Seafood Restaurant	Korean Restaurant

61	Thai Restaurant	Seafood Restaurant	Korean Restaurant
62	Japanese Restaurant	Hawaiian Restaurant	Grocery Store
63	Korean Restaurant	Hawaiian Restaurant	Grocery Store
64	Korean Restaurant	Hawaiian Restaurant	Grocery Store
65	Japanese Restaurant	Hawaiian Restaurant	Grocery Store
66	Japanese Restaurant	Hawaiian Restaurant	Grocery Store
67	Restaurant	Korean Restaurant	Grocery Store
68	Japanese Restaurant	Hawaiian Restaurant	Grocery Store
69	Seafood Restaurant	Korean Restaurant	Hawaiian Restaurant
70	Thai Restaurant	Seafood Restaurant	Korean Restaurant
71	Japanese Restaurant	Hawaiian Restaurant	Grocery Store
72	Japanese Restaurant	Hawaiian Restaurant	Grocery Store
73	Japanese Restaurant	Hawaiian Restaurant	Grocery Store
74	0	0	0
75	Korean Restaurant	Hawaiian Restaurant	Grocery Store
76	Japanese Restaurant	Hawaiian Restaurant	Grocery Store
77	Korean Restaurant	Hawaiian Restaurant	Grocery Store
78	Korean Restaurant	Hawaiian Restaurant	Grocery Store
79	0	0	0
80	Japanese Restaurant	Hawaiian Restaurant	Grocery Store
81	0	0	0
82	Japanese Restaurant	Hawaiian Restaurant	Grocery Store
83	Japanese Restaurant	Hawaiian Restaurant	Grocery Store
84	Japanese Restaurant	Hawaiian Restaurant	Grocery Store
85	Seafood Restaurant	Restaurant	Korean Restaurant
86	Japanese Restaurant	Hawaiian Restaurant	Grocery Store
87	Japanese Restaurant	Hawaiian Restaurant	Grocery Store
88	Japanese Restaurant	Hawaiian Restaurant	Grocery Store
89	0	0	0
90	Japanese Restaurant	Hawaiian Restaurant	Grocery Store
91	0	0	0
92	Korean Restaurant	Japanese Restaurant	Hawaiian Restaurant
93	0	0	0
94	0	0	0
95	0	0	0
96	0	0	0
97	0	0	0
98	0	0	0
99	Japanese Restaurant	Hawaiian Restaurant	Grocery Store
100	0	0	0
101	0	0	0
102	0	0	0

	9th Most Common Venue	10th Most Common Venue
0	0	0
1	0	0
2	0	0

3	0	0
4	Fast Food Restaurant	Asian Restaurant
5	0	0
6	Fast Food Restaurant	Asian Restaurant
7	0	0
8	0	0
9	0	0
10	Fast Food Restaurant	Asian Restaurant
11	0	0
12	Fast Food Restaurant	Asian Restaurant
13	Fast Food Restaurant	Asian Restaurant
14	Fast Food Restaurant	Asian Restaurant
15	0	0
16	0	0
17	Fast Food Restaurant	Asian Restaurant
18	Grocery Store	Fast Food Restaurant
19	Fast Food Restaurant	Asian Restaurant
20	0	0
21	Fast Food Restaurant	Asian Restaurant
22	Fast Food Restaurant	Asian Restaurant
23	Fast Food Restaurant	Asian Restaurant
24	Fast Food Restaurant	Asian Restaurant
25	0	0
26	Fast Food Restaurant	Asian Restaurant
27	Fast Food Restaurant	Asian Restaurant
28	Fast Food Restaurant	Asian Restaurant
29	Fast Food Restaurant	Asian Restaurant
30	0	0
31	0	0
32	0	0
33	0	0
34	0	0
35	0	0
36	Fast Food Restaurant	Asian Restaurant
37	Fast Food Restaurant	Asian Restaurant
38	Fast Food Restaurant	Asian Restaurant
39	Fast Food Restaurant	Asian Restaurant
40	Fast Food Restaurant	Asian Restaurant
41	Fast Food Restaurant	Asian Restaurant
42	Fast Food Restaurant	Asian Restaurant
43	Fast Food Restaurant	Asian Restaurant
44	Fast Food Restaurant	Asian Restaurant
45	Fast Food Restaurant	Asian Restaurant
46	Fast Food Restaurant	Asian Restaurant
47	Fast Food Restaurant	Asian Restaurant
48	Fast Food Restaurant	Asian Restaurant
49	Fast Food Restaurant	Asian Restaurant

```
50    Fast Food Restaurant        Asian Restaurant
51    Fast Food Restaurant        Asian Restaurant
52     Hawaiian Restaurant           Grocery Store
53    Fast Food Restaurant        Asian Restaurant
54     Hawaiian Restaurant           Grocery Store
55     Hawaiian Restaurant    Fast Food Restaurant
56            Grocery Store    Fast Food Restaurant
57       Korean Restaurant     Hawaiian Restaurant
58     Hawaiian Restaurant    Fast Food Restaurant
59    Fast Food Restaurant        Asian Restaurant
60     Hawaiian Restaurant    Fast Food Restaurant
61     Hawaiian Restaurant    Fast Food Restaurant
62    Fast Food Restaurant        Asian Restaurant
63    Fast Food Restaurant        Asian Restaurant
64    Fast Food Restaurant        Asian Restaurant
65    Fast Food Restaurant        Asian Restaurant
66    Fast Food Restaurant        Asian Restaurant
67    Fast Food Restaurant        Asian Restaurant
68    Fast Food Restaurant        Asian Restaurant
69            Grocery Store    Fast Food Restaurant
70     Hawaiian Restaurant    Fast Food Restaurant
71    Fast Food Restaurant        Asian Restaurant
72    Fast Food Restaurant        Asian Restaurant
73    Fast Food Restaurant        Asian Restaurant
74                       0                       0
75    Fast Food Restaurant        Asian Restaurant
76    Fast Food Restaurant        Asian Restaurant
77    Fast Food Restaurant        Asian Restaurant
78    Fast Food Restaurant        Asian Restaurant
79                       0                       0
80    Fast Food Restaurant        Asian Restaurant
81                       0                       0
82    Fast Food Restaurant        Asian Restaurant
83    Fast Food Restaurant        Asian Restaurant
84    Fast Food Restaurant        Asian Restaurant
85     Hawaiian Restaurant           Grocery Store
86    Fast Food Restaurant        Asian Restaurant
87    Fast Food Restaurant        Asian Restaurant
88    Fast Food Restaurant        Asian Restaurant
89                       0                       0
90    Fast Food Restaurant        Asian Restaurant
91                       0                       0
92            Grocery Store    Fast Food Restaurant
93                       0                       0
94                       0                       0
95                       0                       0
96                       0                       0
```

```
97                          0                      0
98                          0                      0
99    Fast Food Restaurant       Asian Restaurant
100                         0                      0
101                         0                      0
102                         0                      0
```

[66]:
```python
# 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'], toronto_merged['Neighbourhood'],
 toronto_merged['Cluster Labels']):
    label = folium.Popup(str(poi) + ' Cluster ' + str(cluster), parse_html=True)
    folium.CircleMarker(
        [lat, lon],
        radius=5,
        popup=label,
        color=rainbow[cluster-1],
        fill=True,
        fill_color=rainbow[cluster-1],
        fill_opacity=0.7).add_to(map_clusters)

map_clusters
```

[66]: <folium.folium.Map at 0x7fc3587970b8>

[67]:
```python
print('There are {} uniques cluster labels.'.format(len(toronto_merged['Cluster
 Labels'].unique()))))
```

There are 6 uniques cluster labels.

[68]:
```python
toronto_merged.loc[toronto_merged['Cluster Labels'] == 0, toronto_merged.
 columns[[1] + list(range(5, toronto_merged.shape[1]))]]
```

[68]:
```
           Borough  Cluster Labels 1st Most Common Venue  \
0      Scarborough               0                      0
1      Scarborough               0                      0
2      Scarborough               0                      0
```

3	Scarborough	0	0
4	Scarborough	0	Sushi Restaurant
5	Scarborough	0	0
6	Scarborough	0	Sushi Restaurant
7	Scarborough	0	0
8	Scarborough	0	0
9	Scarborough	0	0
11	Scarborough	0	0
12	Scarborough	0	Sushi Restaurant
13	Scarborough	0	Sushi Restaurant
14	Scarborough	0	Sushi Restaurant
15	Scarborough	0	0
16	Scarborough	0	0
17	North York	0	Sushi Restaurant
19	North York	0	Sushi Restaurant
20	North York	0	0
21	North York	0	Sushi Restaurant
22	North York	0	Sushi Restaurant
23	North York	0	Sushi Restaurant
24	North York	0	Sushi Restaurant
25	North York	0	0
28	North York	0	Sushi Restaurant
30	North York	0	0
31	North York	0	0
32	North York	0	0
33	North York	0	0
34	North York	0	0
35	East York	0	0
36	East York	0	Sushi Restaurant
39	East York	0	Sushi Restaurant
40	East York	0	Sushi Restaurant
41	East Toronto	0	Sushi Restaurant
42	East Toronto	0	Sushi Restaurant
43	East Toronto	0	Sushi Restaurant
44	Central Toronto	0	Sushi Restaurant
45	Central Toronto	0	Sushi Restaurant
47	Central Toronto	0	Sushi Restaurant
53	Downtown Toronto	0	Sushi Restaurant
62	North York	0	Sushi Restaurant
65	Central Toronto	0	Sushi Restaurant
66	Downtown Toronto	0	Sushi Restaurant
68	Downtown Toronto	0	Sushi Restaurant
71	North York	0	Sushi Restaurant
72	North York	0	Sushi Restaurant
73	York	0	Sushi Restaurant
74	York	0	0
76	West Toronto	0	Sushi Restaurant

79	North York	0	0
80	York	0	Sushi Restaurant
81	York	0	0
82	West Toronto	0	Sushi Restaurant
83	West Toronto	0	Sushi Restaurant
84	West Toronto	0	Sushi Restaurant
86	Mississauga	0	Sushi Restaurant
87	East Toronto	0	Sushi Restaurant
88	Etobicoke	0	Sushi Restaurant
89	Etobicoke	0	0
90	Etobicoke	0	Sushi Restaurant
91	Etobicoke	0	0
93	Etobicoke	0	0
94	Etobicoke	0	0
95	Etobicoke	0	0
96	North York	0	0
97	North York	0	0
98	York	0	0
99	Etobicoke	0	Sushi Restaurant
100	Etobicoke	0	0
101	Etobicoke	0	0
102	Etobicoke	0	0

	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue \
0	0	0	0
1	0	0	0
2	0	0	0
3	0	0	0
4	Thai Restaurant	Seafood Restaurant	Restaurant
5	0	0	0
6	Thai Restaurant	Seafood Restaurant	Restaurant
7	0	0	0
8	0	0	0
9	0	0	0
11	0	0	0
12	Thai Restaurant	Seafood Restaurant	Restaurant
13	Thai Restaurant	Seafood Restaurant	Restaurant
14	Thai Restaurant	Seafood Restaurant	Restaurant
15	0	0	0
16	0	0	0
17	Thai Restaurant	Seafood Restaurant	Restaurant
19	Thai Restaurant	Seafood Restaurant	Restaurant
20	0	0	0
21	Thai Restaurant	Seafood Restaurant	Restaurant
22	Japanese Restaurant	Thai Restaurant	Seafood Restaurant
23	Thai Restaurant	Seafood Restaurant	Restaurant
24	Japanese Restaurant	Thai Restaurant	Seafood Restaurant

25	0	0	0
28	Thai Restaurant	Seafood Restaurant	Restaurant
30	0	0	0
31	0	0	0
32	0	0	0
33	0	0	0
34	0	0	0
35	0	0	0
36	Thai Restaurant	Seafood Restaurant	Restaurant
39	Thai Restaurant	Seafood Restaurant	Restaurant
40	Thai Restaurant	Seafood Restaurant	Restaurant
41	Thai Restaurant	Seafood Restaurant	Restaurant
42	Thai Restaurant	Seafood Restaurant	Restaurant
43	Thai Restaurant	Seafood Restaurant	Restaurant
44	Thai Restaurant	Seafood Restaurant	Restaurant
45	Restaurant	Thai Restaurant	Seafood Restaurant
47	Thai Restaurant	Seafood Restaurant	Restaurant
53	Thai Restaurant	Seafood Restaurant	Restaurant
62	Thai Restaurant	Seafood Restaurant	Restaurant
65	Thai Restaurant	Seafood Restaurant	Restaurant
66	Thai Restaurant	Seafood Restaurant	Restaurant
68	Thai Restaurant	Seafood Restaurant	Restaurant
71	Thai Restaurant	Seafood Restaurant	Restaurant
72	Thai Restaurant	Seafood Restaurant	Restaurant
73	Thai Restaurant	Seafood Restaurant	Restaurant
74	0	0	0
76	Thai Restaurant	Seafood Restaurant	Restaurant
79	0	0	0
80	Thai Restaurant	Seafood Restaurant	Restaurant
81	0	0	0
82	Thai Restaurant	Seafood Restaurant	Restaurant
83	Thai Restaurant	Seafood Restaurant	Restaurant
84	Thai Restaurant	Seafood Restaurant	Restaurant
86	Thai Restaurant	Seafood Restaurant	Restaurant
87	Thai Restaurant	Seafood Restaurant	Restaurant
88	Thai Restaurant	Seafood Restaurant	Restaurant
89	0	0	0
90	Thai Restaurant	Seafood Restaurant	Restaurant
91	0	0	0
93	0	0	0
94	0	0	0
95	0	0	0
96	0	0	0
97	0	0	0
98	0	0	0
99	Thai Restaurant	Seafood Restaurant	Restaurant
100	0	0	0

```
101                        0                   0                    0
102                        0                   0                    0

     5th Most Common Venue 6th Most Common Venue 7th Most Common Venue  \
0                        0                   0                    0
1                        0                   0                    0
2                        0                   0                    0
3                        0                   0                    0
4        Korean Restaurant    Japanese Restaurant    Hawaiian Restaurant
5                        0                   0                    0
6        Korean Restaurant    Japanese Restaurant    Hawaiian Restaurant
7                        0                   0                    0
8                        0                   0                    0
9                        0                   0                    0
11                       0                   0                    0
12       Korean Restaurant    Japanese Restaurant    Hawaiian Restaurant
13       Korean Restaurant    Japanese Restaurant    Hawaiian Restaurant
14       Korean Restaurant    Japanese Restaurant    Hawaiian Restaurant
15                       0                   0                    0
16                       0                   0                    0
17       Korean Restaurant    Japanese Restaurant    Hawaiian Restaurant
19       Korean Restaurant    Japanese Restaurant    Hawaiian Restaurant
20                       0                   0                    0
21       Korean Restaurant    Japanese Restaurant    Hawaiian Restaurant
22               Restaurant      Korean Restaurant    Hawaiian Restaurant
23       Korean Restaurant    Japanese Restaurant    Hawaiian Restaurant
24               Restaurant      Korean Restaurant    Hawaiian Restaurant
25                       0                   0                    0
28       Korean Restaurant    Japanese Restaurant    Hawaiian Restaurant
30                       0                   0                    0
31                       0                   0                    0
32                       0                   0                    0
33                       0                   0                    0
34                       0                   0                    0
35                       0                   0                    0
36       Korean Restaurant    Japanese Restaurant    Hawaiian Restaurant
39       Korean Restaurant    Japanese Restaurant    Hawaiian Restaurant
40       Korean Restaurant    Japanese Restaurant    Hawaiian Restaurant
41       Korean Restaurant    Japanese Restaurant    Hawaiian Restaurant
42       Korean Restaurant    Japanese Restaurant    Hawaiian Restaurant
43       Korean Restaurant    Japanese Restaurant    Hawaiian Restaurant
44       Korean Restaurant    Japanese Restaurant    Hawaiian Restaurant
45       Korean Restaurant    Japanese Restaurant    Hawaiian Restaurant
47       Korean Restaurant    Japanese Restaurant    Hawaiian Restaurant
53       Korean Restaurant    Japanese Restaurant    Hawaiian Restaurant
62       Korean Restaurant    Japanese Restaurant    Hawaiian Restaurant
65       Korean Restaurant    Japanese Restaurant    Hawaiian Restaurant
```

66	Korean Restaurant	Japanese Restaurant	Hawaiian Restaurant
68	Korean Restaurant	Japanese Restaurant	Hawaiian Restaurant
71	Korean Restaurant	Japanese Restaurant	Hawaiian Restaurant
72	Korean Restaurant	Japanese Restaurant	Hawaiian Restaurant
73	Korean Restaurant	Japanese Restaurant	Hawaiian Restaurant
74	0	0	0
76	Korean Restaurant	Japanese Restaurant	Hawaiian Restaurant
79	0	0	0
80	Korean Restaurant	Japanese Restaurant	Hawaiian Restaurant
81	0	0	0
82	Korean Restaurant	Japanese Restaurant	Hawaiian Restaurant
83	Korean Restaurant	Japanese Restaurant	Hawaiian Restaurant
84	Korean Restaurant	Japanese Restaurant	Hawaiian Restaurant
86	Korean Restaurant	Japanese Restaurant	Hawaiian Restaurant
87	Korean Restaurant	Japanese Restaurant	Hawaiian Restaurant
88	Korean Restaurant	Japanese Restaurant	Hawaiian Restaurant
89	0	0	0
90	Korean Restaurant	Japanese Restaurant	Hawaiian Restaurant
91	0	0	0
93	0	0	0
94	0	0	0
95	0	0	0
96	0	0	0
97	0	0	0
98	0	0	0
99	Korean Restaurant	Japanese Restaurant	Hawaiian Restaurant
100	0	0	0
101	0	0	0
102	0	0	0

	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
0	0	0	0
1	0	0	0
2	0	0	0
3	0	0	0
4	Grocery Store	Fast Food Restaurant	Asian Restaurant
5	0	0	0
6	Grocery Store	Fast Food Restaurant	Asian Restaurant
7	0	0	0
8	0	0	0
9	0	0	0
11	0	0	0
12	Grocery Store	Fast Food Restaurant	Asian Restaurant
13	Grocery Store	Fast Food Restaurant	Asian Restaurant
14	Grocery Store	Fast Food Restaurant	Asian Restaurant
15	0	0	0
16	0	0	0

17	Grocery Store	Fast Food Restaurant	Asian Restaurant
19	Grocery Store	Fast Food Restaurant	Asian Restaurant
20	0	0	0
21	Grocery Store	Fast Food Restaurant	Asian Restaurant
22	Grocery Store	Fast Food Restaurant	Asian Restaurant
23	Grocery Store	Fast Food Restaurant	Asian Restaurant
24	Grocery Store	Fast Food Restaurant	Asian Restaurant
25	0	0	0
28	Grocery Store	Fast Food Restaurant	Asian Restaurant
30	0	0	0
31	0	0	0
32	0	0	0
33	0	0	0
34	0	0	0
35	0	0	0
36	Grocery Store	Fast Food Restaurant	Asian Restaurant
39	Grocery Store	Fast Food Restaurant	Asian Restaurant
40	Grocery Store	Fast Food Restaurant	Asian Restaurant
41	Grocery Store	Fast Food Restaurant	Asian Restaurant
42	Grocery Store	Fast Food Restaurant	Asian Restaurant
43	Grocery Store	Fast Food Restaurant	Asian Restaurant
44	Grocery Store	Fast Food Restaurant	Asian Restaurant
45	Grocery Store	Fast Food Restaurant	Asian Restaurant
47	Grocery Store	Fast Food Restaurant	Asian Restaurant
53	Grocery Store	Fast Food Restaurant	Asian Restaurant
62	Grocery Store	Fast Food Restaurant	Asian Restaurant
65	Grocery Store	Fast Food Restaurant	Asian Restaurant
66	Grocery Store	Fast Food Restaurant	Asian Restaurant
68	Grocery Store	Fast Food Restaurant	Asian Restaurant
71	Grocery Store	Fast Food Restaurant	Asian Restaurant
72	Grocery Store	Fast Food Restaurant	Asian Restaurant
73	Grocery Store	Fast Food Restaurant	Asian Restaurant
74	0	0	0
76	Grocery Store	Fast Food Restaurant	Asian Restaurant
79	0	0	0
80	Grocery Store	Fast Food Restaurant	Asian Restaurant
81	0	0	0
82	Grocery Store	Fast Food Restaurant	Asian Restaurant
83	Grocery Store	Fast Food Restaurant	Asian Restaurant
84	Grocery Store	Fast Food Restaurant	Asian Restaurant
86	Grocery Store	Fast Food Restaurant	Asian Restaurant
87	Grocery Store	Fast Food Restaurant	Asian Restaurant
88	Grocery Store	Fast Food Restaurant	Asian Restaurant
89	0	0	0
90	Grocery Store	Fast Food Restaurant	Asian Restaurant
91	0	0	0
93	0	0	0

```
94                  0                    0                      0
95                  0                    0                      0
96                  0                    0                      0
97                  0                    0                      0
98                  0                    0                      0
99      Grocery Store   Fast Food Restaurant      Asian Restaurant
100                 0                    0                      0
101                 0                    0                      0
102                 0                    0                      0
```

[69]:
```python
toronto_merged.loc[toronto_merged['Cluster Labels'] == 1, toronto_merged.
 →columns[[1] + list(range(5, toronto_merged.shape[1]))]]
```

[69]:
```
        Borough  Cluster Labels 1st Most Common Venue 2nd Most Common Venue  \
18   North York               1   Japanese Restaurant      Sushi Restaurant

    3rd Most Common Venue 4th Most Common Venue 5th Most Common Venue  \
18             Restaurant      Asian Restaurant       Thai Restaurant

    6th Most Common Venue 7th Most Common Venue 8th Most Common Venue  \
18      Seafood Restaurant     Korean Restaurant   Hawaiian Restaurant

    9th Most Common Venue 10th Most Common Venue
18          Grocery Store   Fast Food Restaurant
```

[70]:
```python
toronto_merged.loc[toronto_merged['Cluster Labels'] == 2, toronto_merged.
 →columns[[1] + list(range(5, toronto_merged.shape[1]))]]
```

[70]:
```
              Borough  Cluster Labels 1st Most Common Venue  \
26         North York               2      Sushi Restaurant
27         North York               2      Sushi Restaurant
37        East Toronto               2      Sushi Restaurant
38           East York               2      Sushi Restaurant
48     Central Toronto               2      Sushi Restaurant
49     Central Toronto               2      Sushi Restaurant
51    Downtown Toronto               2      Sushi Restaurant
52    Downtown Toronto               2      Sushi Restaurant
54    Downtown Toronto               2      Sushi Restaurant
55    Downtown Toronto               2      Sushi Restaurant
57    Downtown Toronto               2      Sushi Restaurant
58    Downtown Toronto               2      Sushi Restaurant
60    Downtown Toronto               2      Sushi Restaurant
61    Downtown Toronto               2      Sushi Restaurant
63     Central Toronto               2      Sushi Restaurant
64     Central Toronto               2      Sushi Restaurant
67    Downtown Toronto               2      Sushi Restaurant
70    Downtown Toronto               2      Sushi Restaurant
```

```
77      West Toronto             2      Sushi Restaurant
78      West Toronto             2      Sushi Restaurant
85   Downtown Toronto            2      Sushi Restaurant
92        Etobicoke              2      Sushi Restaurant


    2nd Most Common Venue 3rd Most Common Venue 4th Most Common Venue  \
26    Japanese Restaurant       Thai Restaurant    Seafood Restaurant
27    Japanese Restaurant       Thai Restaurant    Seafood Restaurant
37    Japanese Restaurant       Thai Restaurant    Seafood Restaurant
38    Japanese Restaurant       Thai Restaurant    Seafood Restaurant
48    Japanese Restaurant       Thai Restaurant    Seafood Restaurant
49    Japanese Restaurant       Thai Restaurant    Seafood Restaurant
51      Korean Restaurant       Thai Restaurant    Seafood Restaurant
52    Japanese Restaurant            Restaurant     Korean Restaurant
54    Japanese Restaurant  Fast Food Restaurant      Asian Restaurant
55             Restaurant   Japanese Restaurant         Grocery Store
57    Japanese Restaurant         Grocery Store  Fast Food Restaurant
58    Japanese Restaurant            Restaurant         Grocery Store
60    Japanese Restaurant            Restaurant         Grocery Store
61    Japanese Restaurant            Restaurant         Grocery Store
63    Japanese Restaurant       Thai Restaurant    Seafood Restaurant
64    Japanese Restaurant       Thai Restaurant    Seafood Restaurant
67        Thai Restaurant    Seafood Restaurant   Japanese Restaurant
70    Japanese Restaurant            Restaurant         Grocery Store
77    Japanese Restaurant       Thai Restaurant    Seafood Restaurant
78    Japanese Restaurant       Thai Restaurant    Seafood Restaurant
85    Japanese Restaurant  Fast Food Restaurant      Asian Restaurant
92       Asian Restaurant       Thai Restaurant    Seafood Restaurant


    5th Most Common Venue 6th Most Common Venue 7th Most Common Venue  \
26             Restaurant     Korean Restaurant   Hawaiian Restaurant
27             Restaurant     Korean Restaurant   Hawaiian Restaurant
37             Restaurant     Korean Restaurant   Hawaiian Restaurant
38             Restaurant     Korean Restaurant   Hawaiian Restaurant
48             Restaurant     Korean Restaurant   Hawaiian Restaurant
49             Restaurant     Korean Restaurant   Hawaiian Restaurant
51             Restaurant   Japanese Restaurant   Hawaiian Restaurant
52   Fast Food Restaurant      Asian Restaurant       Thai Restaurant
54        Thai Restaurant    Seafood Restaurant            Restaurant
55       Asian Restaurant       Thai Restaurant    Seafood Restaurant
57       Asian Restaurant       Thai Restaurant    Seafood Restaurant
58       Asian Restaurant       Thai Restaurant    Seafood Restaurant
60       Asian Restaurant       Thai Restaurant    Seafood Restaurant
61       Asian Restaurant       Thai Restaurant    Seafood Restaurant
63             Restaurant     Korean Restaurant   Hawaiian Restaurant
64             Restaurant     Korean Restaurant   Hawaiian Restaurant
67    Hawaiian Restaurant            Restaurant     Korean Restaurant
```

```
70      Asian Restaurant      Thai Restaurant    Seafood Restaurant
77            Restaurant    Korean Restaurant    Hawaiian Restaurant
78            Restaurant    Korean Restaurant    Hawaiian Restaurant
85      Thai Restaurant    Seafood Restaurant           Restaurant
92            Restaurant    Korean Restaurant    Japanese Restaurant

    8th Most Common Venue 9th Most Common Venue 10th Most Common Venue
26          Grocery Store  Fast Food Restaurant       Asian Restaurant
27          Grocery Store  Fast Food Restaurant       Asian Restaurant
37          Grocery Store  Fast Food Restaurant       Asian Restaurant
38          Grocery Store  Fast Food Restaurant       Asian Restaurant
48          Grocery Store  Fast Food Restaurant       Asian Restaurant
49          Grocery Store  Fast Food Restaurant       Asian Restaurant
51          Grocery Store  Fast Food Restaurant       Asian Restaurant
52     Seafood Restaurant    Hawaiian Restaurant          Grocery Store
54      Korean Restaurant    Hawaiian Restaurant          Grocery Store
55      Korean Restaurant    Hawaiian Restaurant   Fast Food Restaurant
57            Restaurant      Korean Restaurant     Hawaiian Restaurant
58      Korean Restaurant    Hawaiian Restaurant   Fast Food Restaurant
60      Korean Restaurant    Hawaiian Restaurant   Fast Food Restaurant
61      Korean Restaurant    Hawaiian Restaurant   Fast Food Restaurant
63          Grocery Store  Fast Food Restaurant       Asian Restaurant
64          Grocery Store  Fast Food Restaurant       Asian Restaurant
67          Grocery Store  Fast Food Restaurant       Asian Restaurant
70      Korean Restaurant    Hawaiian Restaurant   Fast Food Restaurant
77          Grocery Store  Fast Food Restaurant       Asian Restaurant
78          Grocery Store  Fast Food Restaurant       Asian Restaurant
85      Korean Restaurant    Hawaiian Restaurant          Grocery Store
92    Hawaiian Restaurant          Grocery Store   Fast Food Restaurant
```

```python
toronto_merged.loc[toronto_merged['Cluster Labels'] == 3, toronto_merged.
  columns[[1] + list(range(5, toronto_merged.shape[1]))]]
```

```
[71]:                  Borough  Cluster Labels 1st Most Common Venue  \
29          North York               3        Sushi Restaurant
46     Central Toronto               3        Sushi Restaurant
56    Downtown Toronto               3        Sushi Restaurant
59    Downtown Toronto               3        Sushi Restaurant
69    Downtown Toronto               3        Sushi Restaurant

    2nd Most Common Venue 3rd Most Common Venue 4th Most Common Venue  \
29            Restaurant      Thai Restaurant    Seafood Restaurant
46            Restaurant      Thai Restaurant    Seafood Restaurant
56            Restaurant    Japanese Restaurant    Asian Restaurant
59            Restaurant    Japanese Restaurant     Thai Restaurant
69            Restaurant    Japanese Restaurant    Asian Restaurant
```

```
     5th Most Common Venue 6th Most Common Venue 7th Most Common Venue  \
29        Korean Restaurant    Japanese Restaurant    Hawaiian Restaurant
46        Korean Restaurant    Japanese Restaurant    Hawaiian Restaurant
56          Thai Restaurant     Seafood Restaurant      Korean Restaurant
59       Seafood Restaurant       Korean Restaurant    Hawaiian Restaurant
69          Thai Restaurant     Seafood Restaurant      Korean Restaurant

     8th Most Common Venue 9th Most Common Venue 10th Most Common Venue
29           Grocery Store  Fast Food Restaurant        Asian Restaurant
46           Grocery Store  Fast Food Restaurant        Asian Restaurant
56       Hawaiian Restaurant         Grocery Store   Fast Food Restaurant
59           Grocery Store  Fast Food Restaurant        Asian Restaurant
69       Hawaiian Restaurant         Grocery Store   Fast Food Restaurant
```

[72]:
```python
toronto_merged.loc[toronto_merged['Cluster Labels'] == 4, toronto_merged.
 ↪columns[[1] + list(range(5, toronto_merged.shape[1]))]]
```

[72]:
```
             Borough  Cluster Labels 1st Most Common Venue  \
10        Scarborough               4    Japanese Restaurant
75  Downtown Toronto               4    Japanese Restaurant

    2nd Most Common Venue 3rd Most Common Venue 4th Most Common Venue  \
10        Thai Restaurant       Sushi Restaurant     Seafood Restaurant
75        Thai Restaurant       Sushi Restaurant     Seafood Restaurant

    5th Most Common Venue 6th Most Common Venue 7th Most Common Venue  \
10              Restaurant       Korean Restaurant    Hawaiian Restaurant
75              Restaurant       Korean Restaurant    Hawaiian Restaurant

    8th Most Common Venue 9th Most Common Venue 10th Most Common Venue
10           Grocery Store  Fast Food Restaurant        Asian Restaurant
75           Grocery Store  Fast Food Restaurant        Asian Restaurant
```

[73]:
```python
toronto_merged.loc[toronto_merged['Cluster Labels'] == 5, toronto_merged.
 ↪columns[[1] + list(range(5, toronto_merged.shape[1]))]]
```

[73]:
```
             Borough  Cluster Labels 1st Most Common Venue  \
50  Downtown Toronto               5        Sushi Restaurant

    2nd Most Common Venue 3rd Most Common Venue 4th Most Common Venue  \
50      Korean Restaurant        Thai Restaurant     Seafood Restaurant

    5th Most Common Venue 6th Most Common Venue 7th Most Common Venue  \
50              Restaurant    Japanese Restaurant    Hawaiian Restaurant

    8th Most Common Venue 9th Most Common Venue 10th Most Common Venue
50           Grocery Store  Fast Food Restaurant        Asian Restaurant
```

0.8 Results and Discussion

Our analysis shows that although there is a great number of Sushi restaurants in Toronto (~800 in our initial area of interest which was radius 1000 around each neighbourhood), there are pockets of low restaurant density fairly close to city center. Highest concentration of restaurants was detected in downtown Toronto area, so we focused our attention to areas north, north-east, far away from downtown area.

Those location candidates were then clustered to create zones of interest which contain greatest number of location candidates. Purpose of this analysis was to only provide info on areas in Toronto but not crowded with existing restaurants (particularly Sushi) - it is entirely possible that there is a very good reason for small number of restaurants in any of those areas, reasons which would make them unsuitable for a new restaurant regardless of lack of competition in the area. Recommended zones should therefore be considered only as a starting point for more detailed analysis which could eventually result in location which has not only no nearby competition but also other factors taken into account and all other relevant conditions met.

0.9 Conclusion

Purpose of this project was to identify Toronto areas close to center with low number of restaurants (particularly SUshi restaurants) in order to aid stakeholders in narrowing down the search for optimal location for a new Sushi restaurant. By calculating restaurant density distribution from Foursquare data we have first identified general avenues that justify further analysis. Clustering of those locations was then performed in order to create major zones of interest (containing greatest number of potential locations) and addresses of those zone centers were created to be used as starting points for final exploration by stakeholders. From the clustering results, area near cluster 2, cluster 4 and cluster 5 might be good to open a new restaurant. However, since cluster 5 is a address in Downtown, it's better to drop this choice. So let's choose cluster 2 and cluster 4 as candidates.

Final decision on optimal restaurant location will be made by stakeholders based on specific characteristics of neighborhoods and locations in every recommended zone, taking into consideration additional factors like attractiveness of each location (proximity to park or water), levels of noise / proximity to major roads, real estate availability, prices, social and economic dynamics of every neighborhood etc.