Proyecto Capstone - La Batalla de los Vecindarios

Descripción del problema y discusión de antecedentes

El objetivo de este proyecto es encontrar el mejor lugar en Toronto (Canadá) para abrir un restaurante de pastas utilizando datos de Foursquare. En general, se analizarán criterios que ayudarán a tener una alta tasa de éxito.

Descripción de los datos y cómo se utilizarán para resolver el problema

Fuente 1: https://en.wikipedia.org/wiki/List_of_postal_codes_of_Canada:_M Contiene información sobre los códigos postales de ciudades de Canadá.

Fuente 2: https://cocl.us/Geospatial_data Contiene coordenadas geográficas de los vecindarios y sus códigos postales.

Fuente 3: https://foursquare.com/developers/apps Se puede obtener el nombre, categoría, lat y long.

En general, lo que se busca es resolver el problema a través de la data, tomar coordenadas de los vecindarios usando el paquete geocoder y realizar clustering de los vecindarios.

```
!pip install geopy
```

```
Looking in indexes: https://pypi.org/simple, https://us-
python.pkg.dev/colab-wheels/public/simple/
Requirement already satisfied: geopy in /usr/local/lib/python3.7/dist-
packages (1.17.0)
Requirement already satisfied: geographiclib<2,>=1.49 in
/usr/local/lib/python3.7/dist-packages (from geopy) (1.52)
```

```
!pip install beautifulsoup4
```

```
Looking in indexes: https://pypi.org/simple, https://us-
python.pkg.dev/colab-wheels/public/simple/
Requirement already satisfied: beautifulsoup4 in
/usr/local/lib/python3.7/dist-packages (4.6.3)
```

```
!pip install requests
```

```
Looking in indexes: https://pypi.org/simple, https://us-
python.pkg.dev/colab-wheels/public/simple/
Requirement already satisfied: requests in
/usr/local/lib/python3.7/dist-packages (2.23.0)
Requirement already satisfied: idna<3,>=2.5 in
/usr/local/lib/python3.7/dist-packages (from requests) (2.10)
Requirement already satisfied: urllib3!=1.25.0,!=1.25.1,<1.26,>=1.21.1
in /usr/local/lib/python3.7/dist-packages (from requests) (1.24.3)
Requirement already satisfied: chardet<4,>=3.0.2 in
```

```
/usr/local/lib/python3.7/dist-packages (from requests) (3.0.4)
Requirement already satisfied: certifi>=2017.4.17 in
/usr/local/lib/python3.7/dist-packages (from requests) (2022.6.15)

!pip install kmeans

Looking in indexes: https://pypi.org/simple, https://us-
python.pkg.dev/colab-wheels/public/simple/
Collecting kmeans
  Downloading kmeans-1.0.2.tar.gz (5.9 kB)
Building wheels for collected packages: kmeans
  Building wheel for kmeans (setup.py) ... eans: filename=kmeans-
1.0.2-cp37-cp37m-linux_x86_64.whl size=11798
sha256=fb7c2e7763879427a9b28fd701cda8df0b3f6d7985a0f928407e45b4ca0e171
8
  Stored in directory:
/root/.cache/pip/wheels/4a/26/51/688c6987fdc6a10c6186c3817f2ef7c92c50c
078a900525c0e
Successfully built kmeans
Installing collected packages: kmeans
Successfully installed kmeans-1.0.2

!pip install folium

Looking in indexes: https://pypi.org/simple, https://us-
python.pkg.dev/colab-wheels/public/simple/
Requirement already satisfied: folium in
/usr/local/lib/python3.7/dist-packages (0.8.3)
Requirement already satisfied: requests in
/usr/local/lib/python3.7/dist-packages (from folium) (2.23.0)
Requirement already satisfied: numpy in /usr/local/lib/python3.7/dist-
packages (from folium) (1.21.6)
Requirement already satisfied: jinja2 in
/usr/local/lib/python3.7/dist-packages (from folium) (2.11.3)
Requirement already satisfied: six in /usr/local/lib/python3.7/dist-
packages (from folium) (1.15.0)
Requirement already satisfied: branca>=0.3.0 in
/usr/local/lib/python3.7/dist-packages (from folium) (0.5.0)
Requirement already satisfied: MarkupSafe>=0.23 in
/usr/local/lib/python3.7/dist-packages (from jinja2->folium) (2.0.1)
Requirement already satisfied: chardet<4,>=3.0.2 in
/usr/local/lib/python3.7/dist-packages (from requests->folium) (3.0.4)
Requirement already satisfied: urllib3!=1.25.0,!=1.25.1,<1.26,>=1.21.1
in /usr/local/lib/python3.7/dist-packages (from requests->folium)
(1.24.3)
Requirement already satisfied: idna<3,>=2.5 in
/usr/local/lib/python3.7/dist-packages (from requests->folium) (2.10)
Requirement already satisfied: certifi>=2017.4.17 in
/usr/local/lib/python3.7/dist-packages (from requests->folium)
(2022.6.15)
```

```
!pip install -U scikit-learn
```

```
Looking in indexes: https://pypi.org/simple, https://us-
python.pkg.dev/colab-wheels/public/simple/
Requirement already satisfied: scikit-learn in
/usr/local/lib/python3.7/dist-packages (1.0.2)
Requirement already satisfied: threadpoolctl>=2.0.0 in
/usr/local/lib/python3.7/dist-packages (from scikit-learn) (3.1.0)
Requirement already satisfied: scipy>=1.1.0 in
/usr/local/lib/python3.7/dist-packages (from scikit-learn) (1.4.1)
Requirement already satisfied: joblib>=0.11 in
/usr/local/lib/python3.7/dist-packages (from scikit-learn) (1.1.0)
Requirement already satisfied: numpy>=1.14.6 in
/usr/local/lib/python3.7/dist-packages (from scikit-learn) (1.21.6)
```

```
import numpy as np
import pandas as pd

pd.set_option('display.max_columns', None)
pd.set_option('display.max_rows', None)

import json

from geopy.geocoders import Nominatim
from bs4 import BeautifulSoup

import requests
from pandas.io.json import json_normalize

import matplotlib.cm as cm
import matplotlib.colors as colors
import matplotlib.pyplot as plt

from sklearn.cluster import KMeans

import folium

#Obteniendo la data de los vecindarios usand beautiful soup
url='https://en.wikipedia.org/wiki/List_of_postal_codes_of_Canada:_M'
result = requests.get(url)
data_html = BeautifulSoup(result.content)

soup = BeautifulSoup(str(data_html))

table_contents=[]
table=soup.find('table')
for row in table.findAll('td'):
    cell = {}
    if row.span.text=='Not assigned':
        pass
```

```
    else:
        cell['PostalCode'] = row.p.text[:3]
        cell['Borough'] = (row.span.text).split('(')[0]
        cell['Neighborhood'] = (((((row.span.text).split('(')
[1]).strip(')')).replace(' /',',')).replace(')',' ')).strip(' ')
        table_contents.append(cell)

df=pd.DataFrame(table_contents)

df['Borough']=df['Borough'].replace({'Downtown TorontoStn A PO Boxes25
The Esplanade':'Downtown Toronto Stn A',
                                     'East TorontoBusiness
reply mail Processing Centre969 Eastern':'East Toronto Business',

'EtobicokeNorthwest':'Etobicoke Northwest','East YorkEast
Toronto':'East York/East Toronto',
                                     'MississaugaCanada Post
Gateway Processing Centre':'Mississauga'})
df.head()
```

	PostalCode	Borough	Neighborhood
0	M3A	North York	Parkwoods
1	M4A	North York	Victoria Village
2	M5A	Downtown Toronto	Regent Park, Harbourfront
3	M6A	North York	Lawrence Manor, Lawrence Heights
4	M7A	Queen's Park	Ontario Provincial Government

```
#Preparación para el procesamiento de data
df_dropna = df.dropna()
empty = 'Not assigned'
df_dropna = df_dropna[(df_dropna.PostalCode != empty ) &
(df_dropna.Borough != empty) & (df_dropna.Neighborhood !=
empty)].reset_index(drop=True)

df_dropna.isnull().sum()
```

```
PostalCode      0
Borough         0
Neighborhood    0
dtype: int64
```

```
df_dropna.loc[df_dropna['Borough'].isin(["Not assigned"])]
```

```
Empty DataFrame
Columns: [PostalCode, Borough, Neighborhood]
Index: []
```

```
df = df_dropna
df.head()
```

	PostalCode	Borough	Neighborhood
0	M3A	North York	Parkwoods

```
1        M4A        North York                  Victoria Village
2        M5A  Downtown Toronto         Regent Park, Harbourfront
3        M6A        North York  Lawrence Manor, Lawrence Heights
4        M7A      Queen's Park     Ontario Provincial Government
```

```
df.shape
```

```
(103, 3)
```

```
#agregamos la latitud y longitud a cada código postal
geo_url = "https://cocl.us/Geospatial_data"
geo_df = pd.read_csv(geo_url)
geo_df.rename(columns={'Postal Code': 'PostalCode'}, inplace=True)
geo_df.head()
```

```
  PostalCode   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
```

```
#combinamos la data
df = pd.merge(df, geo_df, on='PostalCode')
df.head()
```

```
  PostalCode           Borough                       Neighborhood
Latitude  \
0        M3A        North York                          Parkwoods
43.753259
1        M4A        North York                  Victoria Village
43.725882
2        M5A  Downtown Toronto         Regent Park, Harbourfront
43.654260
3        M6A        North York  Lawrence Manor, Lawrence Heights
43.718518
4        M7A      Queen's Park     Ontario Provincial Government
43.662301

   Longitude
0 -79.329656
1 -79.315572
2 -79.360636
3 -79.464763
4 -79.389494
```

```
df.groupby('Borough').count()['Neighborhood']
```

```
Borough
Central Toronto            9
Downtown Toronto          17
Downtown Toronto Stn A     1
```

```
East Toronto               4
East Toronto Business      1
East York                  4
East York/East Toronto     1
Etobicoke                 11
Etobicoke Northwest        1
Mississauga                1
North York                24
Queen's Park               1
Scarborough               17
West Toronto               6
York                       5
Name: Neighborhood, dtype: int64
```

```
df_toronto = df
df_toronto.head()
```

```
  PostalCode           Borough                       Neighborhood
Latitude  \
0        M3A        North York                          Parkwoods
43.753259
1        M4A        North York                    Victoria Village
43.725882
2        M5A  Downtown Toronto         Regent Park, Harbourfront
43.654260
3        M6A        North York  Lawrence Manor, Lawrence Heights
43.718518
4        M7A      Queen's Park     Ontario Provincial Government
43.662301

   Longitude
0 -79.329656
1 -79.315572
2 -79.360636
3 -79.464763
4 -79.389494
```

```
boroughs = df_toronto['Borough'].unique().tolist()


lat_toronto = df_toronto['Latitude'].mean()
lon_toronto = df_toronto['Longitude'].mean()
print('Las coordenadas geográficas de Toronto son {},
{}'.format(lat_toronto, lon_toronto))
```

```
Las coordenadas geográficas de Toronto son 43.704607733980595, -
79.39715291165048
```

```
borough_color = {}
for borough in boroughs:
```

```
    borough_color[borough]= '#%02X%02X%02X' %
tuple(np.random.choice(range(256), size=3))

CLIENT_ID = 'LVNSPMLTBBDPN2INEYVDDVFWLONMFATTHN1UXOKODIXDTMZA'
CLIENT_SECRET = 'UU3FWAT2QOHGJHGYAGR54F5GFB4NJZFNDITCJZUTFCNW2OYI'
VERSION = 20200514 # Foursquare API version

print('Credentials Stored')
```

```
Credentials Stored
```

```
def getNearbyVenues(names, latitudes, longitudes, radius=500):
    LIMIT = 100
    radius = 500
    venues_list=[]
    for name, lat, lng in zip(names, latitudes, longitudes):
        print(name)

        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)

        results = requests.get(url).json()["response"]['groups'][0]
['items']

        venues_list.append([(
            name,
            lat,
            lng,
            v['venue']['name'],
            v['venue']['location']['lat'],
            v['venue']['location']['lng'],
            v['venue']['categories'][0]['name']) for v in results])

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

```
    return(nearby_venues)

toronto_venues = getNearbyVenues(names=df_toronto['Neighborhood'],
                                 latitudes=df_toronto['Latitude'],
                                 longitudes=df_toronto['Longitude'])
```

```
Parkwoods
Victoria Village
Regent Park, Harbourfront
Lawrence Manor, Lawrence Heights
Ontario Provincial Government
Islington Avenue
Malvern, Rouge
Don Mills North
Parkview Hill, Woodbine Gardens
Garden District, Ryerson
Glencairn
West Deane Park, Princess Gardens, Martin Grove, Islington, Cloverdale
Rouge Hill, Port Union, Highland Creek
Don Mills South
Woodbine Heights
St. James Town
Humewood-Cedarvale
Eringate, Bloordale Gardens, Old Burnhamthorpe, Markland Wood
Guildwood, Morningside, West Hill
The Beaches
Berczy Park
Caledonia-Fairbanks
Woburn
Leaside
Central Bay Street
Christie
Cedarbrae
Hillcrest Village
Bathurst Manor, Wilson Heights, Downsview North
Thorncliffe Park
Richmond, Adelaide, King
Dufferin, Dovercourt Village
Scarborough Village
Fairview, Henry Farm, Oriole
Northwood Park, York University
The Danforth  East
Harbourfront East, Union Station, Toronto Islands
Little Portugal, Trinity
Kennedy Park, Ionview, East Birchmount Park
Bayview Village
Downsview East
The Danforth West, Riverdale
Toronto Dominion Centre, Design Exchange
Brockton, Parkdale Village, Exhibition Place
```

Golden Mile, Clairlea, Oakridge
York Mills, Silver Hills
Downsview West
India Bazaar, The Beaches West
Commerce Court, Victoria Hotel
North Park, Maple Leaf Park, Upwood Park
Humber Summit
Cliffside, Cliffcrest, Scarborough Village West
Willowdale, Newtonbrook
Downsview Central
Studio District
Bedford Park, Lawrence Manor East
Del Ray, Mount Dennis, Keelsdale and Silverthorn
Humberlea, Emery
Birch Cliff, Cliffside West
Willowdale South
Downsview Northwest
Lawrence Park
Roselawn
Runnymede, The Junction North
Weston
Dorset Park, Wexford Heights, Scarborough Town Centre
York Mills West
Davisville North
Forest Hill North & West
High Park, The Junction South
Westmount
Wexford, Maryvale
Willowdale West
North Toronto West
The Annex, North Midtown, Yorkville
Parkdale, Roncesvalles
Enclave of L4W
Kingsview Village, St. Phillips, Martin Grove Gardens, Richview Gardens
Agincourt
Davisville
University of Toronto, Harbord
Runnymede, Swansea
Clarks Corners, Tam O'Shanter, Sullivan
Moore Park, Summerhill East
Kensington Market, Chinatown, Grange Park
Milliken, Agincourt North, Steeles East, L'Amoreaux East
Summerhill West, Rathnelly, South Hill, Forest Hill SE, Deer Park
CN Tower, King and Spadina, Railway Lands, Harbourfront West, Bathurst Quay, South Niagara, Island airport
New Toronto, Mimico South, Humber Bay Shores
South Steeles, Silverstone, Humbergate, Jamestown, Mount Olive, Beaumond Heights, Thistletown, Albion Gardens
Steeles West, L'Amoreaux West

```
Rosedale
Enclave of M5E
Alderwood, Long Branch
Clairville, Humberwood, Woodbine Downs, West Humber, Kipling Heights,
Rexdale, Elms, Tandridge, Old Rexdale
Upper Rouge
St. James Town, Cabbagetown
First Canadian Place, Underground city
The Kingsway, Montgomery Road, Old Mill North
Church and Wellesley
Enclave of M4L
Old Mill South, King's Mill Park, Sunnylea, Humber Bay, Mimico NE, The
Queensway East, Royal York South East, Kingsway Park South East
Mimico NW, The Queensway West, South of Bloor, Kingsway Park South
West, Royal York South West
```

```
toronto_venues.tail()
```

```
                                          Neighborhood  \
2140  Mimico NW, The Queensway West, South of Bloor,...
2141  Mimico NW, The Queensway West, South of Bloor,...
2142  Mimico NW, The Queensway West, South of Bloor,...
2143  Mimico NW, The Queensway West, South of Bloor,...
2144  Mimico NW, The Queensway West, South of Bloor,...

      Neighborhood Latitude  Neighborhood Longitude  \
2140              43.628841              -79.520999
2141              43.628841              -79.520999
2142              43.628841              -79.520999
2143              43.628841              -79.520999
2144              43.628841              -79.520999

                           Venue  Venue Latitude  Venue Longitude  \
2140  Islington Florist & Nursery       43.630156       -79.518718
2141            Once Upon A Child       43.631075       -79.518290
2142                Value Village       43.631269       -79.518238
2143         Kingsway Boxing Club       43.627254       -79.526684
2144                 Burrito Boyz       43.626657       -79.526349

               Venue Category
2140              Flower Shop
2141               Kids Store
2142  Thrift / Vintage Store
2143                     Gym
2144           Burrito Place
```

```
toronto_venues.groupby('Neighborhood').count().head()
```

```
                                                    Neighborhood Latitude
\
Neighborhood
```

Agincourt	5
Alderwood, Long Branch	8
Bathurst Manor, Wilson Heights, Downsview North	20
Bayview Village	4
Bedford Park, Lawrence Manor East	20

Neighborhood	Longitude
Agincourt	5
Alderwood, Long Branch	8
Bathurst Manor, Wilson Heights, Downsview North	20
Bayview Village	4
Bedford Park, Lawrence Manor East	20

Neighborhood	Venue	Venue Latitude
Agincourt	5	5
Alderwood, Long Branch	8	8
Bathurst Manor, Wilson Heights, Downsview North	20	20
Bayview Village	4	4
Bedford Park, Lawrence Manor East	20	20

Neighborhood	Venue Longitude
Agincourt	5
Alderwood, Long Branch	8
Bathurst Manor, Wilson Heights, Downsview North	20
Bayview Village	4
Bedford Park, Lawrence Manor East	20

```
                                                    Venue Category
Neighborhood
Agincourt                                                        5
Alderwood, Long Branch                                           8
Bathurst Manor, Wilson Heights, Downsview North                 20
Bayview Village                                                  4
Bedford Park, Lawrence Manor East                               20
```

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

```
There are 272 uniques vanue categories.
```

```
print("The Venue Categories are", toronto_venues['Venue
Category'].unique()[:20])
```

```
The Venue Categories are ['Park' 'Fast Food Restaurant' 'Food & Drink
Shop' 'Hockey Arena'
 'Coffee Shop' 'Portuguese Restaurant' 'Intersection' 'Pizza Place'
 'Bakery' 'Distribution Center' 'New American Restaurant' 'Spa'
 'Restaurant' 'Breakfast Spot' 'Pub' 'Historic Site'
 'Gym / Fitness Center' 'Chocolate Shop' 'Farmers Market'
 'Performing Arts Venue']
```

```
"Italian Restaurant" in toronto_venues['Venue Category'].unique()
```

```
True
```

Data Analysis

```
to_onehot = pd.get_dummies(toronto_venues[['Venue Category']],
prefix="", prefix_sep="")

to_onehot['Neighborhoods'] = toronto_venues['Neighborhood']

fixed_columns = [to_onehot.columns[-1]] + list(to_onehot.columns[:-1])
to_onehot = to_onehot[fixed_columns]

print(to_onehot.shape)
to_onehot.head()
```

```
(2145, 273)
```

	Neighborhoods	Accessories Store	Adult Boutique	Airport	\
0	Parkwoods	0	0	0	
1	Parkwoods	0	0	0	
2	Parkwoods	0	0	0	
3	Victoria Village	0	0	0	
4	Victoria Village	0	0	0	

	Airport Food Court	Airport Gate	Airport Lounge	Airport Service
0	0	0	0	0
1	0	0	0	0
2	0	0	0	0
3	0	0	0	0
4	0	0	0	0

	Airport Terminal	American Restaurant	Antique Shop	Aquarium	Art Gallery
0	0	0	0	0	0
1	0	0	0	0	0
2	0	0	0	0	0
3	0	0	0	0	0
4	0	0	0	0	0

	Arts & Crafts Store	Asian Restaurant	Athletics & Sports	Auto Garage
0	0	0	0	0
1	0	0	0	0
2	0	0	0	0
3	0	0	0	0
4	0	0	0	0

	Auto Workshop	BBQ Joint	Baby Store	Bagel Shop	Bakery	Bank	Bar
0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0

```
4              0          0           0           0       0     0    0


   Baseball Field  Baseball Stadium  Basketball Stadium  Beach  \
0               0                 0                   0      0
1               0                 0                   0      0
2               0                 0                   0      0
3               0                 0                   0      0
4               0                 0                   0      0

   Bed & Breakfast  Beer Bar  Beer Store  Belgian Restaurant  Bike
Shop  \
0                0         0           0                   0
0
1                0         0           0                   0
0
2                0         0           0                   0
0
3                0         0           0                   0
0
4                0         0           0                   0
0

   Bistro  Board Shop  Boat or Ferry  Bookstore  Boutique  \
0       0           0              0          0         0
1       0           0              0          0         0
2       0           0              0          0         0
3       0           0              0          0         0
4       0           0              0          0         0

   Brazilian Restaurant  Breakfast Spot  Brewery  Bridal Shop  \
0                     0               0        0            0
1                     0               0        0            0
2                     0               0        0            0
3                     0               0        0            0
4                     0               0        0            0

   Bubble Tea Shop  Building  Burger Joint  Burrito Place  Bus Line  \
0                0         0             0              0         0
1                0         0             0              0         0
2                0         0             0              0         0
3                0         0             0              0         0
4                0         0             0              0         0

   Bus Station  Bus Stop  Butcher  Café  Candy Store  Caribbean
Restaurant  \
0            0         0        0     0            0
0
1            0         0        0     0            0
```

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

   Carpet Store  Cheese Shop  Chinese Restaurant  Chocolate Shop
Church  \
0             0            0                   0               0
0
1             0            0                   0               0
0
2             0            0                   0               0
0
3             0            0                   0               0
0
4             0            0                   0               0
0

   Climbing Gym  Clothing Store  Cocktail Bar  Coffee Shop  \
0             0               0             0            0
1             0               0             0            0
2             0               0             0            0
3             0               0             0            0
4             0               0             0            1

   College Arts Building  College Auditorium  College Gym  College Rec
Center  \
0                      0                   0            0
0
1                      0                   0            0
0
2                      0                   0            0
0
3                      0                   0            0
0
4                      0                   0            0
0

   College Stadium  Colombian Restaurant  Comfort Food Restaurant
Comic Shop  \
0                0                     0                       0
0
1                0                     0                       0
0
2                0                     0                       0
0
3                0                     0                       0
```

0
4   0   0   0
0

   Concert Hall Construction & Landscaping Convenience Store \
0   0   0   0
1   0   0   0
2   0   0   0
3   0   0   0
4   0   0   0

   Cosmetics Shop Coworking Space Creperie Cuban Restaurant
Cupcake Shop \
0   0   0   0   0
0
1   0   0   0   0
0
2   0   0   0   0
0
3   0   0   0   0
0
4   0   0   0   0
0

   Curling Ice Dance Studio Deli / Bodega Department Store Dessert
Shop \
0   0   0   0   0
0
1   0   0   0   0
0
2   0   0   0   0
0
3   0   0   0   0
0
4   0   0   0   0
0

   Dim Sum Restaurant Diner Discount Store Distribution Center Dog
Run \
0   0   0   0   0
0
1   0   0   0   0
0
2   0   0   0   0
0
3   0   0   0   0
0
4   0   0   0   0
0

```
   Doner Restaurant  Donut Shop  Drugstore  Dumpling Restaurant  \
0                 0           0          0                    0
1                 0           0          0                    0
2                 0           0          0                    0
3                 0           0          0                    0
4                 0           0          0                    0

   Eastern European Restaurant  Electronics Store  Ethiopian
Restaurant  \
0                            0                  0
0
1                            0                  0
0
2                            0                  0
0
3                            0                  0
0
4                            0                  0
0

   Event Space  Falafel Restaurant  Farmers Market  Fast Food
Restaurant  \
0            0                   0               0
0
1            0                   0               0
1
2            0                   0               0
0
3            0                   0               0
0
4            0                   0               0
0

   Field  Filipino Restaurant  Fish & Chips Shop  Fish Market  Flea
Market  \
0      0                    0                  0            0
0
1      0                    0                  0            0
0
2      0                    0                  0            0
0
3      0                    0                  0            0
0
4      0                    0                  0            0
0

   Flower Shop  Food & Drink Shop  Food Court  Food Truck  Fountain  \
0            0                  0           0           0         0
1            0                  0           0           0         0
2            0                  1           0           0         0
```

```
3            0                  0           0           0         0
4            0                  0           0           0         0

   French Restaurant  Fried Chicken Joint  Frozen Yogurt Shop  \
0                  0                    0                   0
1                  0                    0                   0
2                  0                    0                   0
3                  0                    0                   0
4                  0                    0                   0

   Fruit & Vegetable Store  Furniture / Home Store  Gaming Cafe
Garden  \
0                        0                       0            0
0
1                        0                       0            0
0
2                        0                       0            0
0
3                        0                       0            0
0
4                        0                       0            0
0

   Garden Center  Gas Station  Gastropub  Gay Bar  Gelato Shop  \
0              0            0          0        0            0
1              0            0          0        0            0
2              0            0          0        0            0
3              0            0          0        0            0
4              0            0          0        0            0

   General Entertainment  General Travel  Gift Shop  Gluten-free
Restaurant  \
0                      0               0          0
0
1                      0               0          0
0
2                      0               0          0
0
3                      0               0          0
0
4                      0               0          0
0

   Golf Course  Gourmet Shop  Greek Restaurant  Grocery Store  Gym  \
0            0             0                 0              0    0
1            0             0                 0              0    0
2            0             0                 0              0    0
3            0             0                 0              0    0
4            0             0                 0              0    0
```

	Gym / Fitness Center	Gym Pool	Hakka Restaurant	Harbor / Marina
0	0	0	0	0
1	0	0	0	0
2	0	0	0	0
3	0	0	0	0
4	0	0	0	0

	Hardware Store	Health & Beauty Service	Health Food Store	Historic Site
0	0	0	0	0
1	0	0	0	0
2	0	0	0	0
3	0	0	0	0
4	0	0	0	0

	History Museum	Hobby Shop	Hockey Arena	Home Service	Hookah Bar
0	0	0	0	0	0
1	0	0	0	0	0
2	0	0	0	0	0
3	0	0	1	0	0
4	0	0	0	0	0

	Hospital	Hotel	Hotel Bar	IT Services	Ice Cream Shop
0	0	0	0	0	0
1	0	0	0	0	0
2	0	0	0	0	0
3	0	0	0	0	0
4	0	0	0	0	0

	Imported Food Shop	Indian Restaurant	Indie Movie Theater	Intersection
0	0	0	0	

```
0
1                   0                   0                   0
0
2                   0                   0                   0
0
3                   0                   0                   0
0
4                   0                   0                   0
0

   Irish Pub  Italian Restaurant  Japanese Restaurant  Jazz Club  \
0          0                   0                   0          0
1          0                   0                   0          0
2          0                   0                   0          0
3          0                   0                   0          0
4          0                   0                   0          0

   Jewelry Store  Juice Bar  Kids Store  Knitting Store  \
0              0          0           0               0
1              0          0           0               0
2              0          0           0               0
3              0          0           0               0
4              0          0           0               0

   Korean BBQ Restaurant  Korean Restaurant  Lake  Latin American
Restaurant  \
0                      0                  0     0
0
1                      0                  0     0
0
2                      0                  0     0
0
3                      0                  0     0
0
4                      0                  0     0
0

   Light Rail Station  Lingerie Store  Liquor Store  Lounge  Market  \
0                   0               0             0       0       0
1                   0               0             0       0       0
2                   0               0             0       0       0
3                   0               0             0       0       0
4                   0               0             0       0       0

   Martial Arts School  Massage Studio  Mediterranean Restaurant
Men's Store  \
0                    0               0                         0
0
1                    0               0                         0
0
```

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

   Metro Station  Mexican Restaurant  Middle Eastern Restaurant  \
0              0                   0                          0
1              0                   0                          0
2              0                   0                          0
3              0                   0                          0
4              0                   0                          0

   Miscellaneous Shop  Mobile Phone Shop  Modern European
Restaurant  \
0                   0                  0                          0

1                   0                  0                          0

2                   0                  0                          0

3                   0                  0                          0

4                   0                  0                          0


   Molecular Gastronomy Restaurant  Monument / Landmark  Moroccan
Restaurant  \
0                                0                   0
0
1                                0                   0
0
2                                0                   0
0
3                                0                   0
0
4                                0                   0
0

   Motel  Movie Theater  Museum  Music Store  Music Venue
Neighborhood  \
0      0              0       0            0            0
0
1      0              0       0            0            0
0
2      0              0       0            0            0
0
3      0              0       0            0            0
```

0
4   0   0   0   0   0
0

   New American Restaurant Nightclub Noodle House Office Opera
House \
0   0   0   0   0
0
1   0   0   0   0
0
2   0   0   0   0
0
3   0   0   0   0
0
4   0   0   0   0
0

   Optical Shop Organic Grocery Other Great Outdoors Other Repair
Shop \
0   0   0   0
0
1   0   0   0
0
2   0   0   0
0
3   0   0   0
0
4   0   0   0
0

   Outdoor Sculpture Park Performing Arts Venue Pet Store Pharmacy
\
0   0   1   0   0   0

1   0   0   0   0   0

2   0   0   0   0   0

3   0   0   0   0   0

4   0   0   0   0   0

   Pizza Place Playground Plaza Poke Place Polish Restaurant Pool
\
0   0   0   0   0   0   0

1   0   0   0   0   0   0

```
2            0           0      0           0                  0     0

3            0           0      0           0                  0     0

4            0           0      0           0                  0     0


   Portuguese Restaurant  Poutine Place  Pub  Ramen Restaurant  Record
Shop  \
0                      0              0    0                 0
0
1                      0              0    0                 0
0
2                      0              0    0                 0
0
3                      0              0    0                 0
0
4                      0              0    0                 0
0

   Recording Studio  Rental Car Location  Restaurant  River  Roof Deck
\
0                 0                    0           0      0          0

1                 0                    0           0      0          0

2                 0                    0           0      0          0

3                 0                    0           0      0          0

4                 0                    0           0      0          0


   Sake Bar  Salad Place  Salon / Barbershop  Sandwich Place  Scenic
Lookout  \
0         0            0                   0               0
0
1         0            0                   0               0
0
2         0            0                   0               0
0
3         0            0                   0               0
0
4         0            0                   0               0
0

   Sculpture Garden  Seafood Restaurant  Shoe Store  Shopping Mall  \
0                 0                   0           0              0
1                 0                   0           0              0
```

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

   Shopping Plaza  Skate Park  Skating Rink  Smoke Shop  Smoothie Shop
\
0               0           0             0           0               0

1               0           0             0           0               0

2               0           0             0           0               0

3               0           0             0           0               0

4               0           0             0           0               0


   Snack Place  Soccer Field  Soup Place  South American Restaurant
Spa  \
0            0             0           0                          0
0
1            0             0           0                          0
0
2            0             0           0                          0
0
3            0             0           0                          0
0
4            0             0           0                          0
0

   Speakeasy  Sporting Goods Shop  Sports Bar  Sri Lankan Restaurant
Stadium  \
0          0                    0           0                       0
0
1          0                    0           0                       0
0
2          0                    0           0                       0
0
3          0                    0           0                       0
0
4          0                    0           0                       0
0

   Stationery Store  Steakhouse  Strip Club  Summer Camp  Supermarket
\
0                 0           0           0            0             0

1                 0           0           0            0             0
```

```
2                  0           0           0            0            0

3                  0           0           0            0            0

4                  0           0           0            0            0


   Supplement Shop  Sushi Restaurant  Swim School  Taco Place  Tailor
Shop  \
0                  0                 0            0           0
0
1                  0                 0            0           0
0
2                  0                 0            0           0
0
3                  0                 0            0           0
0
4                  0                 0            0           0
0

   Tanning Salon  Tea Room  Thai Restaurant  Theater  Theme Restaurant
\
0              0         0                0        0                 0

1              0         0                0        0                 0

2              0         0                0        0                 0

3              0         0                0        0                 0

4              0         0                0        0                 0


   Thrift / Vintage Store  Tibetan Restaurant  Toy / Game Store  Trail
\
0                       0                   0                 0      0

1                       0                   0                 0      0

2                       0                   0                 0      0

3                       0                   0                 0      0

4                       0                   0                 0      0


   Train Station  Truck Stop  Turkish Restaurant  \
0              0           0                   0
```

```
1              0           0                   0
2              0           0                   0
3              0           0                   0
4              0           0                   0

   Vegetarian / Vegan Restaurant  Video Game Store  Vietnamese
Restaurant  \
0                               0                 0
0
1                               0                 0
0
2                               0                 0
0
3                               0                 0
0
4                               0                 0
0

   Warehouse Store  Wine Bar  Wine Shop  Wings Joint  Women's Store  \
0                0         0          0            0              0
1                0         0          0            0              0
2                0         0          0            0              0
3                0         0          0            0              0
4                0         0          0            0              0

   Yoga Studio
0            0
1            0
2            0
3            0
4            0
```

```
to_grouped = to_onehot.groupby(["Neighborhoods"]).mean().reset_index()


print(to_grouped.shape)
to_grouped.head()
```

```
(100, 273)

                                    Neighborhoods  Accessories Store
\
0                                       Agincourt                0.0

1                            Alderwood, Long Branch                0.0

2  Bathurst Manor, Wilson Heights, Downsview North                0.0

3                                   Bayview Village                0.0
```

4 Bedford Park, Lawrence Manor East 0.0

	Adult Boutique	Airport	Airport Food Court	Airport Gate	Airport Lounge
0	0.0	0.0	0.0	0.0	0.0
1	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0

	Airport Service	Airport Terminal	American Restaurant	Antique Shop
0	0.0	0.0	0.00	0.0
1	0.0	0.0	0.00	0.0
2	0.0	0.0	0.00	0.0
3	0.0	0.0	0.00	0.0
4	0.0	0.0	0.05	0.0

	Aquarium	Art Gallery	Arts & Crafts Store	Asian Restaurant
0	0.0	0.0	0.0	0.0
1	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0

	Athletics & Sports	Auto Garage	Auto Workshop	BBQ Joint	Baby Store
0	0.0	0.0	0.0	0.0	0.0
1	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0

	Bagel Shop	Bakery	Bank	Bar	Baseball Field	Baseball Stadium

```
0         0.0    0.00  0.00  0.0             0.0               0.0
1         0.0    0.00  0.00  0.0             0.0               0.0
2         0.0    0.00  0.10  0.0             0.0               0.0
3         0.0    0.00  0.25  0.0             0.0               0.0
4         0.0    0.05  0.00  0.0             0.0               0.0

   Basketball Stadium  Beach  Bed & Breakfast  Beer Bar  Beer Store  \
0                 0.0    0.0              0.0       0.0         0.0
1                 0.0    0.0              0.0       0.0         0.0
2                 0.0    0.0              0.0       0.0         0.0
3                 0.0    0.0              0.0       0.0         0.0
4                 0.0    0.0              0.0       0.0         0.0

   Belgian Restaurant  Bike Shop  Bistro  Board Shop  Boat or Ferry  \
0                 0.0        0.0     0.0         0.0            0.0
1                 0.0        0.0     0.0         0.0            0.0
2                 0.0        0.0     0.0         0.0            0.0
3                 0.0        0.0     0.0         0.0            0.0
4                 0.0        0.0     0.0         0.0            0.0

   Bookstore  Boutique  Brazilian Restaurant  Breakfast Spot  Brewery
\
0        0.0       0.0                   0.0             0.2      0.0

1        0.0       0.0                   0.0             0.0      0.0

2        0.0       0.0                   0.0             0.0      0.0

3        0.0       0.0                   0.0             0.0      0.0

4        0.0       0.0                   0.0             0.0      0.0


   Bridal Shop  Bubble Tea Shop  Building  Burger Joint  Burrito Place
\
0         0.00              0.0       0.0           0.0            0.0

1         0.00              0.0       0.0           0.0            0.0

2         0.05              0.0       0.0           0.0            0.0

3         0.00              0.0       0.0           0.0            0.0

4         0.00              0.0       0.0           0.0            0.0


   Bus Line  Bus Station  Bus Stop  Butcher  Café  Candy Store  \
0       0.0          0.0       0.0     0.00  0.00          0.0
1       0.0          0.0       0.0     0.00  0.00          0.0
```

```
2       0.0          0.0       0.0     0.00  0.00          0.0
3       0.0          0.0       0.0     0.00  0.25          0.0
4       0.0          0.0       0.0     0.05  0.05          0.0

   Caribbean Restaurant  Carpet Store  Cheese Shop  Chinese Restaurant
\
0                   0.0           0.0          0.0                0.00

1                   0.0           0.0          0.0                0.00

2                   0.0           0.0          0.0                0.00

3                   0.0           0.0          0.0                0.25

4                   0.0           0.0          0.0                0.00


   Chocolate Shop  Church  Climbing Gym  Clothing Store  Cocktail Bar
\
0             0.0     0.0           0.0             0.2           0.0

1             0.0     0.0           0.0             0.0           0.0

2             0.0     0.0           0.0             0.0           0.0

3             0.0     0.0           0.0             0.0           0.0

4             0.0     0.0           0.0             0.0           0.0


   Coffee Shop  College Arts Building  College Auditorium  College Gym
\
0        0.000                    0.0                 0.0          0.0

1        0.125                    0.0                 0.0          0.0

2        0.100                    0.0                 0.0          0.0

3        0.000                    0.0                 0.0          0.0

4        0.050                    0.0                 0.0          0.0


   College Rec Center  College Stadium  Colombian Restaurant  \
0                 0.0              0.0                   0.0
1                 0.0              0.0                   0.0
2                 0.0              0.0                   0.0
3                 0.0              0.0                   0.0
```

```
4                 0.0             0.0                   0.0

   Comfort Food Restaurant  Comic Shop  Concert Hall  \
0                     0.00         0.0           0.0
1                     0.00         0.0           0.0
2                     0.00         0.0           0.0
3                     0.00         0.0           0.0
4                     0.05         0.0           0.0

   Construction & Landscaping  Convenience Store  Cosmetics Shop  \
0                         0.0                0.0             0.0
1                         0.0                0.0             0.0
2                         0.0                0.0             0.0
3                         0.0                0.0             0.0
4                         0.0                0.0             0.0

   Coworking Space  Creperie  Cuban Restaurant  Cupcake Shop  Curling
Ice  \
0              0.0       0.0               0.0           0.0
0.0
1              0.0       0.0               0.0           0.0
0.0
2              0.0       0.0               0.0           0.0
0.0
3              0.0       0.0               0.0           0.0
0.0
4              0.0       0.0               0.0           0.0
0.0

   Dance Studio  Deli / Bodega  Department Store  Dessert Shop  \
0           0.0           0.00               0.0           0.0
1           0.0           0.00               0.0           0.0
2           0.0           0.05               0.0           0.0
3           0.0           0.00               0.0           0.0
4           0.0           0.00               0.0           0.0

   Dim Sum Restaurant  Diner  Discount Store  Distribution Center  Dog
Run  \
0                 0.0   0.00             0.0                  0.0
0.0
1                 0.0   0.00             0.0                  0.0
0.0
2                 0.0   0.05             0.0                  0.0
0.0
3                 0.0   0.00             0.0                  0.0
0.0
4                 0.0   0.00             0.0                  0.0
0.0

   Doner Restaurant  Donut Shop  Drugstore  Dumpling Restaurant  \
```

```
0               0.0         0.0        0.0                  0.0
1               0.0         0.0        0.0                  0.0
2               0.0         0.0        0.0                  0.0
3               0.0         0.0        0.0                  0.0
4               0.0         0.0        0.0                  0.0

   Eastern European Restaurant  Electronics Store  Ethiopian
Restaurant  \
0                           0.0                0.0
0.0
1                           0.0                0.0
0.0
2                           0.0                0.0
0.0
3                           0.0                0.0
0.0
4                           0.0                0.0
0.0

   Event Space  Falafel Restaurant  Farmers Market  Fast Food
Restaurant  \
0          0.0                 0.0             0.0
0.00
1          0.0                 0.0             0.0
0.00
2          0.0                 0.0             0.0
0.00
3          0.0                 0.0             0.0
0.00
4          0.0                 0.0             0.0
0.05

   Field  Filipino Restaurant  Fish & Chips Shop  Fish Market  Flea
Market  \
0    0.0                  0.0                0.0          0.0
0.0
1    0.0                  0.0                0.0          0.0
0.0
2    0.0                  0.0                0.0          0.0
0.0
3    0.0                  0.0                0.0          0.0
0.0
4    0.0                  0.0                0.0          0.0
0.0

   Flower Shop  Food & Drink Shop  Food Court  Food Truck  Fountain  \
0          0.0                0.0         0.0         0.0       0.0
1          0.0                0.0         0.0         0.0       0.0
2          0.0                0.0         0.0         0.0       0.0
3          0.0                0.0         0.0         0.0       0.0
```

```
4          0.0                0.0         0.0         0.0       0.0

   French Restaurant  Fried Chicken Joint  Frozen Yogurt Shop  \
0                0.0                 0.00                 0.0
1                0.0                 0.00                 0.0
2                0.0                 0.05                 0.0
3                0.0                 0.00                 0.0
4                0.0                 0.00                 0.0

   Fruit & Vegetable Store  Furniture / Home Store  Gaming Cafe
Garden  \
0                      0.0                     0.0          0.0
0.0
1                      0.0                     0.0          0.0
0.0
2                      0.0                     0.0          0.0
0.0
3                      0.0                     0.0          0.0
0.0
4                      0.0                     0.0          0.0
0.0

   Garden Center  Gas Station  Gastropub  Gay Bar  Gelato Shop  \
0            0.0         0.00        0.0      0.0          0.0
1            0.0         0.00        0.0      0.0          0.0
2            0.0         0.05        0.0      0.0          0.0
3            0.0         0.00        0.0      0.0          0.0
4            0.0         0.00        0.0      0.0          0.0

   General Entertainment  General Travel  Gift Shop  Gluten-free
Restaurant  \
0                    0.0             0.0        0.0
0.0
1                    0.0             0.0        0.0
0.0
2                    0.0             0.0        0.0
0.0
3                    0.0             0.0        0.0
0.0
4                    0.0             0.0        0.0
0.0

   Golf Course  Gourmet Shop  Greek Restaurant  Grocery Store
Gym  \
0          0.0           0.0              0.00           0.00  0.000

1          0.0           0.0              0.00           0.00  0.125

2          0.0           0.0              0.00           0.00  0.000
```

```
3          0.0           0.0              0.00           0.00  0.000

4          0.0           0.0              0.05           0.05  0.000


   Gym / Fitness Center  Gym Pool  Hakka Restaurant  Harbor /
Marina  \
0                   0.0       0.0               0.0              0.0

1                   0.0       0.0               0.0              0.0

2                   0.0       0.0               0.0              0.0

3                   0.0       0.0               0.0              0.0

4                   0.0       0.0               0.0              0.0


   Hardware Store  Health & Beauty Service  Health Food Store
Historic Site  \
0             0.0                      0.0               0.00
0.0
1             0.0                      0.0               0.00
0.0
2             0.0                      0.0               0.05
0.0
3             0.0                      0.0               0.00
0.0
4             0.0                      0.0               0.00
0.0

   History Museum  Hobby Shop  Hockey Arena  Home Service  Hookah Bar
\
0             0.0         0.0           0.0           0.0         0.0

1             0.0         0.0           0.0           0.0         0.0

2             0.0         0.0           0.0           0.0         0.0

3             0.0         0.0           0.0           0.0         0.0

4             0.0         0.0           0.0           0.0         0.0


   Hospital  Hotel  Hotel Bar  IT Services  Ice Cream Shop  \
0       0.0    0.0        0.0          0.0            0.00
1       0.0    0.0        0.0          0.0            0.00
```

```
2       0.0    0.0        0.0          0.0            0.05
3       0.0    0.0        0.0          0.0            0.00
4       0.0    0.0        0.0          0.0            0.00

   Imported Food Shop  Indian Restaurant  Indie Movie Theater
Intersection  \
0                 0.0               0.00                  0.0
0.0
1                 0.0               0.00                  0.0
0.0
2                 0.0               0.00                  0.0
0.0
3                 0.0               0.00                  0.0
0.0
4                 0.0               0.05                  0.0
0.0

   Irish Pub  Italian Restaurant  Japanese Restaurant  Jazz Club  \
0        0.0                 0.0                 0.00        0.0
1        0.0                 0.0                 0.00        0.0
2        0.0                 0.0                 0.00        0.0
3        0.0                 0.0                 0.25        0.0
4        0.0                 0.1                 0.00        0.0

   Jewelry Store  Juice Bar  Kids Store  Knitting Store  \
0            0.0       0.00         0.0             0.0
1            0.0       0.00         0.0             0.0
2            0.0       0.00         0.0             0.0
3            0.0       0.00         0.0             0.0
4            0.0       0.05         0.0             0.0

   Korean BBQ Restaurant  Korean Restaurant  Lake  Latin American
Restaurant  \
0                    0.0                0.0   0.0
0.2
1                    0.0                0.0   0.0
0.0
2                    0.0                0.0   0.0
0.0
3                    0.0                0.0   0.0
0.0
4                    0.0                0.0   0.0
0.0

   Light Rail Station  Lingerie Store  Liquor Store  Lounge  Market  \
0                 0.0             0.0          0.00     0.2     0.0
1                 0.0             0.0          0.00     0.0     0.0
2                 0.0             0.0          0.00     0.0     0.0
3                 0.0             0.0          0.00     0.0     0.0
4                 0.0             0.0          0.05     0.0     0.0
```

	Martial Arts School	Massage Studio	Mediterranean Restaurant	Men's Store
0	0.0	0.0	0.0	0.0
1	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0

	Metro Station	Mexican Restaurant	Middle Eastern Restaurant
0	0.0	0.0	0.00
1	0.0	0.0	0.00
2	0.0	0.0	0.05
3	0.0	0.0	0.00
4	0.0	0.0	0.00

	Miscellaneous Shop	Mobile Phone Shop	Modern European Restaurant
0	0.0	0.0	0.0
1	0.0	0.0	0.0
2	0.0	0.0	0.0
3	0.0	0.0	0.0
4	0.0	0.0	0.0

	Molecular Gastronomy Restaurant	Monument / Landmark	Moroccan Restaurant
0	0.0	0.0	0.0
1	0.0	0.0	0.0
2	0.0	0.0	0.0
3	0.0	0.0	0.0
4	0.0	0.0	0.0

	Motel	Movie Theater	Museum	Music Store	Music Venue	Neighborhood

```
0    0.0            0.0     0.0          0.0          0.0
0.0
1    0.0            0.0     0.0          0.0          0.0
0.0
2    0.0            0.0     0.0          0.0          0.0
0.0
3    0.0            0.0     0.0          0.0          0.0
0.0
4    0.0            0.0     0.0          0.0          0.0
0.0

   New American Restaurant  Nightclub  Noodle House  Office  Opera
House  \
0                      0.0        0.0           0.0     0.0
0.0
1                      0.0        0.0           0.0     0.0
0.0
2                      0.0        0.0           0.0     0.0
0.0
3                      0.0        0.0           0.0     0.0
0.0
4                      0.0        0.0           0.0     0.0
0.0

   Optical Shop  Organic Grocery  Other Great Outdoors  Other Repair
Shop  \
0           0.0              0.0                   0.0
0.0
1           0.0              0.0                   0.0
0.0
2           0.0              0.0                   0.0
0.0
3           0.0              0.0                   0.0
0.0
4           0.0              0.0                   0.0
0.0

   Outdoor Sculpture  Park  Performing Arts Venue  Pet Store  Pharmacy
\
0                0.0   0.0                    0.0       0.00     0.000

1                0.0   0.0                    0.0       0.00     0.125

2                0.0   0.0                    0.0       0.05     0.050

3                0.0   0.0                    0.0       0.00     0.000

4                0.0   0.0                    0.0       0.00     0.050
```

	Pizza Place	Playground	Plaza	Poke Place	Polish Restaurant	Pool
0	0.00	0.0	0.0	0.0	0.0	0.0
1	0.25	0.0	0.0	0.0	0.0	0.0
2	0.05	0.0	0.0	0.0	0.0	0.0
3	0.00	0.0	0.0	0.0	0.0	0.0
4	0.00	0.0	0.0	0.0	0.0	0.0

	Portuguese Restaurant	Poutine Place	Pub	Ramen Restaurant	Record Shop
0	0.0	0.0	0.000	0.0	0.0
1	0.0	0.0	0.125	0.0	0.0
2	0.0	0.0	0.000	0.0	0.0
3	0.0	0.0	0.000	0.0	0.0
4	0.0	0.0	0.050	0.0	0.0

	Recording Studio	Rental Car Location	Restaurant	River	Roof Deck
0	0.0	0.0	0.00	0.0	0.0
1	0.0	0.0	0.00	0.0	0.0
2	0.0	0.0	0.05	0.0	0.0
3	0.0	0.0	0.00	0.0	0.0
4	0.0	0.0	0.05	0.0	0.0

	Sake Bar	Salad Place	Salon / Barbershop	Sandwich Place	Scenic Lookout
0	0.0	0.0	0.0	0.000	0.0
1	0.0	0.0	0.0	0.125	0.0
2	0.0	0.0	0.0	0.050	0.0
3	0.0	0.0	0.0	0.000	

```
0.0
4       0.0          0.0                 0.0           0.050
0.0

   Sculpture Garden  Seafood Restaurant  Shoe Store  Shopping Mall  \
0               0.0                 0.0         0.0           0.00
1               0.0                 0.0         0.0           0.00
2               0.0                 0.0         0.0           0.05
3               0.0                 0.0         0.0           0.00
4               0.0                 0.0         0.0           0.00

   Shopping Plaza  Skate Park  Skating Rink  Smoke Shop  Smoothie Shop
\
0             0.0         0.0         0.200         0.0            0.0

1             0.0         0.0         0.125         0.0            0.0

2             0.0         0.0         0.000         0.0            0.0

3             0.0         0.0         0.000         0.0            0.0

4             0.0         0.0         0.000         0.0            0.0


   Snack Place  Soccer Field  Soup Place  South American Restaurant
Spa  \
0          0.0           0.0         0.0                        0.0
0.0
1          0.0           0.0         0.0                        0.0
0.0
2          0.0           0.0         0.0                        0.0
0.0
3          0.0           0.0         0.0                        0.0
0.0
4          0.0           0.0         0.0                        0.0
0.0

   Speakeasy  Sporting Goods Shop  Sports Bar  Sri Lankan Restaurant
Stadium  \
0        0.0                  0.0         0.0                    0.0
0.0
1        0.0                  0.0         0.0                    0.0
0.0
2        0.0                  0.0         0.0                    0.0
0.0
3        0.0                  0.0         0.0                    0.0
0.0
4        0.0                  0.0         0.0                    0.0
0.0
```

	Stationery Store	Steakhouse	Strip Club	Summer Camp	Supermarket
0	0.0	0.0	0.0	0.0	0.00
1	0.0	0.0	0.0	0.0	0.00
2	0.0	0.0	0.0	0.0	0.05
3	0.0	0.0	0.0	0.0	0.00
4	0.0	0.0	0.0	0.0	0.00

	Supplement Shop	Sushi Restaurant	Swim School	Taco Place	Tailor Shop
0	0.0	0.00	0.0	0.0	0.0
1	0.0	0.00	0.0	0.0	0.0
2	0.0	0.05	0.0	0.0	0.0
3	0.0	0.00	0.0	0.0	0.0
4	0.0	0.05	0.0	0.0	0.0

	Tanning Salon	Tea Room	Thai Restaurant	Theater	Theme Restaurant
0	0.0	0.0	0.00	0.0	0.0
1	0.0	0.0	0.00	0.0	0.0
2	0.0	0.0	0.00	0.0	0.0
3	0.0	0.0	0.00	0.0	0.0
4	0.0	0.0	0.05	0.0	0.0

	Thrift / Vintage Store	Tibetan Restaurant	Toy / Game Store	Trail
0	0.0	0.0	0.0	0.0
1	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0

```
3                     0.0                 0.0               0.0    0.0

4                     0.0                 0.0               0.0    0.0


   Train Station  Truck Stop  Turkish Restaurant  \
0            0.0         0.0                 0.0
1            0.0         0.0                 0.0
2            0.0         0.0                 0.0
3            0.0         0.0                 0.0
4            0.0         0.0                 0.0

   Vegetarian / Vegan Restaurant  Video Game Store  Vietnamese
Restaurant  \
0                            0.0               0.0
0.0
1                            0.0               0.0
0.0
2                            0.0               0.0
0.0
3                            0.0               0.0
0.0
4                            0.0               0.0
0.0

   Warehouse Store  Wine Bar  Wine Shop  Wings Joint  Women's Store  \
0              0.0       0.0        0.0          0.0            0.0
1              0.0       0.0        0.0          0.0            0.0
2              0.0       0.0        0.0          0.0            0.0
3              0.0       0.0        0.0          0.0            0.0
4              0.0       0.0        0.0          0.0            0.0

   Yoga Studio
0          0.0
1          0.0
2          0.0
3          0.0
4          0.0
```

```
ita = to_grouped[["Neighborhoods","Italian Restaurant"]]
ita.head()
```

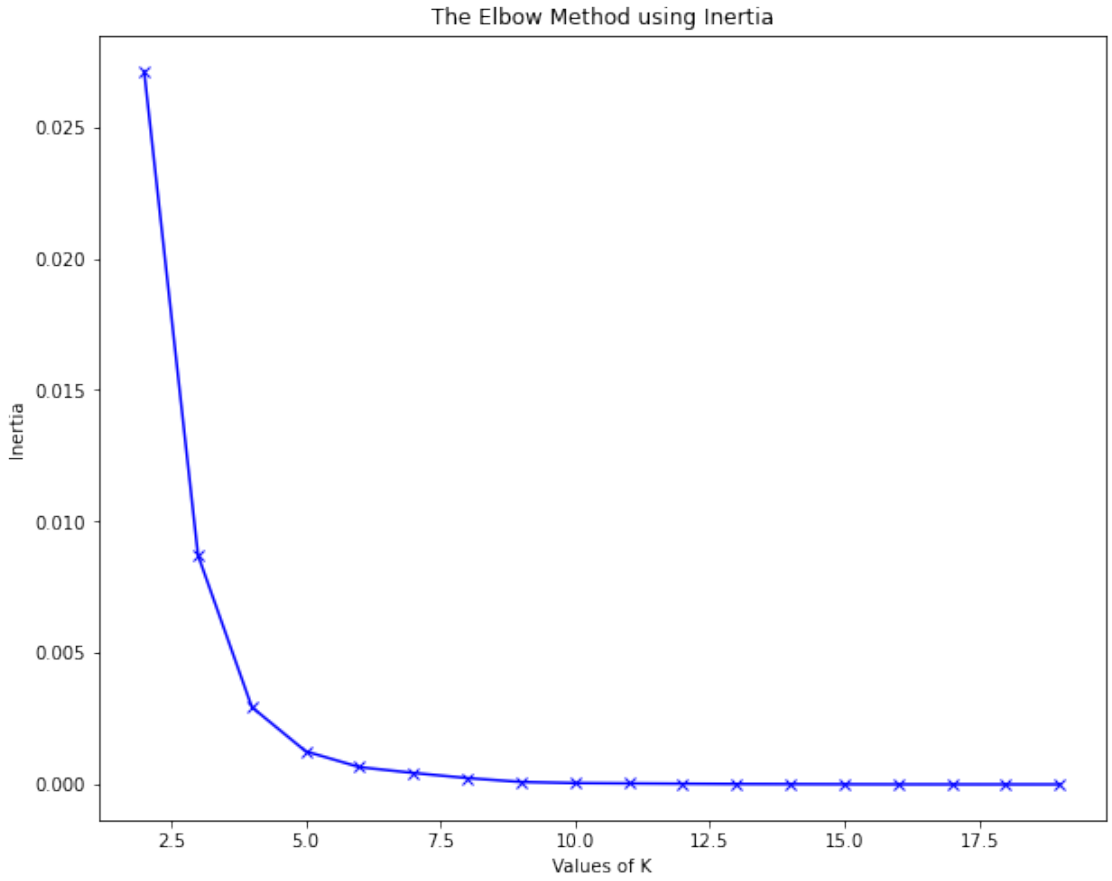
```
                                    Neighborhoods  Italian Restaurant
0                                        Agincourt                 0.0
1                            Alderwood, Long Branch                 0.0
2  Bathurst Manor, Wilson Heights, Downsview North                 0.0
3                                 Bayview Village                 0.0
4                Bedford Park, Lawrence Manor East                 0.1
```

```
ita = ita.rename(columns={'Neighborhoods':'Neighborhood'})
```

Clustering

```
X = ita.drop(['Neighborhood'], axis=1)

plt.figure(figsize=[10, 8])
inertia=[]
range_val=range(2,20)
for i in range_val:
  kmean=KMeans(n_clusters=i)
  kmean.fit_predict(X)
  inertia.append(kmean.inertia_)
plt.plot(range_val,inertia,'bx-')
plt.xlabel('Values of K')
plt.ylabel('Inertia')
plt.title('The Elbow Method using Inertia')
plt.show()
```




```
kclusters = 4

toronto_grouped_clustering = ita.drop('Neighborhood', 1)

kmeans = KMeans(n_clusters=kclusters,
random_state=0).fit(toronto_grouped_clustering)
```

```
kmeans.labels_[0:10]
```

```
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:3:
FutureWarning: In a future version of pandas all arguments of
DataFrame.drop except for the argument 'labels' will be keyword-only
  This is separate from the ipykernel package so we can avoid doing
imports until
```

```
array([0, 0, 0, 0, 1, 0, 0, 3, 0, 0], dtype=int32)
```

```
np.unique(kmeans.labels_)
```

```
array([0, 1, 2, 3], dtype=int32)
```

```
to_merged = ita.copy()
```

```
to_merged["Cluster Labels"] = kmeans.labels_
```

```
to_merged.head()
```

```
                                     Neighborhood  Italian Restaurant
\
0                                       Agincourt                 0.0

1                           Alderwood, Long Branch                 0.0

2  Bathurst Manor, Wilson Heights, Downsview North                 0.0

3                                 Bayview Village                 0.0

4               Bedford Park, Lawrence Manor East                 0.1


   Cluster Labels
0               0
1               0
2               0
3               0
4               1
```

```
to_merged = to_merged.join(toronto_venues.set_index("Neighborhood"),
on="Neighborhood")
```

```
print(to_merged.shape)
to_merged.head()
```

```
(2145, 9)
```

```
  Neighborhood  Italian Restaurant  Cluster Labels  Neighborhood
Latitude  \
```

```
0    Agincourt                 0.0               0
43.7942
0    Agincourt                 0.0               0
43.7942
0    Agincourt                 0.0               0
43.7942
0    Agincourt                 0.0               0
43.7942
0    Agincourt                 0.0               0
43.7942

   Neighborhood Longitude                      Venue  Venue Latitude
\
0              -79.262029  Panagio's Breakfast & Lunch       43.792370

0              -79.262029               El Pulgarcito       43.792648

0              -79.262029                    Twilight       43.791999

0              -79.262029                      Mark's       43.791179

0              -79.262029             Commander Arena       43.794867


   Venue Longitude             Venue Category
0       -79.260203             Breakfast Spot
0       -79.259208  Latin American Restaurant
0       -79.258584                     Lounge
0       -79.259714             Clothing Store
0       -79.267989               Skating Rink
```

```
print(to_merged.shape)
to_merged.sort_values(["Cluster Labels"], inplace=True)
to_merged.tail()
```

```
(2145, 9)

                                       Neighborhood  Italian
Restaurant  \
63                     Ontario Provincial Government
0.028571
63                     Ontario Provincial Government
0.028571
63                     Ontario Provincial Government
0.028571
63                     Ontario Provincial Government
0.028571
40  Harbourfront East, Union Station, Toronto Islands
0.020000
```

```
    Cluster Labels  Neighborhood Latitude  Neighborhood Longitude  \
63               3              43.662301              -79.389494
63               3              43.662301              -79.389494
63               3              43.662301              -79.389494
63               3              43.662301              -79.389494
40               3              43.640816              -79.381752

             Venue  Venue Latitude  Venue Longitude         Venue
Category
63           SUDS       43.659880       -79.394712
Bar
63    Tim Hortons       43.658906       -79.388696            Coffee
Shop
63   CIUT 89.5 FM       43.663818       -79.395092  General
Entertainment
63  Booster Juice       43.658657       -79.388682          Smoothie
Shop
40      Pizzaiolo       43.639113       -79.387266            Pizza
Place
```

```
to_merged['Venue Category'].value_counts()['Italian Restaurant']
```

```
39
```

Visualización

```
# creando mapas
map_clusters = folium.Map(location=[lat_toronto, lon_toronto],
zoom_start=11)
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]
markers_colors = []
for lat, lon, poi, cluster in zip(to_merged['Neighborhood Latitude'],
to_merged['Neighborhood Longitude'], to_merged['Neighborhood'],
to_merged['Cluster Labels']):
    label = folium.Popup(str(poi) + ' - Cluster ' + str(cluster))
    folium.CircleMarker(
        [lat, lon],
        radius=5,
        popup=label,
        color=rainbow[cluster-1],
        fill_color=rainbow[cluster-1],
        fill_opacity=0.8).add_to(map_clusters)
```

```
map_clusters
```

```
<folium.folium.Map at 0x7fbabfcd3ad0>
```

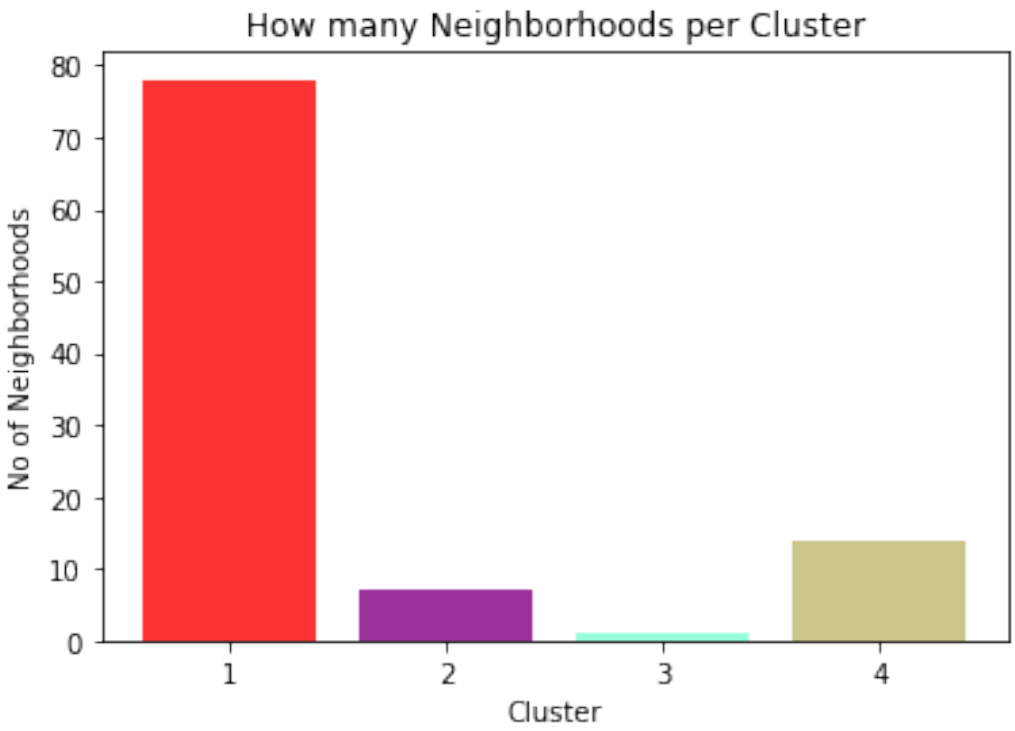
```
ita["Cluster Labels"] = kmeans.labels_
ita.head()
```

	Neighborhood	Italian Restaurant
0	Agincourt	0.0
1	Alderwood, Long Branch	0.0
2	Bathurst Manor, Wilson Heights, Downsview North	0.0
3	Bayview Village	0.0
4	Bedford Park, Lawrence Manor East	0.1

	Cluster Labels
0	0
1	0
2	0
3	0
4	1

```
objects = (1,2,3,4)
y_pos = np.arange(len(objects))
performance = ita['Cluster
Labels'].value_counts().to_frame().sort_index(ascending=True)
perf = performance['Cluster Labels'].tolist()
plt.bar(y_pos, perf, align='center', alpha=0.8, color=['red',
'purple','aquamarine', 'darkkhaki'])
plt.xticks(y_pos, objects)
plt.ylabel('No of Neighborhoods')
plt.xlabel('Cluster')
plt.title('How many Neighborhoods per Cluster')

plt.show()
```




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

```
0    78
3    14
1     7
2     1
Name: Cluster Labels, dtype: int64
```

Análisis de cada cluster

```
df_new = df[['Borough', 'Neighborhood']]
df_new.head()
```

```
           Borough                     Neighborhood
0        North York                        Parkwoods
1        North York                  Victoria Village
2  Downtown Toronto         Regent Park, Harbourfront
3        North York  Lawrence Manor, Lawrence Heights
4      Queen's Park     Ontario Provincial Government
```

```
cluster1 = to_merged.loc[to_merged['Cluster Labels'] == 0]
df_cluster1 = pd.merge(df_new, cluster1, on='Neighborhood')
df_cluster1.head()
```

```
      Borough      Neighborhood  Italian Restaurant  Cluster Labels  \
0  North York         Parkwoods                 0.0               0
1  North York         Parkwoods                 0.0               0
2  North York         Parkwoods                 0.0               0
```

```
3  North York  Victoria Village                 0.0               0
4  North York  Victoria Village                 0.0               0

   Neighborhood Latitude  Neighborhood Longitude
Venue  \
0              43.753259              -79.329656           Variety
Store
1              43.753259              -79.329656
KFC
2              43.753259              -79.329656         Brookbanks
Park
3              43.725882              -79.315572             Tim
Hortons
4              43.725882              -79.315572  Victoria Village
Arena

   Venue Latitude  Venue Longitude        Venue Category
0       43.751974       -79.333114     Food & Drink Shop
1       43.754387       -79.333021  Fast Food Restaurant
2       43.751976       -79.332140                  Park
3       43.725517       -79.313103           Coffee Shop
4       43.723481       -79.315635          Hockey Arena
```

```
cluster2=to_merged.loc[to_merged['Cluster Labels'] == 1]
df_cluster2 = pd.merge(df_new, cluster2, on='Neighborhood')
df_cluster2.head()
```

```
      Borough     Neighborhood  Italian Restaurant  Cluster Labels  \
0  North York  Don Mills South            0.055556               1
1  North York  Don Mills South            0.055556               1
2  North York  Don Mills South            0.055556               1
3  North York  Don Mills South            0.055556               1
4  North York  Don Mills South            0.055556               1

   Neighborhood Latitude  Neighborhood Longitude
Venue  \
0               43.7259              -79.340923  Fitness Connection

1               43.7259              -79.340923              Oomomo

2               43.7259              -79.340923  Sorento Restaurant

3               43.7259              -79.340923              Subway

4               43.7259              -79.340923        Swiss Chalet


   Venue Latitude  Venue Longitude      Venue Category
0       43.727473       -79.341707                 Gym
1       43.726429       -79.343283      Discount Store
```

```
2       43.726575       -79.341989  Italian Restaurant
3       43.724322       -79.336858      Sandwich Place
4       43.726747       -79.341625          Restaurant
```

```
cluster3 = to_merged.loc[to_merged['Cluster Labels'] == 2]
df_cluster3 = pd.merge(df_new, cluster3, on='Neighborhood')
df_cluster3.head()
```

```
      Borough Neighborhood  Italian Restaurant  Cluster Labels  \
0  North York    Glencairn                 0.2               2
1  North York    Glencairn                 0.2               2
2  North York    Glencairn                 0.2               2
3  North York    Glencairn                 0.2               2
4  North York    Glencairn                 0.2               2

   Neighborhood Latitude  Neighborhood Longitude  \
0              43.709577              -79.445073
1              43.709577              -79.445073
2              43.709577              -79.445073
3              43.709577              -79.445073
4              43.709577              -79.445073

                              Venue  Venue Latitude  Venue Longitude
\
0  R Bakery - Delicious Cakes, Breads       43.707420       -79.443126

1                   Domino's Pizza       43.707170       -79.442658

2                  Filipino Grocery       43.705607       -79.442575

3                    Pasta Goodness       43.709457       -79.443863

4            Miyako Sushi Restaurant       43.709111       -79.443930


       Venue Category
0             Bakery
1         Pizza Place
2   Convenience Store
3   Italian Restaurant
4  Japanese Restaurant
```

```
cluster4 = to_merged.loc[to_merged['Cluster Labels'] == 3]
df_cluster4 = pd.merge(df_new, cluster4, on='Neighborhood')
df_cluster4.head()
```

```
       Borough                    Neighborhood  Italian Restaurant  \
0  Queen's Park  Ontario Provincial Government            0.028571
1  Queen's Park  Ontario Provincial Government            0.028571
2  Queen's Park  Ontario Provincial Government            0.028571
```

```
3  Queen's Park  Ontario Provincial Government            0.028571
4  Queen's Park  Ontario Provincial Government            0.028571

   Cluster Labels  Neighborhood Latitude  Neighborhood Longitude  \
0               3              43.662301              -79.389494
1               3              43.662301              -79.389494
2               3              43.662301              -79.389494
3               3              43.662301              -79.389494
4               3              43.662301              -79.389494

            Venue  Venue Latitude  Venue Longitude         Venue
Category
0    Queen's Park       43.663946       -79.392180
Park
1         Nando's       43.661728       -79.386391  Portuguese
Restaurant
2        Mercatto       43.660391       -79.387664     Italian
Restaurant
3  NEO COFFEE BAR       43.660130       -79.385830            Coffee
Shop
4    Central YMCA       43.663083       -79.385025            Summer
Camp
```

Número de vecindarios y número de restaurantes italianos por cluster

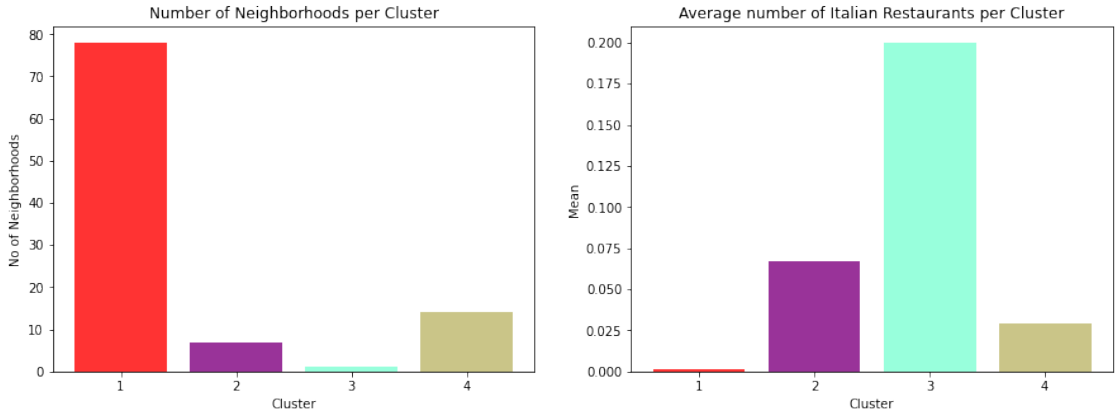
```
plt.figure(figsize=(15,5))

plt.subplot(1,2,1)
objects = (1,2,3,4)
y_pos = np.arange(len(objects))
performance = ita['Cluster
Labels'].value_counts().to_frame().sort_index(ascending=True)
perf_1 = performance['Cluster Labels'].tolist()
plt.bar(y_pos, perf_1, align='center', alpha=0.8, color=['red',
'purple','aquamarine', 'darkkhaki'])
plt.xticks(y_pos, objects)
plt.ylabel('No of Neighborhoods')
plt.xlabel('Cluster')
plt.title('Number of Neighborhoods per Cluster')

plt.subplot(1, 2, 2)
clusters_mean = [df_cluster1['Italian
Restaurant'].mean(),df_cluster2['Italian
Restaurant'].mean(),df_cluster3['Italian Restaurant'].mean(),
                 df_cluster4['Italian Restaurant'].mean()]
y_pos = np.arange(len(objects))
perf_2 = clusters_mean
plt.bar(y_pos, perf_2, align='center', alpha=0.8, color=['red',
'purple','aquamarine', 'darkkhaki'])
```

```
plt.xticks(y_pos, objects)
plt.ylabel('Mean')
plt.xlabel('Cluster')
plt.title('Average number of Italian Restaurants per Cluster')
```

```
Text(0.5, 1.0, 'Average number of Italian Restaurants per Cluster')
```



Conclusión

Los vecindarios ubicados en el área del este de Toronto (grupo 3) tienen el promedio más alto de restaurantes italianos, que está representado por el color aguamarina. North York tiene el segundo mayor número de restaurantes italianos presentes. En cuanto a los lugares cercanos, el lugar óptimo para poner un nuevo restaurante italiano es en Victoria Village, North York (cluster-1) ya que hay muchos vecindarios en esa área pero una pequeña cantidad de restaurantes italianos, por lo tanto, eliminando cualquier competencia. El segundo Los mejores vecindarios que tienen una gran oportunidad serían áreas como Queen's Park, que se encuentra en el Grupo 4. Tener 70 vecindarios en el área sin restaurantes italianos brinda una buena oportunidad para abrir un nuevo restaurante. Esto concluye los hallazgos óptimos para este proyecto y recomienda al emprendedor abrir un auténtico restaurante italiano en estos lugares con poca o ninguna competencia. No obstante, si la comida es auténtica, asequible y de buen gusto, estoy seguro de que tendrá muchos seguidores en todas partes.