

Capstone Project - The Battle of the Neighborhoods (Week 2)

Applied Data Science Capstone by IBM/Coursera

Table of contents

- [Introduction: Business Problem](#)
- [Data](#)
- [Methodology](#)
- [Analysis](#)
- [Results and Discussion](#)
- [Conclusion](#)

Introduction: Business Problem

1) We are a fast food brand looking for the best place to open a shop in Toronto. In general we are looking for a place of concentration families with kids, because children are just crazy about cheap and tasty food and don't care if it is healthy or not.

2) Probably, that place already has other fast foods nearby (we are not the only smart guys here), this will be the first marker. A bakery or confectionery would be another sign of a correct place for us. And the third marker could be an event place or a playground. Ideally, there won't be many competitors to our business. Let's analyze the neighbourhoods and see if there is something suitable for us.

Data

1) Get postal codes data from Wiki (within the city of Toronto in the province of Ontario)

In [84]:

```
from bs4 import BeautifulSoup
import requests
import csv
import lxml
import re
import pandas as pd
import numpy as np
from sklearn.cluster import KMeans
```

In [85]:

```
source = requests.get('https://en.wikipedia.org/wiki/List_of_postal_codes_of_Canada:_M').text
soup = BeautifulSoup(source, 'lxml')

my_table = soup.find('table', {'class': 'wikitable sortable'})
thread = my_table.findAll('th')
thread = str(thread).split(',')
for el in range(len(thread)):
    thread[el] = thread[el].replace("[", "")
    thread[el] = thread[el].replace("]", "")
    thread[el] = thread[el].replace("<th>", "")
    thread[el] = thread[el].replace("</th>", "")
    thread[el] = thread[el].replace("\n", "")
    thread[el] = thread[el].strip()

tbody = my_table.findAll('td')
#print(tbody)
table = []
for el in range(0, len(tbody), 3):
    temp_list = []
    temp_list.append(tbody[el])
    temp_list.append(tbody[el+1])
    temp_list.append(tbody[el+2])
```

```

temp_list.append(body[el+2])
table.append(temp_list)
#print(table)
def pattern_recognition(word):
    code1 = re.compile('title=\"(.*)\"')
    match_code1 = code1.search(word)
    if match_code1:
        return match_code1.group(0)

frame = []
for unit in table:
    temp_frame = []
    for el in unit:
        el = str(el).replace("<td>", "")
        el = str(el).replace("</td>", "")
        el = str(el).replace("\n", "")
        pattern = pattern_recognition(el)
        if pattern != None:
            pattern = pattern.replace("title=\"", "")
            pattern = pattern.replace("\"", "")
            temp_frame.append(pattern)
        else:
            temp_frame.append(el)
    frame.append(temp_frame)

df = pd.DataFrame(frame)
df.columns = [thread[0], thread[1], thread[2]]
df.replace('Not assigned', np.NaN, inplace=True)
df.head(20)

```

Out[85]:

	Postcode	Borough	Neighbourhood
0	M1A	NaN	NaN
1	M2A	NaN	NaN
2	M3A	North York	Parkwoods
3	M4A	North York	Victoria Village
4	M5A	Downtown Toronto	Harbourfront (Toronto)
5	M5A	Downtown Toronto	Regent Park
6	M6A	North York	Lawrence Heights
7	M6A	North York	Lawrence Manor
8	M7A	Queen's Park (Toronto)	NaN
9	M8A	NaN	NaN
10	M9A	Etobicoke	Islington Avenue
11	M1B	Scarborough, Toronto	Rouge, Toronto
12	M1B	Scarborough, Toronto	Malvern, Toronto
13	M2B	NaN	NaN
14	M3B	North York	Don Mills North
15	M4B	East York	Woodbine Gardens
16	M4B	East York	Parkview Hill
17	M5B	Downtown Toronto	Ryerson
18	M5B	Downtown Toronto	Garden District
19	M6B	North York	Glencairn

In [86]:

```
df.shape
```

Out[86]:

(288, 3)

In [87]:

```
df.Borough.unique()
```

Out[87]:

```
array([nan, 'North York', 'Downtown Toronto', "Queen's Park (Toronto)",
       'Etobicoke', 'Scarborough, Toronto', 'East York', 'York',
       'East Toronto', 'West Toronto', 'Central Toronto', 'Mississauga'],
      dtype=object)
```

In [88]:

```
df['Neighbourhood'].isnull().value_counts()
```

Out[88]:

```
False    210
True       78
Name: Neighbourhood, dtype: int64
```

In [89]:

```
df['Borough'].isnull().value_counts()
```

Out[89]:

```
False    211
True       77
Name: Borough, dtype: int64
```

In [90]:

```
df = df[df['Borough'].notnull()]
df.head()
```

Out[90]:

	Postcode	Borough	Neighbourhood
2	M3A	North York	Parkwoods
3	M4A	North York	Victoria Village
4	M5A	Downtown Toronto	Harbourfront (Toronto)
5	M5A	Downtown Toronto	Regent Park
6	M6A	North York	Lawrence Heights

In [91]:

```
df.shape
```

Out[91]:

```
(211, 3)
```

In [92]:

```
df['Neighbourhood'] = df.apply(
    lambda row: row['Borough'] if pd.isnull(row['Neighbourhood']) else row['Neighbourhood'],
    axis=1)
df.head(10)
```

Out[92]:

	Postcode	Borough	Neighbourhood
2	M3A	North York	Parkwoods
3	M4A	North York	Victoria Village
4	M5A	Downtown Toronto	Harbourfront (Toronto)
5	M5A	Downtown Toronto	Regent Park
6	M6A	North York	Lawrence Heights
7	M6A	North York	Lawrence Manor
8	M7A	Queen's Park (Toronto)	Queen's Park (Toronto)
10	M9A	Etobicoke	Islington Avenue
11	M1B	Scarborough, Toronto	Rouge, Toronto
12	M1B	Scarborough, Toronto	Malvern, Toronto

In [93]:

```
df.index = pd.RangeIndex(len(df.index))
df.head()
```

Out [93]:

	Postcode	Borough	Neighbourhood
0	M3A	North York	Parkwoods
1	M4A	North York	Victoria Village
2	M5A	Downtown Toronto	Harbourfront (Toronto)
3	M5A	Downtown Toronto	Regent Park
4	M6A	North York	Lawrence Heights

In [94]:

```
result1 = [df['Postcode'][0]]
result2 = [df['Borough'][0]]
result3 = [df['Neighbourhood'][0]]

for k, a, b in zip(df['Postcode'][1:], df['Borough'][1:], df['Neighbourhood'][1:]):
    if k == result1[-1] and b != result3[-1]: # If k matches the last value in result1,
        result3[-1] += ", " + b # add a to the last value of result3
    else: # Otherwise add a new row with the values
        result1.append(k)
        result2.append(a)
        result3.append(b)

# Create a new dataframe using these result lists
data = pd.DataFrame({'Postcode': result1, 'Borough': result2, 'Neighbourhood': result3})
data.head(20)
```

Out [94]:

	Postcode	Borough	Neighbourhood
0	M3A	North York	Parkwoods
1	M4A	North York	Victoria Village
2	M5A	Downtown Toronto	Harbourfront (Toronto), Regent Park
3	M6A	North York	Lawrence Heights, Lawrence Manor
4	M7A	Queen's Park (Toronto)	Queen's Park (Toronto)
5	M9A	Etobicoke	Islington Avenue
6	M1B	Scarborough, Toronto	Rouge, Toronto, Malvern, Toronto
7	M3B	North York	Don Mills North
8	M4B	East York	Woodbine Gardens, Parkview Hill

	Postcode	Borough	Neighbourhood
9	M5B	Downtown Toronto	Ryerson, Garden District
10	M6B	North York	Glencairn
11	M9B	Etobicoke	Cloverdale, Islington, Toronto, Martin Grove, ...
12	M1C	Scarborough, Toronto	Highland Creek (Toronto), Rouge Hill, Port Uni...
13	M3C	North York	Flemingdon Park, Don Mills South
14	M4C	East York	Woodbine Heights
15	M5C	Downtown Toronto	St. James Town
16	M6C	York	Humewood-Cedarvale
17	M9C	Etobicoke	Bloordale Gardens, Eringate, Markland Wood, Ol...
18	M1E	Scarborough, Toronto	Guildwood, Morningside, Toronto, West Hill, To...
19	M4E	East Toronto	The Beaches

In [95]:

```
data.shape
```

Out[95]:

```
(103, 3)
```

2) Add GPS coordinates

In [96]:

```
df_coord = pd.read_csv('Geospatial_Coordinates.csv')
df_coord.head()
```

Out[96]:

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

In [97]:

```
df_coord.shape
```

Out[97]:

```
(103, 3)
```

In [98]:

```
df_coord.rename(columns={'Postal Code':'Postcode'}, inplace=True)
df_coord.head()
```

Out[98]:

	Postcode	Latitude	Longitude
0	M1B	43.806686	-79.194353
1	M1C	43.784535	-79.160497
2	M1E	43.763573	-79.188711
3	M1G	43.770992	-79.216917
4	M1H	43.773136	-79.239476

```
Postcode Latitude Longitude
```

In [121]:

```
frames = [data,df_coord]
df_keys = pd.merge(data,df_coord, on='Postcode')
df_keys.head()
```

Out[121]:

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

In [122]:

```
df_keys.rename(columns={'Postcode':'PostalCode'}, inplace=True)
df_keys.head()
```

Out[122]:

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

Methodology

In this project we will be looking for the best places to open a new fast food restaurant. The places must satisfy the following criterias:

- suitable for families with children
- presence of bakery or confectionery
- presence of event place or playground To do that we need to get information about venue already existed in each area using Foursquare API and pull out the most common ones. Then cluster all the areas using k-mean classifier. And analyse whether a certain cluster match our criterias or not.

Analysis

Let's perform some explanatory data analysis and derive some additional info from our raw data

1) Plotting the data

In [123]:

```
import matplotlib.cm as cm
import matplotlib.colors as colors
import folium
from geopy.geocoders import Nominatim
```

In [124]:

```
address = 'Toronto'
```

```

geolocator = Nominatim(user_agent="ny_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 43.653963, -79.387207.

In [125]:

```

# create map of Toronto using latitude and longitude values
map_newyork = folium.Map(location=[latitude, longitude], zoom_start=10)

# add markers to map
for lat, lng, borough, neighborhood in zip(df_keys['Latitude'], df_keys['Longitude'], df_keys['Borough'], df_keys['Neighbourhood']):
    label = '{} {}'.format(neighborhood, borough)
    label = folium.Popup(label, parse_html=True)
    folium.CircleMarker(
        [lat, lng],
        radius=5,
        popup=label,
        color='blue',
        fill=True,
        fill_color='#3186cc',
        fill_opacity=0.7,
        parse_html=False).add_to(map_newyork)

map_newyork

```

Out[125]:

2) Get venue data in each Neighbourhood using Foursquare

In [126]:

```

CLIENT_ID = 'OSUQFPQS1YKMG4YH1AN5BHBHPKGTNAEHSPXYDUR5URYXEHTX'
CLIENT_SECRET = '1U0U0DMU4CL4AQRILIOSB4VVVFFZYIR1VMNUBY5CEPEMRE1Z'
VERSION = '20180605'

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

```

Your credentails:

CLIENT_ID: OSUQFPQS1YKMG4YH1AN5BHBHPKGTNAEHSPXYDUR5URYXEHTX

CLIENT_SECRET:1U0U0DMU4CL4AQRLILOS4VVFVFFZYIR1VMNUBY5CEPEMRE1Z

3) Explore Neighborhoods

In [104]:

```
def getNearbyVenues(names, latitudes, longitudes, radius=500,LIMIT=100):

    venues_list=[]
    for name, lat, lng in zip(names, latitudes, longitudes):
        print(name)

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

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

        # return only relevant information for each nearby venue
        venues_list.append([(
            name,
            lat,
            lng,
            v['venue']['name'],
            v['venue']['location']['lat'],
            v['venue']['location']['lng'],
            v['venue']['categories'][0]['name']) for v in results])

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

    return(nearby_venues)
```

In [55]:

```
Toronto_venues = getNearbyVenues(names=df_keys['Neighbourhood'],
                                  latitudes=df_keys['Latitude'],
                                  longitudes=df_keys['Longitude']
                                  )
```

Parkwoods
Victoria Village
Harbourfront (Toronto), Regent Park
Lawrence Heights, Lawrence Manor
Queen's Park (Toronto)
Islington Avenue
Rouge, Toronto, Malvern, Toronto
Don Mills North
Woodbine Gardens, Parkview Hill
Ryerson, Garden District
Glencairn
Cloverdale, Islington, Toronto, Martin Grove, Princess Gardens, West Deane Park
Highland Creek (Toronto), Rouge Hill, Port Union, Toronto
Flemingdon Park, Don Mills South
Woodbine Heights
St. James Town
Humanaud Cedarvale

Humberwood-Cedarvale

Bloordale Gardens, Eringate, Markland Wood, Old Burnhamthorpe

Guildwood, Morningside, Toronto, West Hill, Toronto

The Beaches

Berczy Park

Caledonia-Fairbanks

Woburn, Toronto

Leaside

Central Bay Street

Christie

Cedarbrae

Hillcrest Village

Bathurst Manor, Downsview North, Wilson Heights, Toronto

Thorncliffe Park

Adelaide, King, Richmond

Dovercourt Village, Dufferin

Scarborough Village

Fairview, Henry Farm, Oriole

Northwood Park, York University

East Toronto

Harbourfront East, Toronto Islands, Union Station (Toronto)

Little Portugal, Toronto, Trinity-Bellwoods

East Birchmount Park, Ionview, Kennedy Park, Toronto

Bayview Village

CFB Toronto, Downsview East

The Danforth West, Riverdale, Toronto

Design Exchange, Toronto Dominion Centre

Brockton, Exhibition Place, Parkdale Village

Clairlea, Golden Mile, Toronto, Oakridge, Toronto

Silver Hills, York Mills

Downsview

The Beaches West, India Bazaar

Commerce Court, Victoria Hotel

Downsview, Toronto, North Park, Upwood Park

Humber Summit

Cliffcrest, Cliffside, Toronto, Scarborough Village West

Newtonbrook, Willowdale, Toronto

Downsview Central

Studio District

Bedford Park, Toronto, Lawrence Manor East

Del Ray, Keelesdale, Mount Dennis, Silverthorn, Toronto

Emery, Toronto, Humberlea

Birch Cliff, Cliffside West

Willowdale South

Downsview Northwest

Lawrence Park, Toronto

Roselawn

The Junction North, Runnymede

Weston, Toronto

Dorset Park, Scarborough Town Centre, Wexford Heights

York Mills West

Davisville North

Forest Hill North, Forest Hill West

High Park, The Junction South

Westmount

Maryvale, Toronto, Wexford, Toronto

Willowdale West

North Toronto West

The Annex, North Midtown, Yorkville, Toronto

Parkdale, Toronto, Roncesvalles, Toronto

Canada Post Gateway Processing Centre

Kingsview Village, Martin Grove Gardens, Richview Gardens, St. Phillips

Agincourt, Toronto

Davisville

Harbord, University of Toronto

Runnymede, Toronto, Swansea, Toronto

Clarks Corners, Sullivan, Tam O'Shanter - Sullivan

Moore Park, Toronto, Summerhill East

Chinatown, Toronto, Grange Park (Toronto), Kensington Market

Agincourt North, L'Amoreaux East, Milliken, Ontario, Steeles East

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

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

Humber Bay Shores, Mimico South, New Toronto

Albion Gardens, Beaumont Heights, Humbergate, Mount Olive-Silverstone-Jamestown, Mount Olive-Silverstone-Jamestown, Silverstone, Toronto, South Steeles, Thistletown

L'Amoreaux West

Rosedale, Toronto

Rosedale, Toronto
Stn A PO Boxes 25 The Esplanade
Alderwood, Toronto, Long Branch, Toronto
Northwest
Upper Rouge
Cabbagetown, Toronto, St. James Town
First Canadian Place, Underground city
The Kingsway, Montgomery Road, Old Mill North
Church and Wellesley
Business Reply Mail Processing Centre 969 Eastern
Humber Bay, King's Mill Park, Kingsway Park South East, Mimico, Old Mill, Toronto, The Queensway,
Fairmont Royal York Hotel, Sunnylea
Kingsway Park South West, Mimico, The Queensway, Royal York South West, South of Bloor

In [127]:

```
print(Toronto_venues.shape)
Toronto_venues.head()
```

(2247, 7)

Out[127]:

	Neighbourhood	Neighbourhood Latitude	Neighbourhood Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
0	Parkwoods	43.753259	-79.329656	Brookbanks Park	43.751976	-79.332140	Park
1	Parkwoods	43.753259	-79.329656	KFC	43.754387	-79.333021	Fast Food Restaurant
2	Parkwoods	43.753259	-79.329656	Variety Store	43.751974	-79.333114	Food & Drink Shop
3	Parkwoods	43.753259	-79.329656	TTC stop - 44 Valley Woods	43.755402	-79.333741	Bus Stop
4	Victoria Village	43.725882	-79.315572	Victoria Village Arena	43.723481	-79.315635	Hockey Arena

In [128]:

```
Toronto_venues.groupby('Neighbourhood').count()
```

Out[128]:

	Neighbourhood	Neighbourhood Latitude	Neighbourhood Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
	Adelaide, King, Richmond	100	100	100	100	100	100
	Agincourt North, L'Amoreaux East, Milliken, Ontario, Steeles East	2	2	2	2	2	2
	Agincourt, Toronto	4	4	4	4	4	4
	Albion Gardens, Beaumond Heights, Humbergate, Mount Olive-Silverstone-Jamestown, Mount Olive-Silverstone-Jamestown, Silverstone, Toronto, South Steeles, Thistletown	12	12	12	12	12	12
	Alderwood, Toronto, Long Branch, Toronto	10	10	10	10	10	10
	Bathurst Manor, Downsview North, Wilson Heights, Toronto	18	18	18	18	18	18
	Bayview Village	4	4	4	4	4	4
	Bedford Park, Toronto, Lawrence Manor East	24	24	24	24	24	24
	Berczy Park	55	55	55	55	55	55
	Birch Cliff, Cliffside West	4	4	4	4	4	4
	Bloordale Gardens, Eringate, Markland Wood, Old Burnhamthorpe	6	6	6	6	6	6
	Brockton, Exhibition Place, Parkdale Village	20	20	20	20	20	20
	Business Reply Mail Processing Centre 969 Eastern	17	17	17	17	17	17
	CFB Toronto, Downsview East	3	3	3	3	3	3
	CN Tower, Bathurst Quay, Island airport, Harbourfront West, King and Spadina, Railway Lands, South Niagara	13	13	13	13	13	13

Cabbagetown, Toronto, St. James Town	Neighbourhood Latitude ⁴³ ₆	Neighbourhood Longitude ⁴³ ₆	Venue ⁴³ ₆	Venue ⁴³ ₆ Latitude	Venue ⁴³ ₆ Longitude	Venue ⁴³ ₆ Category
Caledonia-Fairbanks Neighbourhood Canada Post Gateway Processing Centre	11	11	11	11	11	11
Cedarbrae	7	7	7	7	7	7
Central Bay Street	84	84	84	84	84	84
Chinatown, Toronto, Grange Park (Toronto), Kensington Market	100	100	100	100	100	100
Christie	16	16	16	16	16	16
Church and Wellesley	89	89	89	89	89	89
Clairlea, Golden Mile, Toronto, Oakridge, Toronto	9	9	9	9	9	9
Clarks Corners, Sullivan, Tam O'Shanter – Sullivan	10	10	10	10	10	10
Cliffcrest, Cliffside, Toronto, Scarborough Village West	2	2	2	2	2	2
Cloverdale, Islington, Toronto, Martin Grove, Princess Gardens, West Deane Park	1	1	1	1	1	1
Commerce Court, Victoria Hotel	100	100	100	100	100	100
Davisville	37	37	37	37	37	37
Davisville North	11	11	11	11	11	11
...
Northwood Park, York University	5	5	5	5	5	5
Parkdale, Toronto, Roncesvalles, Toronto	15	15	15	15	15	15
Parkwoods	4	4	4	4	4	4
Queen's Park (Toronto)	39	39	39	39	39	39
Rosedale, Toronto	4	4	4	4	4	4
Roselawn	1	1	1	1	1	1
Rouge, Toronto, Malvern, Toronto	1	1	1	1	1	1
Runnymede, Toronto, Swansea, Toronto	39	39	39	39	39	39
Ryerson, Garden District	100	100	100	100	100	100
Scarborough Village	1	1	1	1	1	1
Silver Hills, York Mills	2	2	2	2	2	2
St. James Town	100	100	100	100	100	100
Stn A PO Boxes 25 The Esplanade	97	97	97	97	97	97
Studio District	37	37	37	37	37	37
The Annex, North Midtown, Yorkville, Toronto	25	25	25	25	25	25
The Beaches	4	4	4	4	4	4
The Beaches West, India Bazaar	22	22	22	22	22	22
The Danforth West, Riverdale, Toronto	43	43	43	43	43	43
The Junction North, Runnymede	3	3	3	3	3	3
The Kingsway, Montgomery Road, Old Mill North	2	2	2	2	2	2
Thorncliffe Park	17	17	17	17	17	17
Victoria Village	4	4	4	4	4	4
Westmount	8	8	8	8	8	8
Weston, Toronto	3	3	3	3	3	3
Willowdale South	35	35	35	35	35	35
Willowdale West	4	4	4	4	4	4
Woburn, Toronto	3	3	3	3	3	3
Woodbine Gardens, Parkview Hill	13	13	13	13	13	13
Woodbine Heights	8	8	8	8	8	8
York Mills West	2	2	2	2	2	2

100 rows × 6 columns

In [129]:

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

There are 275 uniques categories.

4) Analyze Each Neighborhood in Toronto

In [130]:

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

# add neighborhood column back to dataframe
Toronto_onehot['Neighbourhood'] = Toronto_venues['Neighbourhood']

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

Toronto_onehot.head()
```

Out[130]:

	Neighbourhood	Accessories Store	Adult Boutique	Afghan Restaurant	Airport	Airport Food Court	Airport Gate	Airport Lounge	Airport Service	Airport Terminal	...	Train Station	Vegetarian / Vegan Restaurant	V G S
0	Parkwoods	0	0	0	0	0	0	0	0	0	...	0	0	
1	Parkwoods	0	0	0	0	0	0	0	0	0	...	0	0	
2	Parkwoods	0	0	0	0	0	0	0	0	0	...	0	0	
3	Parkwoods	0	0	0	0	0	0	0	0	0	...	0	0	
4	Victoria Village	0	0	0	0	0	0	0	0	0	...	0	0	

5 rows × 276 columns

In [131]:

```
Toronto_grouped = Toronto_onehot.groupby('Neighbourhood').mean().reset_index()
Toronto_grouped.shape
```

Out[131]:

(100, 276)

5) Create a pandas dataframe with each neighborhood and it top 5 most common venues

In [132]:

```
num_top_venues = 5

for hood in Toronto_grouped['Neighbourhood']:
    print("-----"+hood+"-----")
    temp = Toronto_grouped[Toronto_grouped['Neighbourhood'] == hood].T.reset_index()
    temp.columns = ['venue', 'freq']
    temp = temp.iloc[1:]
    temp['freq'] = temp['freq'].astype(float)
    temp = temp.round({'freq': 2})
    print(temp.sort_values('freq', ascending=False).reset_index(drop=True).head(num_top_venues))
    print('\n')
```

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

	venue	freq
0	Coffee Shop	0.06
1	Bar	0.04
2	Café	0.04
3	Steakhouse	0.04
4	Thai Restaurant	0.04

Adelaport North, Midwayway East, Midwayway, Ontario, Stephen East

----Agincourt North, L'Amoreaux East, Milliken, Ontario, Steeles East----

	venue	freq
0	Playground	0.5
1	Park	0.5
2	Accessories Store	0.0
3	Mexican Restaurant	0.0
4	Monument / Landmark	0.0

----Agincourt, Toronto----

	venue	freq
0	Sandwich Place	0.25
1	Lounge	0.25
2	Breakfast Spot	0.25
3	Clothing Store	0.25
4	Miscellaneous Shop	0.00

----Albion Gardens, Beaumont Heights, Humbergate, Mount Olive-Silverstone-Jamestown, Mount Olive-Silverstone-Jamestown, Silverstone, Toronto, South Steeles, Thistletown----

	venue	freq
0	Grocery Store	0.17
1	Pizza Place	0.08
2	Japanese Restaurant	0.08
3	Pharmacy	0.08
4	Beer Store	0.08

----Alderwood, Toronto, Long Branch, Toronto----

	venue	freq
0	Pizza Place	0.2
1	Skating Rink	0.1
2	Pharmacy	0.1
3	Sandwich Place	0.1
4	Gym	0.1

----Bathurst Manor, Downsview North, Wilson Heights, Toronto----

	venue	freq
0	Coffee Shop	0.11
1	Bridal Shop	0.06
2	Sushi Restaurant	0.06
3	Frozen Yogurt Shop	0.06
4	Supermarket	0.06

----Bayview Village----

	venue	freq
0	Café	0.25
1	Japanese Restaurant	0.25
2	Bank	0.25
3	Chinese Restaurant	0.25
4	Movie Theater	0.00

----Bedford Park, Toronto, Lawrence Manor East----

	venue	freq
0	Coffee Shop	0.08
1	Fast Food Restaurant	0.08
2	Italian Restaurant	0.08
3	Boutique	0.04
4	Thai Restaurant	0.04

----Berczy Park----

	venue	freq
0	Coffee Shop	0.07
1	Cocktail Bar	0.05
2	Cheese Shop	0.04
3	Bakery	0.04
4	Seafood Restaurant	0.04

----Birch Cliff, Cliffside West----

	venue	freq
0	Café	0.25
1	General Entertainment	0.25
2	Club / Night	0.25

2	Skating Rink	0.25
3	College Stadium	0.25
4	Park	0.00

----Bloordale Gardens, Eringate, Markland Wood, Old Burnhamthorpe----

	venue	freq
0	Pizza Place	0.17
1	Park	0.17
2	Café	0.17
3	Beer Store	0.17
4	Liquor Store	0.17

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

	venue	freq
0	Breakfast Spot	0.10
1	Coffee Shop	0.10
2	Café	0.10
3	Falafel Restaurant	0.05
4	Burrito Place	0.05

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

	venue	freq
0	Light Rail Station	0.12
1	Comic Shop	0.06
2	Recording Studio	0.06
3	Farmers Market	0.06
4	Spa	0.06

----CFB Toronto, Downsview East----

	venue	freq
0	Airport	0.33
1	Bus Stop	0.33
2	Park	0.33
3	Accessories Store	0.00
4	Middle Eastern Restaurant	0.00

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

	venue	freq
0	Airport Lounge	0.15
1	Airport Service	0.15
2	Airport Terminal	0.15
3	Boat or Ferry	0.08
4	Sculpture Garden	0.08

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

	venue	freq
0	Coffee Shop	0.09
1	Restaurant	0.07
2	Café	0.05
3	Pizza Place	0.05
4	Bakery	0.05

----Caledonia-Fairbanks----

	venue	freq
0	Park	0.33
1	Pharmacy	0.17
2	Women's Store	0.17
3	Fast Food Restaurant	0.17
4	Market	0.17

----Canada Post Gateway Processing Centre----

	venue	freq
0	Coffee Shop	0.18
1	Hotel	0.18
2	Middle Eastern Restaurant	0.09
3	Sandwich Place	0.09
4	Mediterranean Restaurant	0.09

----Cedarbrae----

	venue	freq
0	Hakka Restaurant	0.14
1	Bank	0.14
2	Bakery	0.14
3	Athletics & Sports	0.14
4	Thai Restaurant	0.14

----Central Bay Street----

	venue	freq
0	Coffee Shop	0.15
1	Italian Restaurant	0.05
2	Burger Joint	0.04
3	Bar	0.04
4	Bubble Tea Shop	0.04

----Chinatown, Toronto, Grange Park (Toronto), Kensington Market----

	venue	freq
0	Café	0.07
1	Bar	0.06
2	Vietnamese Restaurant	0.06
3	Vegetarian / Vegan Restaurant	0.05
4	Bakery	0.04

----Christie----

	venue	freq
0	Grocery Store	0.19
1	Café	0.19
2	Park	0.12
3	Restaurant	0.06
4	Diner	0.06

----Church and Wellesley----

	venue	freq
0	Coffee Shop	0.07
1	Japanese Restaurant	0.07
2	Sushi Restaurant	0.04
3	Gay Bar	0.04
4	Restaurant	0.03

----Clairlea, Golden Mile, Toronto, Oakridge, Toronto----

	venue	freq
0	Bakery	0.22
1	Bus Line	0.22
2	Fast Food Restaurant	0.11
3	Park	0.11
4	Soccer Field	0.11

----Clarks Corners, Sullivan, Tam O'Shanter - Sullivan----

	venue	freq
0	Pizza Place	0.2
1	Pharmacy	0.1
2	Noodle House	0.1
3	Fried Chicken Joint	0.1
4	Thai Restaurant	0.1

----Cliffcrest, Cliffside, Toronto, Scarborough Village West----

	venue	freq
0	American Restaurant	0.5
1	Motel	0.5
2	Market	0.0
3	Martial Arts Dojo	0.0
4	Massage Studio	0.0

----Cloverdale, Islington, Toronto, Martin Grove, Princess Gardens, West Deane Park----

	venue	freq
0	Bank	1.0
1	Accessories Store	0.0

2	Mexican Restaurant	0.0
3	Molecular Gastronomy Restaurant	0.0
4	Modern European Restaurant	0.0

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

	venue	freq
0	Coffee Shop	0.12
1	Café	0.06
2	Hotel	0.06
3	American Restaurant	0.04
4	Restaurant	0.04

----Davisville----

	venue	freq
0	Sandwich Place	0.08
1	Dessert Shop	0.08
2	Pizza Place	0.08
3	Restaurant	0.05
4	Italian Restaurant	0.05

----Davisville North----

	venue	freq
0	Breakfast Spot	0.09
1	Hotel	0.09
2	Asian Restaurant	0.09
3	Dance Studio	0.09
4	Food & Drink Shop	0.09

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

	venue	freq
0	Coffee Shop	0.13
1	Pub	0.13
2	Sports Bar	0.07
3	Pizza Place	0.07
4	Convenience Store	0.07

----Del Ray, Keele, Mount Dennis, Silverthorn, Toronto----

	venue	freq
0	Sandwich Place	0.25
1	Discount Store	0.25
2	Convenience Store	0.25
3	Check Cashing Service	0.25
4	Miscellaneous Shop	0.00

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

	venue	freq
0	Coffee Shop	0.13
1	Café	0.08
2	Hotel	0.07
3	Restaurant	0.04
4	American Restaurant	0.04

----Don Mills North----

	venue	freq
0	Japanese Restaurant	0.17
1	Gym / Fitness Center	0.17
2	Caribbean Restaurant	0.17
3	Baseball Field	0.17
4	Basketball Court	0.17

----Dorset Park, Scarborough Town Centre, Wexford Heights----

	venue	freq
0	Indian Restaurant	0.29
1	Light Rail Station	0.14
2	Chinese Restaurant	0.14
3	Pet Store	0.14
4	Vietnamese Restaurant	0.14

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

	venue	freq
0	Pharmacy	0.10
1	Supermarket	0.10
2	Bakery	0.10
3	Discount Store	0.10
4	Music Venue	0.05

----Downsview----

	venue	freq
0	Grocery Store	0.50
1	Bank	0.25
2	Shopping Mall	0.25
3	Accessories Store	0.00
4	Middle Eastern Restaurant	0.00

----Downsview Central----

	venue	freq
0	Food Truck	0.33
1	Business Service	0.33
2	Baseball Field	0.33
3	Malay Restaurant	0.00
4	Molecular Gastronomy Restaurant	0.00

----Downsview Northwest----

	venue	freq
0	Athletics & Sports	0.25
1	Gym / Fitness Center	0.25
2	Coffee Shop	0.25
3	Grocery Store	0.25
4	Accessories Store	0.00

----Downsview, Toronto, North Park, Upwood Park----

	venue	freq
0	Park	0.25
1	Construction & Landscaping	0.25
2	Bakery	0.25
3	Basketball Court	0.25
4	Accessories Store	0.00

----East Birchmount Park, Ionview, Kennedy Park, Toronto----

	venue	freq
0	Discount Store	0.29
1	Department Store	0.14
2	Hobby Shop	0.14
3	Coffee Shop	0.14
4	Bus Station	0.14

----East Toronto----

	venue	freq
0	Park	0.50
1	Coffee Shop	0.25
2	Convenience Store	0.25
3	Accessories Store	0.00
4	Middle Eastern Restaurant	0.00

----Emery, Toronto, Humberlea----

	venue	freq
0	Furniture / Home Store	0.5
1	Baseball Field	0.5
2	Monument / Landmark	0.0
3	Molecular Gastronomy Restaurant	0.0
4	Modern European Restaurant	0.0

----Fairview, Henry Farm, Oriole----

	venue	freq
0	Clothing Store	0.15
1	Fast Food Restaurant	0.08
2	Coffee Shop	0.06

3	Restaurant	0.03
4	Bus Station	0.03

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

	venue	freq
0	Coffee Shop	0.08
1	Café	0.07
2	Hotel	0.06
3	American Restaurant	0.03
4	Bar	0.03

----Flemingdon Park, Don Mills South----

	venue	freq
0	Beer Store	0.10
1	Gym	0.10
2	Asian Restaurant	0.10
3	Coffee Shop	0.10
4	Clothing Store	0.05

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

	venue	freq
0	Park	0.25
1	Jewelry Store	0.25
2	Sushi Restaurant	0.25
3	Trail	0.25
4	Accessories Store	0.00

----Glencairn----

	venue	freq
0	Japanese Restaurant	0.25
1	Park	0.25
2	Bakery	0.25
3	Pub	0.25
4	Middle Eastern Restaurant	0.00

----Guildwood, Morningside, Toronto, West Hill, Toronto----

	venue	freq
0	Spa	0.12
1	Intersection	0.12
2	Rental Car Location	0.12
3	Mexican Restaurant	0.12
4	Electronics Store	0.12

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

	venue	freq
0	Café	0.14
1	Bakery	0.06
2	Japanese Restaurant	0.06
3	Bookstore	0.06
4	Theater	0.06

----Harbourfront (Toronto), Regent Park----

	venue	freq
0	Coffee Shop	0.17
1	Park	0.06
2	Pub	0.06
3	Bakery	0.06
4	Café	0.06

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

	venue	freq
0	Coffee Shop	0.13
1	Aquarium	0.05
2	Hotel	0.05
3	Italian Restaurant	0.04
4	Café	0.04

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

	venue	freq
0	Bar	0.08
1	Mexican Restaurant	0.08
2	Café	0.08
3	Flea Market	0.04
4	Arts & Crafts Store	0.04

----Highland Creek (Toronto), Rouge Hill, Port Union, Toronto----

	venue	freq
0	History Museum	0.5
1	Bar	0.5
2	Accessories Store	0.0
3	Middle Eastern Restaurant	0.0
4	Monument / Landmark	0.0

----Hillcrest Village----

	venue	freq
0	Golf Course	0.2
1	Athletics & Sports	0.2
2	Dog Run	0.2
3	Pool	0.2
4	Mediterranean Restaurant	0.2

----Humber Bay Shores, Mimico South, New Toronto----

	venue	freq
0	Pet Store	0.07
1	Restaurant	0.07
2	Flower Shop	0.07
3	Liquor Store	0.07
4	Seafood Restaurant	0.07

----Humber Bay, King's Mill Park, Kingsway Park South East, Mimico, Old Mill, Toronto, The Queensway, Fairmont Royal York Hotel, Sunnylea----

	venue	freq
0	Baseball Field	0.5
1	Locksmith	0.5
2	Accessories Store	0.0
3	Molecular Gastronomy Restaurant	0.0
4	Modern European Restaurant	0.0

----Humber Summit----

	venue	freq
0	Pizza Place	0.5
1	Empanada Restaurant	0.5
2	Mexican Restaurant	0.0
3	Monument / Landmark	0.0
4	Molecular Gastronomy Restaurant	0.0

----Humewood-Cedarvale----

	venue	freq
0	Field	0.33
1	Hockey Arena	0.33
2	Trail	0.33
3	Metro Station	0.00
4	Molecular Gastronomy Restaurant	0.00

----Kingsview Village, Martin Grove Gardens, Richview Gardens, St. Phillips----

	venue	freq
0	Pizza Place	0.25
1	Park	0.25
2	Bus Line	0.25
3	Mobile Phone Shop	0.25
4	Mexican Restaurant	0.00

----Kingsway Park South West, Mimico, The Queensway, Royal York South West, South of Bloor----

	venue	freq
0	Convenience Store	0.07
1	Gym	0.07
2	Supplement Shop	0.07

3 Tanning Salon 0.07
4 Discount Store 0.07

----L'Amoreaux West----

	venue	freq
0	Fast Food Restaurant	0.17
1	Chinese Restaurant	0.17
2	Coffee Shop	0.08
3	Breakfast Spot	0.08
4	Pharmacy	0.08

----Lawrence Heights, Lawrence Manor----

	venue	freq
0	Clothing Store	0.31
1	Accessories Store	0.08
2	Coffee Shop	0.08
3	Boutique	0.08
4	Miscellaneous Shop	0.08

----Lawrence Park, Toronto----

	venue	freq
0	Park	0.33
1	Bus Line	0.33
2	Swim School	0.33
3	Accessories Store	0.00
4	Middle Eastern Restaurant	0.00

----Leaside----

	venue	freq
0	Coffee Shop	0.10
1	Sporting Goods Shop	0.10
2	Burger Joint	0.06
3	Breakfast Spot	0.03
4	Liquor Store	0.03

----Little Portugal, Toronto, Trinity-Bellwoods----

	venue	freq
0	Bar	0.14
1	Asian Restaurant	0.05
2	Coffee Shop	0.05
3	Café	0.03
4	Men's Store	0.03

----Maryvale, Toronto, Wexford, Toronto----

	venue	freq
0	Auto Garage	0.2
1	Smoke Shop	0.2
2	Bakery	0.2
3	Sandwich Place	0.2
4	Breakfast Spot	0.2

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

	venue	freq
0	Playground	0.25
1	Gym	0.25
2	Tennis Court	0.25
3	Restaurant	0.25
4	Accessories Store	0.00

----North Toronto West----

	venue	freq
0	Sporting Goods Shop	0.11
1	Coffee Shop	0.11
2	Yoga Studio	0.05
3	Park	0.05
4	Clothing Store	0.05

----Northwest----

	venue	freq
0	Drugstore	0.5
1	Rental Car Location	0.5
2	Accessories Store	0.0
3	Molecular Gastronomy Restaurant	0.0
4	Modern European Restaurant	0.0

----Northwood Park, York University----

	venue	freq
0	Furniture / Home Store	0.2
1	Massage Studio	0.2
2	Coffee Shop	0.2
3	Bar	0.2
4	Miscellaneous Shop	0.2

----Parkdale, Toronto, Roncesvalles, Toronto----

	venue	freq
0	Breakfast Spot	0.13
1	Gift Shop	0.13
2	Burger Joint	0.07
3	Eastern European Restaurant	0.07
4	Bar	0.07

----Parkwoods----

	venue	freq
0	Fast Food Restaurant	0.25
1	Bus Stop	0.25
2	Park	0.25
3	Food & Drink Shop	0.25
4	Mexican Restaurant	0.00

----Queen's Park (Toronto)----

	venue	freq
0	Coffee Shop	0.23
1	Gym	0.05
2	Japanese Restaurant	0.05
3	Burger Joint	0.05
4	Diner	0.05

----Rosedale, Toronto----

	venue	freq
0	Park	0.50
1	Trail	0.25
2	Playground	0.25
3	Accessories Store	0.00
4	Molecular Gastronomy Restaurant	0.00

----Roselawn----

	venue	freq
0	Garden	1.0
1	Mexican Restaurant	0.0
2	Monument / Landmark	0.0
3	Molecular Gastronomy Restaurant	0.0
4	Modern European Restaurant	0.0

----Rouge, Toronto, Malvern, Toronto----

	venue	freq
0	Fast Food Restaurant	1.0
1	Accessories Store	0.0
2	Mexican Restaurant	0.0
3	Monument / Landmark	0.0
4	Molecular Gastronomy Restaurant	0.0

----Runnymede, Toronto, Swansea, Toronto----

	venue	freq
0	Coffee Shop	0.10
1	Café	0.08
2	Pizza Place	0.08
3	Sushi Restaurant	0.05

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

	venue	freq
0	Coffee Shop	0.08
1	Clothing Store	0.07
2	Café	0.04
3	Cosmetics Shop	0.04
4	Middle Eastern Restaurant	0.03

----Scarborough Village----

	venue	freq
0	Playground	1.0
1	Accessories Store	0.0
2	Mexican Restaurant	0.0
3	Monument / Landmark	0.0
4	Molecular Gastronomy Restaurant	0.0

----Silver Hills, York Mills----

	venue	freq
0	Cafeteria	0.5
1	Martial Arts Dojo	0.5
2	Middle Eastern Restaurant	0.0
3	Motel	0.0
4	Monument / Landmark	0.0

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

	venue	freq
0	Coffee Shop	0.07
1	Restaurant	0.06
2	Café	0.05
3	Hotel	0.05
4	Breakfast Spot	0.04

----Stn A PO Boxes 25 The Esplanade----

	venue	freq
0	Coffee Shop	0.11
1	Café	0.04
2	Restaurant	0.04
3	Seafood Restaurant	0.03
4	Hotel	0.03

----Studio District----

	venue	freq
0	Café	0.11
1	Coffee Shop	0.08
2	Bakery	0.05
3	Italian Restaurant	0.05
4	Gastropub	0.05

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

	venue	freq
0	Coffee Shop	0.12
1	Sandwich Place	0.12
2	Café	0.12
3	Pizza Place	0.08
4	History Museum	0.04

----The Beaches----

	venue	freq
0	Health Food Store	0.25
1	Neighborhood	0.25
2	Coffee Shop	0.25
3	Pub	0.25
4	Accessories Store	0.00

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

	venue	freq
--	-------	------

0	Sandwich Place	0.09
1	Fish & Chips Shop	0.05
2	Intersection	0.05
3	Brewery	0.05
4	Fast Food Restaurant	0.05

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

	venue	freq
0	Greek Restaurant	0.21
1	Coffee Shop	0.09
2	Italian Restaurant	0.07
3	Ice Cream Shop	0.07
4	Fruit & Vegetable Store	0.02

----The Junction North, Runnymede----

	venue	freq
0	Pizza Place	0.33
1	Caribbean Restaurant	0.33
2	Bus Line	0.33
3	Museum	0.00
4	Motel	0.00

----The Kingsway, Montgomery Road, Old Mill North----

	venue	freq
0	Park	0.5
1	River	0.5
2	Accessories Store	0.0
3	Middle Eastern Restaurant	0.0
4	Monument / Landmark	0.0

----Thorncliffe Park----

	venue	freq
0	Indian Restaurant	0.12
1	Yoga Studio	0.06
2	Pizza Place	0.06
3	Park	0.06
4	Coffee Shop	0.06

----Victoria Village----

	venue	freq
0	Intersection	0.25
1	Coffee Shop	0.25
2	Hockey Arena	0.25
3	Portuguese Restaurant	0.25
4	Accessories Store	0.00

----Westmount----

	venue	freq
0	Pizza Place	0.25
1	Chinese Restaurant	0.12
2	Middle Eastern Restaurant	0.12
3	Sandwich Place	0.12
4	Intersection	0.12

----Weston, Toronto----

	venue	freq
0	Park	0.67
1	Convenience Store	0.33
2	Accessories Store	0.00
3	Mexican Restaurant	0.00
4	Monument / Landmark	0.00

----Willowdale South----

	venue	freq
0	Ramen Restaurant	0.09
1	Restaurant	0.09
2	Coffee Shop	0.09
3	Café	0.06
4	Pizza Place	0.06

```

----Willowdale West----
      venue  freq
0      Pharmacy 0.25
1      Coffee Shop 0.25
2      Grocery Store 0.25
3      Pizza Place 0.25
4  Performing Arts Venue 0.00

----Woburn, Toronto----
      venue  freq
0      Coffee Shop 0.67
1      Korean Restaurant 0.33
2      Accessories Store 0.00
3  Middle Eastern Restaurant 0.00
4      Monument / Landmark 0.00

----Woodbine Gardens, Parkview Hill----
      venue  freq
0      Pizza Place 0.15
1  Fast Food Restaurant 0.15
2      Pharmacy 0.08
3      Intersection 0.08
4      Bank 0.08

----Woodbine Heights----
      venue  freq
0  Skating Rink 0.25
1  Curling Ice 0.12
2      Pharmacy 0.12
3      Park 0.12
4  Beer Store 0.12

----York Mills West----
      venue  freq
0      Park 0.5
1      Bank 0.5
2      Accessories Store 0.0
3      Mexican Restaurant 0.0
4  Molecular Gastronomy Restaurant 0.0

```

In [139]:

```

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

    return row_categories_sorted.index.values[0:num_top_venues]

```

In [140]:

```

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'] = Toronto_grouped['Neighbourhood']

for ind in np.arange(Toronto_grouped.shape[0]):

```



```
neighborhoods_venues_sorted.iloc[ind, 1:] = return_most_common_venues(Toronto_grouped.iloc[ind,
:], num_top_venues)

neighborhoods_venues_sorted.head()
```

Out[140]:

	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
0	Adelaide, King, Richmond	Coffee Shop	Bar	Thai Restaurant	Café	Steakhouse	American Restaurant	Restaurant	Burger Joint	Sushi Restaurant	Gym
1	Agincourt North, L'Amoreaux East, Milliken, On...	Park	Playground	Yoga Studio	Doner Restaurant	Department Store	Dessert Shop	Dim Sum Restaurant	Diner	Discount Store	Dog Run
2	Agincourt, Toronto	Lounge	Sandwich Place	Clothing Store	Breakfast Spot	Donut Shop	Dim Sum Restaurant	Diner	Discount Store	Dog Run	Doner Restaurant
3	Albion Gardens, Beaumont Heights, Humbergate, ...	Grocery Store	Beer Store	Fried Chicken Joint	Japanese Restaurant	Fast Food Restaurant	Liquor Store	Discount Store	Pharmacy	Pizza Place	Sandwich Place
4	Alderwood, Toronto, Long Branch, Toronto	Pizza Place	Gym	Skating Rink	Pharmacy	Pool	Pub	Dance Studio	Sandwich Place	Coffee Shop	General Entertainment

6) Cluster Neighborhoods into 5 similar groups

In [141]:

```
kclusters = 5
Toronto_grouped_clustering = Toronto_grouped.drop('Neighbourhood', 1)
kmeans = KMeans(n_clusters=kclusters, random_state=0).fit(Toronto_grouped_clustering)
neighborhoods_venues_sorted.insert(0, 'Cluster Labels', kmeans.labels_)
Toronto_merged = df_keys
Toronto_merged = Toronto_merged.join(neighborhoods_venues_sorted.set_index('Neighbourhood'), on='Neighbourhood')
Toronto_merged.head()
```

Out[141]:

	PostalCode	Borough	Neighbourhood	Latitude	Longitude	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue
0	M3A	North York	Parkwoods	43.753259	-79.329656	2.0	Bus Stop	Park	Fast Food Restaurant	Food & Drink Shop	Doner Restaurant	
1	M4A	North York	Victoria Village	43.725882	-79.315572	0.0	Coffee Shop	Portuguese Restaurant	Intersection	Hockey Arena	Yoga Studio	Res
2	M5A	Downtown Toronto	Harbourfront (Toronto), Regent Park	43.654260	-79.360636	0.0	Coffee Shop	Park	Bakery	Café	Pub	
3	M6A	North York	Lawrence Heights, Lawrence Manor	43.718518	-79.464763	0.0	Clothing Store	Accessories Store	Boutique	Gift Shop	Furniture / Home Store	
4	M7A	Queen's Park (Toronto)	Queen's Park (Toronto)	43.662301	-79.389494	0.0	Coffee Shop	Gym	Japanese Restaurant	Diner	Burger Joint	

In [142]:

```
Toronto_merged['Cluster Labels'].value_counts()
```

Out[142]:

```
0.0    83
2.0    13
1.0     2
3.0     1
4.0     1
```

```
Name: Cluster Labels, dtype: int64
```

In [143]:

```
Toronto_merged['Cluster Labels'] = Toronto_merged['Cluster Labels'].fillna(0)
Toronto_merged['Cluster Labels'] = Toronto_merged['Cluster Labels'].astype(int)
Toronto_merged.head()
```

Out[143]:

	PostalCode	Borough	Neighbourhood	Latitude	Longitude	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue
0	M3A	North York	Parkwoods	43.753259	79.329656	2	Bus Stop	Park	Fast Food Restaurant	Food & Drink Shop	Doner Restaurant	
1	M4A	North York	Victoria Village	43.725882	79.315572	0	Coffee Shop	Portuguese Restaurant	Intersection	Hockey Arena	Yoga Studio	Res
2	M5A	Downtown Toronto	Harbourfront (Toronto), Regent Park	43.654260	79.360636	0	Coffee Shop	Park	Bakery	Café	Pub	
3	M6A	North York	Lawrence Heights, Lawrence Manor	43.718518	79.464763	0	Clothing Store	Accessories Store	Boutique	Gift Shop	Furniture / Home Store	
4	M7A	Queen's Park (Toronto)	Queen's Park (Toronto)	43.662301	79.389494	0	Coffee Shop	Gym	Japanese Restaurant	Diner	Burger Joint	

In [144]:

```
Toronto_merged['Cluster Labels'].unique()
```

Out[144]:

```
array([2, 0, 4, 1, 3], dtype=int64)
```

7) Plot the clustered data

In [148]:

```
# create map
map_clusters = folium.Map(location=[latitude, longitude], zoom_start=10)

# set color scheme for the clusters
x = np.arange(kclusters)
ys = [i + x + (i*x)**2 for i in range(kclusters)]
colors_array = cm.rainbow(np.linspace(0, 1, len(ys)))
rainbow = [colors.rgb2hex(i) for i in colors_array]

# add markers to the map
markers_colors = []
for lat, lon, 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
```

Out[148]:

Cluster 0:

In [149]:

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

Out[149]:

	Borough	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue
1	North York	0	Coffee Shop	Portuguese Restaurant	Intersection	Hockey Arena	Yoga Studio	Doner Restaurant	Dessert Shop	Dim Sum Restaurant
2	Downtown Toronto	0	Coffee Shop	Park	Bakery	Café	Pub	Theater	Breakfast Spot	Mexican Restaurant
3	North York	0	Clothing Store	Accessories Store	Boutique	Gift Shop	Furniture / Home Store	Event Space	Miscellaneous Shop	Shoe Store
4	Queen's Park (Toronto)	0	Coffee Shop	Gym	Japanese Restaurant	Diner	Burger Joint	Yoga Studio	Smoothie Shop	Seafood Restaurant
5	Etobicoke	0	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
6	Scarborough, Toronto	0	Fast Food Restaurant	Donut Shop	Dessert Shop	Dim Sum Restaurant	Diner	Discount Store	Dog Run	Doner Restaurant
7	North York	0	Gym / Fitness Center	Baseball Field	Café	Japanese Restaurant	Caribbean Restaurant	Basketball Court	Discount Store	Dog Run
8	East York	0	Fast Food Restaurant	Pizza Place	Pet Store	Athletics & Sports	Gastropub	Intersection	Pharmacy	Café
9	Downtown Toronto	0	Coffee Shop	Clothing Store	Café	Cosmetics Shop	Middle Eastern Restaurant	Theater	Diner	Restaurant
12	Scarborough, Toronto	0	Bar	History Museum	Yoga Studio	Dim Sum Restaurant	Diner	Discount Store	Dog Run	Doner Restaurant
13	North York	0	Coffee Shop	Asian Restaurant	Gym	Beer Store	General Entertainment	Italian Restaurant	Japanese Restaurant	Fast Food Restaurant
14	East York	0	Skating Rink	Pharmacy	Video Store	Cosmetics Shop	Curling Ice	Beer Store	Park	Gift Shop
15	Downtown Toronto	0	Coffee Shop	Restaurant	Hotel	Café	Breakfast Spot	Gastropub	Bakery	Cosmetics Shop
16	York	0	Hockey Arena	Trail	Field	Dessert Shop	Dim Sum Restaurant	Diner	Discount Store	Dog Run
17	Etobicoke	0	Pharmacy	Beer Store	Pizza Place	Café	Liquor Store	Park	Gift Shop	Electronics Store

			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	
18	Scarborough, Toronto	Cluster Labels	0	Pub	Coffee Shop	Health Food Store	Neighborhood	Yoga Studio	Dessert Shop	Dim Sum Restaurant	Diner
20	Downtown Toronto		0	Coffee Shop	Cocktail Bar	Bakery	Café	Seafood Restaurant	Restaurant	Pub	Cheese Shop
22	Scarborough, Toronto		0	Coffee Shop	Korean Restaurant	Drugstore	Dim Sum Restaurant	Diner	Discount Store	Dog Run	Doner Restaurant
23	East York		0	Coffee Shop	Sporting Goods Shop	Burger Joint	Smoothie Shop	Restaurant	Dessert Shop	Supermarket	Bank
24	Downtown Toronto		0	Coffee Shop	Italian Restaurant	Burger Joint	Bar	Café	Bubble Tea Shop	Sandwich Place	Ice Cream Shop
25	Downtown Toronto		0	Grocery Store	Café	Park	Baby Store	Coffee Shop	Italian Restaurant	Nightclub	Convenience Store
26	Scarborough, Toronto		0	Hakka Restaurant	Caribbean Restaurant	Bank	Bakery	Fried Chicken Joint	Thai Restaurant	Athletics & Sports	Convenience Store
27	North York		0	Athletics & Sports	Golf Course	Dog Run	Pool	Mediterranean Restaurant	Eastern European Restaurant	Dumpling Restaurant	Drugstore
28	North York		0	Coffee Shop	Sandwich Place	Supermarket	Restaurant	Bank	Deli / Bodega	Fried Chicken Joint	Frozen Yogurt Shop
29	East York		0	Indian Restaurant	Yoga Studio	Pharmacy	Bank	Discount Store	Sandwich Place	Burger Joint	Intersection
30	Downtown Toronto		0	Coffee Shop	Bar	Thai Restaurant	Café	Steakhouse	American Restaurant	Restaurant	Burger Joint
31	West Toronto		0	Bakery	Supermarket	Discount Store	Pharmacy	Music Venue	Café	Middle Eastern Restaurant	Bar
33	North York		0	Clothing Store	Fast Food Restaurant	Coffee Shop	Bus Station	Toy / Game Store	Food Court	Restaurant	Bakery
34	North York		0	Bar	Coffee Shop	Furniture / Home Store	Massage Studio	Miscellaneous Shop	Yoga Studio	Dim Sum Restaurant	Diner
...
69	West Toronto		0	Mexican Restaurant	Bar	Café	Italian Restaurant	Bakery	Cajun / Creole Restaurant	Flea Market	Fried Chicken Joint
70	Etobicoke		0	Pizza Place	Coffee Shop	Playground	Sandwich Place	Middle Eastern Restaurant	Chinese Restaurant	Intersection	Donut Shop
71	Scarborough, Toronto		0	Auto Garage	Smoke Shop	Breakfast Spot	Sandwich Place	Bakery	Doner Restaurant	Dim Sum Restaurant	Diner
72	North York		0	Pharmacy	Grocery Store	Pizza Place	Coffee Shop	Dog Run	Deli / Bodega	Department Store	Dessert Shop
73	Central Toronto		0	Sporting Goods Shop	Coffee Shop	Yoga Studio	Gift Shop	Fast Food Restaurant	Diner	Dessert Shop	Metro Station
74	Central Toronto		0	Café	Sandwich Place	Coffee Shop	Pizza Place	American Restaurant	Cheese Shop	BBQ Joint	Cosmetics Shop
75	West Toronto		0	Breakfast Spot	Gift Shop	Restaurant	Italian Restaurant	Bookstore	Dog Run	Bar	Movie Theater
76	Mississauga		0	Hotel	Coffee Shop	Gym / Fitness Center	Mediterranean Restaurant	Middle Eastern Restaurant	Sandwich Place	Burrito Place	American Restaurant
78	Scarborough, Toronto		0	Lounge	Sandwich Place	Clothing Store	Breakfast Spot	Donut Shop	Dim Sum Restaurant	Diner	Discount Store
79	Central Toronto		0	Pizza Place	Sandwich Place	Dessert Shop	Restaurant	Sushi Restaurant	Café	Italian Restaurant	Coffee Shop
80	Downtown Toronto		0	Café	Japanese Restaurant	Bar	Bakery	Restaurant	Bookstore	Theater	Yoga Studio
81	West Toronto		0	Coffee Shop	Café	Pizza Place	Sushi Restaurant	Italian Restaurant	Diner	Food	Bakery
82	Scarborough, Toronto		0	Pizza Place	Italian Restaurant	Pharmacy	Fried Chicken Joint	Noodle House	Rental Car Location	Chinese Restaurant	Fast Food Restaurant
83	Central Toronto		0	Gym	Restaurant	Tennis Court	Playground	Dog Run	Department Store	Dessert Shop	Dim Sum Restaurant
84	Downtown Toronto		0	Café	Bar	Vietnamese Restaurant	Vegetarian / Vegan	Coffee Shop	Bakery	Chinese Restaurant	Mexican Restaurant

	Toronto											
	Borough	Cluster	1st Most	2nd Most	Restaurant	Restaurant	5th Most	6th Most	Restaurant	Restaurant		
86	Central Toronto	Labels	Common Venue	Common Venue	3rd Most Common Venue	4th Most Common Venue	Common Venue	Common Venue	7th Most Common Venue	8th Most Common Venue	Fried Chicken Joint	
		0	Pub	Coffee Shop	Bagel Shop	Light Rail Station	Supermarket	Vietnamese Restaurant	Pizza Place			
87	Downtown Toronto	0	Airport Lounge	Airport Service	Airport Terminal	Boat or Ferry	Harbor / Marina	Airport	Airport Food Court	Airport Gate		
88	Etobicoke	0	Pet Store	Bakery	Fried Chicken Joint	Flower Shop	Fast Food Restaurant	Liquor Store	Pharmacy	Pizza Place		
89	Etobicoke	0	Grocery Store	Beer Store	Fried Chicken Joint	Japanese Restaurant	Fast Food Restaurant	Liquor Store	Discount Store	Pharmacy		
90	Scarborough, Toronto	0	Chinese Restaurant	Fast Food Restaurant	Pizza Place	Sandwich Place	Thrift / Vintage Store	Breakfast Spot	Grocery Store	Pharmacy		
92	Downtown Toronto	0	Coffee Shop	Café	Restaurant	Seafood Restaurant	Pub	Hotel	Cocktail Bar	Fast Food Restaurant		
93	Etobicoke	0	Pizza Place	Gym	Skating Rink	Pharmacy	Pool	Pub	Dance Studio	Sandwich Place		
94	Etobicoke	0	Rental Car Location	Drugstore	Yoga Studio	Doner Restaurant	Dessert Shop	Dim Sum Restaurant	Diner	Discount Store		
95	Scarborough, Toronto	0	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN		
96	Downtown Toronto	0	Coffee Shop	Restaurant	Italian Restaurant	Café	Pub	Pizza Place	Bakery	Sandwich Place		
97	Downtown Toronto	0	Coffee Shop	Café	Hotel	Burger Joint	Gastropub	Restaurant	Deli / Bodega	Bar		
99	Downtown Toronto	0	Coffee Shop	Japanese Restaurant	Sushi Restaurant	Gay Bar	Restaurant	Burger Joint	Yoga Studio	Pub		
100	East Toronto	0	Light Rail Station	Auto Workshop	Recording Studio	Smoke Shop	Burrito Place	Fast Food Restaurant	Farmers Market	Garden		
101	Etobicoke	0	Locksmith	Baseball Field	Falafel Restaurant	Event Space	Ethiopian Restaurant	Empanada Restaurant	Electronics Store	Eastern European Restaurant		
102	Etobicoke	0	Gym	Tanning Salon	Grocery Store	Convenience Store	Burrito Place	Burger Joint	Discount Store	Sandwich Place		

86 rows × 12 columns

Cluster 1 :

In [150]:

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

Out[150]:

	Borough	Cluster	1st Most	2nd Most	3rd Most	4th Most	5th Most	6th Most	7th Most	8th Most	9th Most	10th Most
		Labels	Common Venue	Common Venue	Common Venue	Common Venue	Common Venue	Common Venue	Common Venue	Common Venue	Common Venue	Common Venue
32	Scarborough, Toronto	1	Playground	Yoga Studio	Donut Shop	Dessert Shop	Dim Sum Restaurant	Diner	Discount Store	Dog Run	Doner Restaurant	Drugstore
85	Scarborough, Toronto	1	Park	Playground	Yoga Studio	Doner Restaurant	Department Store	Dessert Shop	Dim Sum Restaurant	Diner	Discount Store	Dog Run

Cluster 2 :

In [151]:

```
Toronto_merged.loc[Toronto_merged['Cluster Labels'] == 2, Toronto_merged.columns[[1] + list(range(5, Toronto_merged.shape[1]))]]
```

Out[151]:

	Borough	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
0	North York	2	Bus Stop	Park	Fast Food Restaurant	Food & Drink Shop	Doner Restaurant	Dessert Shop	Dim Sum Restaurant	Diner	Discount Store	D
10	North York	2	Park	Japanese Restaurant	Bakery	Pub	Department Store	Dim Sum Restaurant	Diner	Discount Store	Dog Run	Res
21	York	2	Park	Pharmacy	Women's Store	Fast Food Restaurant	Market	Doner Restaurant	Dessert Shop	Dim Sum Restaurant	Diner	D
35	East York	2	Park	Convenience Store	Coffee Shop	Yoga Studio	Dim Sum Restaurant	Diner	Discount Store	Dog Run	Doner Restaurant	
40	North York	2	Park	Bus Stop	Airport	Yoga Studio	Donut Shop	Dim Sum Restaurant	Diner	Discount Store	Dog Run	Res
49	North York	2	Basketball Court	Park	Bakery	Construction & Landscaping	Drugstore	Diner	Discount Store	Dog Run	Doner Restaurant	
61	Central Toronto	2	Park	Bus Line	Swim School	Yoga Studio	Dog Run	Dessert Shop	Dim Sum Restaurant	Diner	Discount Store	Res
64	York	2	Park	Convenience Store	Yoga Studio	Dessert Shop	Dim Sum Restaurant	Diner	Discount Store	Dog Run	Doner Restaurant	
66	North York	2	Park	Bank	Yoga Studio	Donut Shop	Dim Sum Restaurant	Diner	Discount Store	Dog Run	Doner Restaurant	Dr
68	Central Toronto	2	Park	Trail	Sushi Restaurant	Jewelry Store	Eastern European Restaurant	Dumpling Restaurant	Drugstore	Donut Shop	Doner Restaurant	I
77	Etobicoke	2	Park	Pizza Place	Mobile Phone Shop	Bus Line	Dog Run	Dessert Shop	Dim Sum Restaurant	Diner	Discount Store	Res
91	Downtown Toronto	2	Park	Trail	Playground	Department Store	Dessert Shop	Dim Sum Restaurant	Diner	Discount Store	Dog Run	Res
98	Etobicoke	2	Park	River	Yoga Studio	Dog Run	Department Store	Dessert Shop	Dim Sum Restaurant	Diner	Discount Store	Res

Cluster 3 :

In [152]:

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

Out[152]:

	Borough	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
62	Central Toronto	3	Garden	Yoga Studio	Doner Restaurant	Dessert Shop	Dim Sum Restaurant	Diner	Discount Store	Dog Run	Donut Shop	Deli / Bodega

Cluster 4:

In [153]:

```
Toronto_merged.loc[Toronto_merged['Cluster Labels'] == 4, Toronto_merged.columns[[1] + list(range(5, Toronto_merged.shape[1]))]]
```

Out[153]:

	Borough	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
11	Etobicoke	4	Bank	Yoga Studio	Donut Shop	Dim Sum Restaurant	Diner	Discount Store	Dog Run	Doner Restaurant	Drugstore	Department Store

Results and Discussion

Results and Discussion

The best of all clusters above is Cluster 1 for the following reasons:

- Location. It's located aside of downtown, but no too far. Which is a good place for families with children.
- The key markers matched. The area has Playground, Donut Shop, Dessert Shop.
- No other fast foods in around. The competition will be less.
- Some Boroughs in Cluster 0 would satisfy our criterias, but competition would be higher there.
- Other clusters don't match the requirements at all.

Conclusion

The goal of the project was fulfilled. The best borough for our goal is Scarborough, Toronto.