The Battle of Neighborhoods - Moscow

May 24, 2020

Segmenting and Clustering Neighborhoods in Moscow

0.1 Introduction

As a young professional living in Moscow I am currently renting an apartment, but I am considering buying my own apartment in the future. I like the neighborhood I currently live in and I want to find some similar neighborhoods for possible relocation.

0.2 Table of Contents

Before we get the data and start exploring it, let's download all the dependencies that we will need.

[1]:
```
import numpy as np # library to handle data in a vectorized manner

import pandas as pd # library for data analsysis
pd.set_option('display.max_columns', None)
pd.set_option('display.max_rows', None)

import requests # library to handle requests

# Matplotlib and associated plotting modules
import matplotlib.cm as cm
import matplotlib.colors as colors

# import k-means from clustering stage
```

```
from sklearn.cluster import KMeans

# import DBSCAN from clustering stage
from sklearn.cluster import DBSCAN
from sklearn import metrics
from sklearn.preprocessing import StandardScaler

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

print('Libraries imported.')
```

```
Libraries imported.
```

0.3 Description of data

There are several sources of data used in this analysis. 1. Moscow geographical data on boroughs and neighborhoods Gis-LAB, an independent resource on Moscow geo data, can be used to obtain a CSV file with neighborhoods, boroughs and geo data on the borders of the neighborhoods in latitudes and longitudes. That data will then have to be adjusted as for the clustering I will need a single point within the borders of the neighborhood for segmentation.

2. Data on average price in different Moscow neighborhoods
   IRN, analytical center for real estate, has the data on average price per sq.m for neighborhoods in Moscow. That data will be used for pre-selecting neighborhoods based on price.

3. Foursquare API data on venues. Having pre-selected neighborhoods data i will use a get request to get data on venues located near the neighborhood center. I will only need data on the venue type, as the neighborhoods will be clustered based on that.

0.4 Methodology

In this notebook, I will use Foursquare API to explore neighborhoods in Moscow to find appropriate neighborhoods for relocation. I will pre-select the neighborhoods using DBSCAN algorithm based on price and then use the **explore** function to get the most common venue categories in each neighborhood, and then use this feature to group the neighborhoods into clusters. I will use the k-means clustering algorithm to complete this task. Finally, i will use the Folium library to visualize the neighborhoods in Moscow and their emerging clusters and based on the clustering results choose the appropriate neighborhoods.

0.5 Download and Explore Dataset

In order to segement the neighborhoods and explore them, we will essentially need a dataset that contains the boroughs and the neighborhoods that exist in each borough as well as the the latitude and logitude coordinates of each neighborhood.

Let's first download the file with names of boroughs and neighborhoods in Moscow and their geographical coordinates and have a look on it.

[3]:
```
moscow_df=pd.read_csv('mo.csv')
moscow_df.head()
```

[3]:
```
                                                 WKT              NAME  \
0  MULTIPOLYGON (((36.8031012 55.4408329,36.80319…
1  POLYGON ((37.4276499 55.7482092,37.4284863 55…
2  POLYGON ((36.8035692 55.4516224,36.8045117 55…
3  POLYGON ((36.9372397 55.2413907,36.9372604 55…
4  POLYGON ((37.4395575 55.6273129,37.4401803 55…     "      "

      OKATO     OKTMO          NAME_AO  OKATO_AO       ABBREV_AO  \
0  45298555  45945000               45298000
1  45268595  45328000               45268000
2  45298567  45954000               45298000
3  45298575  45956000               45298000
4  45297568  45953000            45297000

                TYPE_MO
0
1
2
3
4
```

To save space I can remove columns with unnecessary information.

[4]:
```
moscow_df=moscow_df.drop(columns=['OKATO', 'OKTMO', 'NAME_AO',␣
↪'OKATO_AO','TYPE_MO'])
```

Proceeding with tidying up the data i will rename the columns for clarity and analyze the results by boroughs.

[5]:
```
moscow_df.rename(columns={'NAME':'Neighborhood','ABBREV_AO':
↪'Borough'},inplace=True)
moscow_df['Borough'].value_counts()
```

[5]:
```
               17
               16
               16
               16
               13
               12
               12
           11
              10
               10
                8
                5
```

```
Name: Borough, dtype: int64
```

At this stage I understand, that I am mostly interested in certain boroughs, mostly located to the North or West of the City, closer to where I work. So let's remove the other boroughs from analysis.

[6]:
```
boroughs=['  ','  ','  ','  ','  ']
moscow_df = moscow_df[moscow_df.Borough.isin(boroughs)]
```

Checking the resulting shape of the dataframe.

[7]:
```
moscow_df.shape
```

[7]:
```
(64, 3)
```

Now we need to get a single central point for longitude and latitude for each neighborhood. Currently we have a list of all points representing the border of each neighborhood in the column WKT. I will get a mean of latitude and longitude for all of those points for my further analysis.

[8]:
```
# define a function that takes mean of a string of coordinates divided by a␣
 ↪comma
def coord(list):

    i=0
    row1=[]
    for coordinate in coordinates:
        r=coordinates[i].split(',')
        r=[float(r[0].replace('((',' ').replace('))',' ')),float(r[1].
 ↪replace('((',' ').replace('))',' '))]
        row1=row1+r
        i=i+1
        latitude=sum((row1[::2]))/len(row1[::2])
        longitude=sum((row1[1::2]))/len(row1[1::2])
    return [latitude,longitude]
```

[9]:
```
# create an empty table to store coordinates
df_lalg=pd.DataFrame(columns=['Latitude','Longitude'])
i=0
# run a cicle for all neighborhoods
while i<=moscow_df.shape[0]-1:
    coordinates=moscow_df['WKT'].iloc[i].split(' ')
    coordinates=coordinates[2:len(coordinates)-2]
    lg=coord(coordinates)
    df_lalg=df_lalg.append({'Latitude':lg[0],'Longitude':
 ↪lg[1]},ignore_index=True)
    i=i+1
```

[10]:
```
# merge the two tables together
moscow_df.reset_index(drop=True,inplace=True)
moscow_df=moscow_df.merge(df_lalg,left_index=True,right_index=True)
# drop unnecessary columns
moscow_df=moscow_df.drop(columns=['WKT'])
```

Let's check the resulting dataframe.

[11]:
```
moscow_df.head()
```

[11]:
```
     Neighborhood Borough   Latitude  Longitude
0                  55.748708  37.474149
1                     55.612560  37.280081
2                     55.798118  37.475900
3                    55.886669  37.529184
4                     55.865166  37.486793
```

[12]:
```
moscow_df.shape
```

[12]:
```
(64, 4)
```

0.6 Segmenting by price

Let's start with downloading the file with the data on average price per sq.m. for neighborhoods in Moscow and add it to the original dataframe.

[13]:
```
moscow_price=pd.read_excel('Price.xlsx')
moscow_price.head()
```

[13]:
```
  Neighborhood  Price per sq.m  Unnamed: 2  Unnamed: 3  Unnamed: 4  \
0                   403710         NaN         NaN         NaN
1                    384385         NaN         NaN         NaN
2                     370425          NaN          NaN          NaN
3                    361844         NaN         NaN         NaN
4                    345097         NaN         NaN         NaN

   Unnamed: 5  Unnamed: 6 Unnamed: 7
0         NaN         NaN        NaN
1         NaN         NaN        NaN
2         NaN         NaN        NaN
3         NaN         NaN        NaN
4         NaN         NaN        NaN
```

[14]:
```
moscow_df=moscow_df.join(moscow_price[['Neighborhood','Price per sq.m']].
↪set_index('Neighborhood'), on='Neighborhood')
```

[15]:
```
moscow_df.shape
```

[15]:
```
(64, 5)
```

Further I will check, whether all neighborhoods have been assigned a price per sq.m.

[16]:
```
moscow_df['Price per sq.m'].isna().value_counts()
```

[16]:
```
False    62
True      2
Name: Price per sq.m, dtype: int64
```

Since some of the neighborhoods are missing a price, I will assign an average price to those neighborhoods.

[17]:
```
moscow_df.describe()
```

[17]:

	Latitude	Longitude	Price per sq.m
count	64.000000	64.000000	62.000000
mean	55.802519	37.529175	196998.677419
std	0.073974	0.109717	58668.458329
min	55.612560	37.104304	137036.000000
25%	55.750567	37.473558	155005.750000
50%	55.806166	37.550749	183106.000000
75%	55.865264	37.610455	207106.000000
max	55.943791	37.701189	384385.000000

[18]:
```
moscow_df.fillna(value=moscow_df['Price per sq.m'].mean(),inplace=True)
```

Let's check the results.

[19]:
```
moscow_df['Price per sq.m'].isna().value_counts()
```

[19]:
```
False    64
Name: Price per sq.m, dtype: int64
```

All set, the data is ready for clustering.

[20]:
```
# transform the data for segmenting into a NumPy array

price_clustering=moscow_df['Price per sq.m']
price_clustering=price_clustering.to_numpy()
price_clustering=np.reshape(price_clustering,(-1, 1))
```

[21]:
```
# transform data for clustering
X= StandardScaler().fit_transform(price_clustering)

# compute DBSCAN
db = DBSCAN(eps=0.3, min_samples=10).fit(X)
core_samples_mask = np.zeros_like(db.labels_, dtype=bool)
core_samples_mask[db.core_sample_indices_] = True
```

```
labels = db.labels_

# number of clusters in labels, ignoring noise if present.
n_clusters_ = len(set(labels)) - (1 if -1 in labels else 0)
n_noise_ = list(labels).count(-1)

print('Estimated number of clusters: %d' % n_clusters_)
print('Estimated number of noise points: %d' % n_noise_)
print("Silhouette Coefficient: %0.3f"
      % metrics.silhouette_score(X, labels))
```

```
Estimated number of clusters: 1
Estimated number of noise points: 13
Silhouette Coefficient: 0.713
```

[22]:
```
# add clustering labels
moscow_df.insert(0, 'Cluster Labels', labels)

moscow_df.head()
```

[22]:
```
   Cluster Labels    Neighborhood Borough   Latitude  Longitude  \
0               0                    55.748708  37.474149
1               0                       55.612560  37.280081
2               0                       55.798118  37.475900
3               0                     55.886669  37.529184
4               0                       55.865166  37.486793

   Price per sq.m
0        207763.0
1        137036.0
2        188032.0
3        153984.0
4        164663.0
```

Let's examine the results of clustering.

[23]:
```
moscow_df['Cluster Labels'].value_counts()
```

[23]:
```
 0    51
-1    13
Name: Cluster Labels, dtype: int64
```

[24]:
```
moscow_df.head()
```

[24]:
```
   Cluster Labels    Neighborhood Borough   Latitude  Longitude  \
0               0                    55.748708  37.474149
1               0                       55.612560  37.280081
2               0                       55.798118  37.475900
```

```
3               0                    55.886669  37.529184
4               0                      55.865166  37.486793

   Price per sq.m
0        207763.0
1        137036.0
2        188032.0
3        153984.0
4        164663.0
```

DBSCAN algorithm identified 1 cluster and several noise points. Now I will examine the noise points.

[25]:
```
moscow_df[moscow_df['Cluster Labels'] == -1]
```

[25]:
```
    Cluster Labels    Neighborhood Borough   Latitude  Longitude  \
22              -1                      55.696332  37.504112
27              -1                     55.738817  37.532958
29              -1                      55.781101  37.568215
32              -1                     55.762533  37.579689
37              -1                      55.740496  37.589018
43              -1                       55.751186  37.595816
45              -1                      55.769137  37.605589
46              -1                      55.729036  37.610110
51              -1                      55.776174  37.627336
53              -1                     55.730883  37.631416
55              -1                      55.765190  37.667150
56              -1                     55.773126  37.647874
58              -1                      55.742243  37.665034

    Price per sq.m
22        244627.0
27        256013.0
29        242010.0
32        309195.0
37        330257.0
43        370425.0
45        345097.0
46        384385.0
51        276583.0
53        312005.0
55        233088.0
56        267042.0
58        254289.0
```

The results seem correct, as all of those neighborhoods are very expensive and should be excluded from further classification. So I will drop those noise points and irrelevant columns.

[26]:
```
moscow_df = moscow_df[moscow_df['Cluster Labels'] == 0].reset_index(drop=True)
moscow_df.drop(columns=['Cluster Labels','Price per sq.m'],inplace=True)

moscow_df.head()
```

[26]:

	Neighborhood	Borough	Latitude	Longitude
0			55.748708	37.474149
1			55.612560	37.280081
2			55.798118	37.475900
3			55.886669	37.529184
4			55.865166	37.486793

[27]:
```
print('The resulting dataframe has {} boroughs and {} neighborhoods.'.format(
        len(moscow_df['Borough'].unique()),
        moscow_df.shape[0]
    )
)
```

```
The resulting dataframe has 4 boroughs and 51 neighborhoods.
```

Let's view the selected neighborhoords on a map.

[28]:
```
# create map of Moscow using latitude and longitude values
map_moscow = folium.Map(location=[55.751244, 37.618423], zoom_start=12)

# add markers to map
for lat, lng, borough, neighborhood in zip(moscow_df['Latitude'],␣
 ↪moscow_df['Longitude'], moscow_df['Borough'], moscow_df['Neighborhood']):
    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_moscow)

map_moscow
```

[28]:
```
<folium.folium.Map at 0x7f7ef5dee390>
```

Define Foursquare Credentials and Version

[29]:
```
CLIENT_ID = 'SK0IS030B0SVY4PBGQXI5SE2DEMFCTPBUZLHLAE3N3F0NFNI' # your␣
 ↪Foursquare ID
```

```
CLIENT_SECRET = 'TKJXRTX3FZFXSNGZEULGGOLVYWAPZQWDCTQM2T4KTZJM4W3L' # your␣
 ↪Foursquare Secret
VERSION = '20201605' # Foursquare API version

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

```
Your credentails:
CLIENT_ID: SKOISO3OBOSVY4PBGQXI5SE2DEMFCTPBUZLHLAE3N3FONFNI
CLIENT_SECRET:TKJXRTX3FZFXSNGZEULGGOLVYWAPZQWDCTQM2T4KTZJM4W3L
```

[30]:
```
LIMIT = 100 # limit of number of venues returned by Foursquare API
radius = 500 # define radius
```

0.7 Explore Neighborhoods in Moscow

Let's create a function to repeat the same process to all the neighborhoods in Moscow

[31]:
```
def getNearbyVenues(names, latitudes, longitudes, radius=500):

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

        # create the API request URL
        url = 'https://api.foursquare.com/v2/venues/explore?
 ↪&client_id={}&client_secret={}&v={}&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 = ['Neighborhood',
                  'Neighborhood Latitude',
                  'Neighborhood Longitude',
                  'Venue',
                  'Venue Latitude',
                  'Venue Longitude',
                  'Venue Category']

    return(nearby_venues)
```

Now write the code to run the above function on each neighborhood and create a new dataframe called *moscow_venues*.

[32]:
```
moscow_venues = getNearbyVenues(names=moscow_df['Neighborhood'],
                                    latitudes=moscow_df['Latitude'],
                                    longitudes=moscow_df['Longitude']
                                   )
```

Let's check the size of the resulting dataframe.

[33]:
```
print(moscow_venues.shape)
moscow_venues.head()
```

```
(854, 7)
```

[33]:

	Neighborhood	Neighborhood Latitude	Neighborhood Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
0		55.748708	37.474149		55.750919	37.478342	Athletics & Sports
1		55.748708	37.474149		55.747616	37.474336	Beach
2		55.748708	37.474149		55.745042	37.471349	BBQ Joint
3		55.748708	37.474149		55.750337	37.479428	Tea Room
4		55.748708	37.474149		55.748931	37.480362	Concert Hall

Let's check how many venues were returned for each neighborhood.

[34]:
```
moscow_venues.groupby('Neighborhood').count()
```

[34]:

Neighborhood	Neighborhood Latitude	Neighborhood Longitude	Venue
	28	28	28
	8	8	8
	9	9	9
	34	34	34
	7	7	7
	6	6	6
	80	80	80
	4	4	4
	48	48	48
	8	8	8
	10	10	10
	14	14	14
	11	11	11
	18	18	18
	6	6	6
	5	5	5
	17	17	17
	22	22	22
	14	14	14
	6	6	6
	26	26	26
	20	20	20
	15	15	15
	3	3	3
-	4	4	4
	33	33	33
	16	16	16
-	7	7	7
-	20	20	20
	12	12	12
	16	16	16
	26	26	26
	20	20	20
	24	24	24
	11	11	11
	3	3	3
	54	54	54
	6	6	6
	15	15	15
	6	6	6
-	25	25	25
-	9	9	9
	5	5	5

	22		22	22
-	21		21	21
	23		23	23
	30		30	30
	11		11	11
	11		11	11
	5		5	5

	Venue Latitude	Venue Longitude	Venue Category
Neighborhood			
	28	28	28
	8	8	8
	9	9	9
	34	34	34
	7	7	7
	6	6	6
	80	80	80
	4	4	4
	48	48	48
	8	8	8
	10	10	10
	14	14	14
	11	11	11
	18	18	18
	6	6	6
	5	5	5
	17	17	17
	22	22	22
	14	14	14
	6	6	6
	26	26	26
	20	20	20
	15	15	15
	3	3	3
-	4	4	4
	33	33	33
	16	16	16
-	7	7	7
-	20	20	20
	12	12	12
	16	16	16
	26	26	26
	20	20	20
	24	24	24
	11	11	11
	3	3	3
	54	54	54

```
                                6                6                6
                               15               15               15
                              6                6                6
    -                        25               25               25
  -                           9                9                9
                              5                5                5
                               22               22               22
    -                        21               21               21
                              23               23               23
                                30               30               30
                             11               11               11
                              11               11               11
                               5                5                5
```

Let's find out how many unique categories can be curated from all the returned venues.

[35]:
```
print('There are {} uniques categories.'.format(len(moscow_venues['Venue␣
↪Category'].unique())))
```

```
There are 205 uniques categories.
```

[36]:
```
moscow_venues['Venue Category'].value_counts()
```

[36]:
```
Supermarket                    37
Coffee Shop                    29
Pharmacy                       28
Gym / Fitness Center           26
Park                           25
Pizza Place                    24
Café                           22
Restaurant                     20
Bus Stop                       20
Clothing Store                 18
Cosmetics Shop                 17
Convenience Store              16
Fast Food Restaurant           16
Health Food Store              15
Sushi Restaurant               13
Food & Drink Shop              12
Middle Eastern Restaurant      11
Bakery                         11
Caucasian Restaurant           10
Auto Workshop                  10
Sporting Goods Shop            10
Flower Shop                    10
Pet Store                      10
Gym                            10
```

Bookstore	9
Salon / Barbershop	9
Hotel	8
Photography Studio	8
Farmers Market	7
Eastern European Restaurant	7
Electronics Store	7
Grocery Store	7
Athletics & Sports	7
Kids Store	7
Multiplex	7
Gourmet Shop	6
Wine Shop	6
Soccer Field	6
Arts & Crafts Store	6
Dance Studio	6
Yoga Studio	6
Shoe Store	6
Beer Bar	6
Shopping Mall	6
Japanese Restaurant	5
Blini House	5
Boutique	5
Martial Arts Dojo	5
Gastropub	5
Plaza	5
Liquor Store	5
Toy / Game Store	5
Playground	5
Science Museum	4
Arcade	4
Concert Hall	4
Lake	4
Mobile Phone Shop	4
Garden	4
Women's Store	4
Big Box Store	4
Asian Restaurant	4
Gym Pool	4
Hobby Shop	4
Baby Store	3
Pedestrian Plaza	3
Scenic Lookout	3
Pub	3
Noodle House	3
Stables	3
Italian Restaurant	3

Bath House	3
Paper / Office Supplies Store	3
Bar	3
Lingerie Store	3
Skate Park	3
Fountain	3
Dessert Shop	3
Ice Cream Shop	3
Other Repair Shop	2
Museum	2
Modern European Restaurant	2
Board Shop	2
Pool	2
Burger Joint	2
Vape Store	2
Tram Station	2
History Museum	2
Bus Line	2
Fabric Shop	2
Department Store	2
Hot Dog Joint	2
Beer Store	2
Recording Studio	2
Surf Spot	2
Music Venue	2
Health & Beauty Service	2
Dry Cleaner	2
Butcher	2
Market	2
Spa	2
Art Gallery	2
Automotive Shop	2
Dog Run	2
Chinese Restaurant	2
Climbing Gym	2
Medical Center	2
Theater	2
Soccer Stadium	2
Recreation Center	2
Accessories Store	2
Karaoke Bar	2
Snack Place	2
Tennis Court	2
Jewelry Store	2
Shipping Store	2
Train Station	1
Furniture / Home Store	1

Cocktail Bar	1
Gift Shop	1
Outdoor Sculpture	1
Tree	1
Pool Hall	1
Vegetarian / Vegan Restaurant	1
Stadium	1
Track	1
Track Stadium	1
Bowling Alley	1
Greek Restaurant	1
Hardware Store	1
Jewish Restaurant	1
Arts & Entertainment	1
Salad Place	1
Russian Restaurant	1
Bus Station	1
Tea Room	1
Warehouse Store	1
Gymnastics Gym	1
Dairy Store	1
Skating Rink	1
Sculpture Garden	1
Locksmith	1
Hockey Rink	1
Men's Store	1
Dumpling Restaurant	1
Outdoor Gym	1
Exhibit	1
Rock Climbing Spot	1
Breakfast Spot	1
Historic Site	1
Gun Range	1
Trail	1
Vietnamese Restaurant	1
Mexican Restaurant	1
Strip Club	1
Campground	1
Camera Store	1
Israeli Restaurant	1
Boxing Gym	1
Pelmeni House	1
Dive Spot	1
Tattoo Parlor	1
Nightclub	1
Supplement Shop	1
Belgian Restaurant	1

```
Comic Shop                          1
Performing Arts Venue               1
Coworking Space                     1
Adult Boutique                      1
Rock Club                           1
Frozen Yogurt Shop                  1
Movie Theater                       1
Aquarium                            1
Indoor Play Area                    1
Optical Shop                        1
Lighthouse                          1
Garden Center                       1
Sports Club                         1
Miscellaneous Shop                  1
Indie Theater                       1
Public Art                          1
Forest                              1
Smoke Shop                          1
Design Studio                       1
Brazilian Restaurant                1
Cantonese Restaurant                1
Rental Car Location                 1
Print Shop                          1
Food Court                          1
College Gym                         1
Botanical Garden                    1
Seafood Restaurant                  1
Volleyball Court                    1
Shawarma Place                      1
Donut Shop                          1
Art Museum                          1
Pie Shop                            1
Beach                               1
Film Studio                         1
BBQ Joint                           1
Massage Studio                      1
Fish Market                         1
Hookah Bar                          1
Other Great Outdoors                1
Jazz Club                           1
Name: Venue Category, dtype: int64
```

0.7.1 Analyze each neighborhood

[37]:
```
# one hot encoding
moscow_onehot = pd.get_dummies(moscow_venues[['Venue Category']], prefix="",␣
 ↪prefix_sep="")

# add neighborhood column back to dataframe
moscow_onehot['Neighborhood'] = moscow_venues['Neighborhood']

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

moscow_onehot.head()
```

[37]:

	Neighborhood	Accessories Store	Adult Boutique	Aquarium	Arcade	Art Gallery	Art Museum	Arts & Crafts Store	Arts & Entertainment	Asian Restaurant	Athletics & Sports	Auto Workshop	Automotive Shop	BBQ Joint	Baby Store	Bakery	Bar	Bath House	Beach	Beer Bar	Beer Store	Belgian Restaurant	Big Box Store	Blini House	Board Shop
0		0	0	0	0	0	0	0	0	0	1	0	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	0	0	0	0	0	1	0	0	0	0	0	0
2		0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
3		0	0	0	0	0	0	0	0	0	0	0	0	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	0	0	0	0	0	0	0	0	0	0	0	0

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

   Bookstore  Botanical Garden  Boutique  Bowling Alley  Boxing 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

   Brazilian Restaurant  Breakfast Spot  Burger Joint  Bus Line  Bus Station  \
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 Stop  Butcher  Café  Camera Store  Campground  Cantonese 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

   Caucasian Restaurant  Chinese Restaurant  Climbing Gym  Clothing 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

   Cocktail Bar  Coffee Shop  College Gym  Comic Shop  Concert Hall  \
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             1

   Convenience Store  Cosmetics Shop  Coworking Space  Dairy 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

   Dance Studio  Department Store  Design Studio  Dessert Shop  Dive Spot  \
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

   Dog Run  Donut Shop  Dry Cleaner  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  Exhibit  Fabric 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

   Farmers Market  Fast Food Restaurant  Film Studio  Fish Market  \
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

   Flower Shop  Food & Drink Shop  Food Court  Forest  Fountain  \
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

   Frozen Yogurt Shop  Furniture / Home Store  Garden  Garden 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

   Gastropub  Gift Shop  Gourmet Shop  Greek Restaurant  Grocery 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
```

```
   Gun Range  Gym  Gym / Fitness Center  Gym Pool  Gymnastics 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

   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 Rink  Hookah Bar  Hot Dog Joint  Hotel  \
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

   Ice Cream Shop  Indie Theater  Indoor Play Area  Israeli 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

   Italian Restaurant  Japanese Restaurant  Jazz Club  Jewelry Store  \
0                   0                    0          0              0
1                   0                    0          0              0
2                   0                    0          0              0
3                   0                    0          0              0
4                   0                    0          0              0

   Jewish Restaurant  Karaoke Bar  Kids Store  Lake  Lighthouse  \
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

   Lingerie Store  Liquor Store  Locksmith  Market  Martial Arts Dojo  \
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

   Massage Studio  Medical Center  Men's Store  Mexican 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

   Middle Eastern Restaurant  Miscellaneous Shop  Mobile Phone Shop  \
0                          0                   0                  0
1                          0                   0                  0
2                          0                   0                  0
3                          0                   0                  0
4                          0                   0                  0

   Modern European Restaurant  Movie Theater  Multiplex  Museum  Music Venue  \
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

   Nightclub  Noodle House  Optical Shop  Other Great Outdoors  \
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

   Other Repair Shop  Outdoor Gym  Outdoor Sculpture  \
0                  0            0                  0
1                  0            0                  0
2                  0            0                  0
3                  0            0                  0
4                  0            0                  0

   Paper / Office Supplies Store  Park  Pedestrian Plaza  Pelmeni House  \
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

   Performing Arts Venue  Pet Store  Pharmacy  Photography Studio  Pie 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

   Pizza Place  Playground  Plaza  Pool  Pool Hall  Print Shop  Pub  \
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

   Public Art  Recording Studio  Recreation Center  Rental Car Location  \
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

   Restaurant  Rock Climbing Spot  Rock Club  Russian Restaurant  Salad Place  \
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

   Salon / Barbershop  Scenic Lookout  Science Museum  Sculpture 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

   Seafood Restaurant  Shawarma Place  Shipping Store  Shoe 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

   Shopping Mall  Skate Park  Skating Rink  Smoke Shop  Snack Place  \
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

   Soccer Field  Soccer Stadium  Spa  Sporting Goods Shop  Sports Club  \
```

```
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

   Stables  Stadium  Strip Club  Supermarket  Supplement Shop  Surf Spot  \
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

   Sushi Restaurant  Tattoo Parlor  Tea Room  Tennis Court  Theater  \
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

   Toy / Game Store  Track  Track Stadium  Trail  Train Station  Tram Station  \
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

   Tree  Vape Store  Vegetarian / Vegan Restaurant  Vietnamese 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

   Volleyball Court  Warehouse Store  Wine Shop  Women's Store  Yoga Studio
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
```

And let's examine the new dataframe size.

[38]:
```
moscow_onehot.shape
```

[38]:
```
(854, 206)
```

Next, let's group rows by neighborhood and by taking the mean of the frequency of occurrence of

each category.

[39]:
```
moscow_grouped = moscow_onehot.groupby('Neighborhood').mean().reset_index()
```

Let's confirm the new size.

[40]:
```
moscow_grouped.head()
```

[40]:

	Neighborhood	Accessories Store	Adult Boutique	Aquarium	Arcade
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

	Art Gallery	Art Museum	Arts & Crafts Store	Arts & Entertainment
0	0.0	0.0	0.000000	0.0
1	0.0	0.0	0.000000	0.0
2	0.0	0.0	0.000000	0.0
3	0.0	0.0	0.029412	0.0
4	0.0	0.0	0.000000	0.0

	Asian Restaurant	Athletics & Sports	Auto Workshop	Automotive Shop
0	0.000000	0.0	0.107143	0.0
1	0.000000	0.0	0.125000	0.0
2	0.000000	0.0	0.000000	0.0
3	0.000000	0.0	0.000000	0.0
4	0.142857	0.0	0.000000	0.0

	BBQ Joint	Baby Store	Bakery	Bar	Bath House	Beach	Beer Bar
0	0.0	0.000000	0.0	0.000000	0.0	0.0	0.0
1	0.0	0.000000	0.0	0.000000	0.0	0.0	0.0
2	0.0	0.000000	0.0	0.000000	0.0	0.0	0.0
3	0.0	0.029412	0.0	0.000000	0.0	0.0	0.0
4	0.0	0.000000	0.0	0.142857	0.0	0.0	0.0

	Beer Store	Belgian Restaurant	Big Box Store	Blini House	Board Shop
0	0.0	0.0	0.0	0.000000	0.0
1	0.0	0.0	0.0	0.000000	0.0
2	0.0	0.0	0.0	0.000000	0.0
3	0.0	0.0	0.0	0.029412	0.0
4	0.0	0.0	0.0	0.000000	0.0

	Bookstore	Botanical Garden	Boutique	Bowling Alley	Boxing Gym
0	0.000000	0.0	0.000000	0.0	0.0
1	0.000000	0.0	0.000000	0.0	0.0
2	0.000000	0.0	0.000000	0.0	0.0
3	0.029412	0.0	0.029412	0.0	0.0

```
4   0.000000               0.0  0.000000            0.0         0.0

   Brazilian Restaurant  Breakfast Spot  Burger Joint  Bus Line  Bus Station  \
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

   Bus Stop  Butcher      Café  Camera Store  Campground  \
0  0.035714      0.0  0.000000           0.0         0.0
1  0.125000      0.0  0.000000           0.0         0.0
2  0.000000      0.0  0.111111           0.0         0.0
3  0.029412      0.0  0.000000           0.0         0.0
4  0.142857      0.0  0.000000           0.0         0.0

   Cantonese Restaurant  Caucasian Restaurant  Chinese Restaurant  \
0                   0.0              0.035714                 0.0
1                   0.0              0.000000                 0.0
2                   0.0              0.000000                 0.0
3                   0.0              0.029412                 0.0
4                   0.0              0.000000                 0.0

   Climbing Gym  Clothing Store  Cocktail Bar  Coffee Shop  College Gym  \
0           0.0        0.000000           0.0          0.0          0.0
1           0.0        0.000000           0.0          0.0          0.0
2           0.0        0.111111           0.0          0.0          0.0
3           0.0        0.029412           0.0          0.0          0.0
4           0.0        0.000000           0.0          0.0          0.0

   Comic Shop  Concert Hall  Convenience Store  Cosmetics Shop  \
0         0.0           0.0           0.000000        0.035714
1         0.0           0.0           0.000000        0.000000
2         0.0           0.0           0.000000        0.000000
3         0.0           0.0           0.029412        0.088235
4         0.0           0.0           0.000000        0.000000

   Coworking Space  Dairy Store  Dance Studio  Department Store  \
0              0.0          0.0      0.035714               0.0
1              0.0          0.0      0.000000               0.0
2              0.0          0.0      0.000000               0.0
3              0.0          0.0      0.000000               0.0
4              0.0          0.0      0.000000               0.0

   Design Studio  Dessert Shop  Dive Spot   Dog Run  Donut Shop  Dry Cleaner  \
0            0.0           0.0        0.0  0.035714         0.0        0.000
1            0.0           0.0        0.0  0.000000         0.0        0.125
```

```
2           0.0          0.0        0.0  0.000000         0.0        0.000
3           0.0          0.0        0.0  0.000000         0.0        0.000
4           0.0          0.0        0.0  0.000000         0.0        0.000

   Dumpling Restaurant  Eastern European Restaurant  Electronics Store  \
0                  0.0                          0.0           0.000000
1                  0.0                          0.0           0.000000
2                  0.0                          0.0           0.000000
3                  0.0                          0.0           0.029412
4                  0.0                          0.0           0.000000

   Exhibit  Fabric Shop  Farmers Market  Fast Food Restaurant  Film Studio  \
0      0.0     0.000000        0.035714              0.000000          0.0
1      0.0     0.000000        0.000000              0.000000          0.0
2      0.0     0.000000        0.000000              0.000000          0.0
3      0.0     0.029412        0.000000              0.029412          0.0
4      0.0     0.000000        0.000000              0.142857          0.0

   Fish Market  Flower Shop  Food & Drink Shop  Food Court  Forest  Fountain  \
0          0.0          0.0           0.000000         0.0     0.0       0.0
1          0.0          0.0           0.000000         0.0     0.0       0.0
2          0.0          0.0           0.000000         0.0     0.0       0.0
3          0.0          0.0           0.029412         0.0     0.0       0.0
4          0.0          0.0           0.000000         0.0     0.0       0.0

   Frozen Yogurt Shop  Furniture / Home Store  Garden  Garden Center  \
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

   Gastropub  Gift Shop  Gourmet Shop  Greek Restaurant  Grocery Store  \
0        0.0   0.035714           0.0               0.0          0.000
1        0.0   0.000000           0.0               0.0          0.125
2        0.0   0.000000           0.0               0.0          0.000
3        0.0   0.000000           0.0               0.0          0.000
4        0.0   0.000000           0.0               0.0          0.000

   Gun Range       Gym  Gym / Fitness Center  Gym Pool  Gymnastics Gym  \
0        0.0  0.000000              0.071429       0.0             0.0
1        0.0  0.000000              0.000000       0.0             0.0
2        0.0  0.000000              0.000000       0.0             0.0
3        0.0  0.029412              0.029412       0.0             0.0
4        0.0  0.000000              0.000000       0.0             0.0

   Hardware Store  Health & Beauty Service  Health Food Store  Historic Site  \
```

```
0            0.0                    0.0          0.035714            0.0
1            0.0                    0.0          0.000000            0.0
2            0.0                    0.0          0.000000            0.0
3            0.0                    0.0          0.029412            0.0
4            0.0                    0.0          0.000000            0.0

   History Museum  Hobby Shop  Hockey Rink  Hookah Bar  Hot Dog Joint  \
0             0.0         0.0          0.0         0.0       0.000000
1             0.0         0.0          0.0         0.0       0.000000
2             0.0         0.0          0.0         0.0       0.000000
3             0.0         0.0          0.0         0.0       0.029412
4             0.0         0.0          0.0         0.0       0.000000

      Hotel  Ice Cream Shop  Indie Theater  Indoor Play Area  \
0  0.107143             0.0            0.0               0.0
1  0.000000             0.0            0.0               0.0
2  0.000000             0.0            0.0               0.0
3  0.000000             0.0            0.0               0.0
4  0.000000             0.0            0.0               0.0

   Israeli Restaurant  Italian Restaurant  Japanese Restaurant  Jazz Club  \
0                 0.0                 0.0             0.000000   0.000000
1                 0.0                 0.0             0.000000   0.000000
2                 0.0                 0.0             0.000000   0.111111
3                 0.0                 0.0             0.029412   0.000000
4                 0.0                 0.0             0.000000   0.000000

   Jewelry Store  Jewish Restaurant  Karaoke Bar  Kids Store   Lake  \
0            0.0                0.0          0.0    0.000000  0.000
1            0.0                0.0          0.0    0.000000  0.125
2            0.0                0.0          0.0    0.000000  0.000
3            0.0                0.0          0.0    0.029412  0.000
4            0.0                0.0          0.0    0.000000  0.000

   Lighthouse  Lingerie Store  Liquor Store  Locksmith  Market  \
0         0.0             0.0      0.000000        0.0     0.0
1         0.0             0.0      0.000000        0.0     0.0
2         0.0             0.0      0.000000        0.0     0.0
3         0.0             0.0      0.029412        0.0     0.0
4         0.0             0.0      0.000000        0.0     0.0

   Martial Arts Dojo  Massage Studio  Medical Center  Men's Store  \
0           0.000000             0.0        0.035714          0.0
1           0.000000             0.0        0.000000          0.0
2           0.111111             0.0        0.000000          0.0
3           0.000000             0.0        0.000000          0.0
4           0.000000             0.0        0.000000          0.0
```

	Mexican Restaurant	Middle Eastern Restaurant	Miscellaneous 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

	Mobile Phone Shop	Modern European Restaurant	Movie Theater	Multiplex
0	0.035714	0.0	0.0	0.0
1	0.000000	0.0	0.0	0.0
2	0.000000	0.0	0.0	0.0
3	0.029412	0.0	0.0	0.0
4	0.000000	0.0	0.0	0.0

	Museum	Music Venue	Nightclub	Noodle House	Optical Shop
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

	Other Great Outdoors	Other Repair Shop	Outdoor Gym	Outdoor Sculpture
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

	Paper / Office Supplies Store	Park	Pedestrian Plaza	Pelmeni House
0	0.000000	0.035714	0.0	0.0
1	0.000000	0.000000	0.0	0.0
2	0.000000	0.000000	0.0	0.0
3	0.029412	0.000000	0.0	0.0
4	0.000000	0.142857	0.0	0.0

	Performing Arts Venue	Pet Store	Pharmacy	Photography Studio	Pie Shop
0	0.0	0.000000	0.000000	0.0	0.0
1	0.0	0.000000	0.000000	0.0	0.0
2	0.0	0.000000	0.222222	0.0	0.0
3	0.0	0.029412	0.058824	0.0	0.0
4	0.0	0.000000	0.000000	0.0	0.0

	Pizza Place	Playground	Plaza	Pool	Pool Hall	Print Shop	Pub
0	0.071429	0.0	0.000000	0.0	0.0	0.000000	0.000
1	0.000000	0.0	0.000000	0.0	0.0	0.000000	0.125
2	0.000000	0.0	0.000000	0.0	0.0	0.000000	0.000

```
3     0.000000         0.0  0.029412   0.0        0.0    0.029412  0.000
4     0.000000         0.0  0.142857   0.0        0.0    0.000000  0.000

   Public Art  Recording Studio  Recreation Center  Rental Car Location  \
0         0.0          0.035714                0.0                  0.0
1         0.0          0.000000                0.0                  0.0
2         0.0          0.000000                0.0                  0.0
3         0.0          0.000000                0.0                  0.0
4         0.0          0.000000                0.0                  0.0

   Restaurant  Rock Climbing Spot  Rock Club  Russian Restaurant  Salad Place  \
0    0.035714                 0.0        0.0                 0.0          0.0
1    0.000000                 0.0        0.0                 0.0          0.0
2    0.000000                 0.0        0.0                 0.0          0.0
3    0.000000                 0.0        0.0                 0.0          0.0
4    0.000000                 0.0        0.0                 0.0          0.0

   Salon / Barbershop  Scenic Lookout  Science Museum  Sculpture Garden  \
0            0.000000             0.0             0.0               0.0
1            0.125000             0.0             0.0               0.0
2            0.111111             0.0             0.0               0.0
3            0.000000             0.0             0.0               0.0
4            0.000000             0.0             0.0               0.0

   Seafood Restaurant  Shawarma Place  Shipping Store  Shoe 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

   Shopping Mall  Skate Park  Skating Rink  Smoke Shop  Snack Place  \
0            0.0         0.0           0.0    0.000000     0.035714
1            0.0         0.0           0.0    0.000000     0.000000
2            0.0         0.0           0.0    0.111111     0.000000
3            0.0         0.0           0.0    0.000000     0.000000
4            0.0         0.0           0.0    0.000000     0.000000

   Soccer Field  Soccer Stadium  Spa  Sporting Goods Shop  Sports Club  \
0         0.000             0.0  0.0                  0.0     0.035714
1         0.125             0.0  0.0                  0.0     0.000000
2         0.000             0.0  0.0                  0.0     0.000000
3         0.000             0.0  0.0                  0.0     0.000000
4         0.000             0.0  0.0                  0.0     0.000000

   Stables  Stadium  Strip Club  Supermarket  Supplement Shop  Surf Spot  \
0      0.0      0.0         0.0     0.071429              0.0        0.0
```

```
1      0.0      0.0         0.0     0.000000              0.0        0.0
2      0.0      0.0         0.0     0.000000              0.0        0.0
3      0.0      0.0         0.0     0.029412              0.0        0.0
4      0.0      0.0         0.0     0.142857              0.0        0.0

   Sushi Restaurant  Tattoo Parlor  Tea Room  Tennis Court  Theater  \
0          0.000000            0.0       0.0           0.0      0.0
1          0.000000            0.0       0.0           0.0      0.0
2          0.000000            0.0       0.0           0.0      0.0
3          0.029412            0.0       0.0           0.0      0.0
4          0.000000            0.0       0.0           0.0      0.0

   Toy / Game Store  Track  Track Stadium  Trail  Train Station  Tram Station  \
0          0.000000    0.0            0.0    0.0            0.0           0.0
1          0.000000    0.0            0.0    0.0            0.0           0.0
2          0.000000    0.0            0.0    0.0            0.0           0.0
3          0.029412    0.0            0.0    0.0            0.0           0.0
4          0.000000    0.0            0.0    0.0            0.0           0.0

   Tree  Vape Store  Vegetarian / Vegan Restaurant  Vietnamese 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

   Volleyball Court  Warehouse Store  Wine Shop  Women's Store  Yoga Studio
0               0.0              0.0        0.0            0.0     0.035714
1               0.0              0.0        0.0            0.0     0.000000
2               0.0              0.0        0.0            0.0     0.111111
3               0.0              0.0        0.0            0.0     0.029412
4               0.0              0.0        0.0            0.0     0.000000
```

Let's put that into a *pandas* dataframe.

[41]:
```
moscow_grouped.drop(columns=["Bus Line","Bus Stop"],inplace=True)
```

First, let's write a function to sort the venues in descending order.

[42]:
```
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]
```

Now let's create the new dataframe and display the top 10 venues for each neighborhood.

[43]:
```
num_top_venues = 10

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

# create columns according to number of top venues
columns = ['Neighborhood']
for ind in np.arange(num_top_venues):
    try:
        columns.append('{}{} Most Common Venue'.format(ind+1, indicators[ind]))
    except:
        columns.append('{}th Most Common Venue'.format(ind+1))

# create a new dataframe
neighborhoods_venues_sorted = pd.DataFrame(columns=columns)
neighborhoods_venues_sorted['Neighborhood'] = moscow_grouped['Neighborhood']
```

[44]:
```
for ind in np.arange(moscow_grouped.shape[0]):
    neighborhoods_venues_sorted.iloc[ind, 1:] =␣
 ↪return_most_common_venues(moscow_grouped.iloc[ind, :], num_top_venues)

neighborhoods_venues_sorted.head(15)
```

[44]:

	Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue
0		Hotel	Auto Workshop	Pizza Place	Supermarket	Gym / Fitness Center
1		Soccer Field	Pub	Lake	Dry Cleaner	Auto Workshop
2		Pharmacy	Yoga Studio	Martial Arts Dojo	Smoke Shop	Jazz Club
3		Cosmetics Shop	Pharmacy	Yoga Studio	Electronics Store	Boutique
4		Park	Plaza	Supermarket	Asian Restaurant	Fast Food Restaurant
5		Italian Restaurant	Department Store	Skating Rink	Pharmacy	Gym
6		Coffee Shop	Photography Studio	Kids Store	Martial Arts Dojo	Clothing Store
7		Soccer Field	Fast Food Restaurant			
8		Clothing Store	Shoe Store			
9		Supermarket	Bookstore			
10		Food & Drink Shop	Supermarket			
11		Supermarket	Modern European Restaurant			
12		Cosmetics Shop	Health Food Store			
13		Café	Convenience Store			
14		Pizza Place	Athletics & Sports			

```
7                Scenic Lookout           Yoga Studio                Exhibit
8                Lingerie Store   Sporting Goods Shop           Coffee Shop
9                     Pet Store    Miscellaneous Shop                  Café
10                         Park               Stadium            Playground
11                         Gym           Pizza Place            Restaurant
12  Eastern European Restaurant              Pharmacy    Salon / Barbershop
13                     Pharmacy        Farmers Market                  Park
14                Auto Workshop                 Track                  Park

        6th Most Common Venue      7th Most Common Venue  \
0                Yoga Studio             Farmers Market
1          Salon / Barbershop              Grocery Store
2                       Café             Clothing Store
3         Caucasian Restaurant             Clothing Store
4                         Bar                Yoga Studio
5                         Bar             Farmers Market
6           Accessories Store           Sushi Restaurant
7                      Forest                 Food Court
8               Shopping Mall          Toy / Game Store
9                         Gym                Baby Store
10               Pizza Place  Middle Eastern Restaurant
11                  Pharmacy                        Park
12                      Café                Supermarket
13  Middle Eastern Restaurant       Gym / Fitness Center
14                Yoga Studio                Fabric Shop

          8th Most Common Venue 9th Most Common Venue 10th Most Common Venue
0                  Sports Club     Mobile Phone Shop            Snack Place
1                      Exhibit            Food Court      Food & Drink Shop
2           Salon / Barbershop            Food Court      Food & Drink Shop
3            Convenience Store                 Plaza              Pet Store
4                     Fountain                Forest            Food Court
5                       Forest            Food Court      Food & Drink Shop
6                Dance Studio          Music Venue              Boutique
7            Food & Drink Shop          Flower Shop            Fish Market
8           Seafood Restaurant        Garden Center              Bookstore
9          Dumpling Restaurant          Fish Market              Fountain
10               Gourmet Shop               Exhibit            Flower Shop
11  Eastern European Restaurant                 Café           Soccer Field
12               Dance Studio       History Museum      Food & Drink Shop
13               Big Box Store       Hardware Store              Exhibit
14                    Fountain                Forest            Food Court
```

[45]:
```
moscow_grouped.head()
```

[45]:
```
      Neighborhood  Accessories Store  Adult Boutique  Aquarium  Arcade  \
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

   Art Gallery  Art Museum  Arts & Crafts Store  Arts & Entertainment  \
0          0.0         0.0             0.000000                   0.0
1          0.0         0.0             0.000000                   0.0
2          0.0         0.0             0.000000                   0.0
3          0.0         0.0             0.029412                   0.0
4          0.0         0.0             0.000000                   0.0

   Asian Restaurant  Athletics & Sports  Auto Workshop  Automotive Shop  \
0          0.000000                 0.0       0.107143              0.0
1          0.000000                 0.0       0.125000              0.0
2          0.000000                 0.0       0.000000              0.0
3          0.000000                 0.0       0.000000              0.0
4          0.142857                 0.0       0.000000              0.0

   BBQ Joint  Baby Store  Bakery       Bar  Bath House  Beach  Beer Bar  \
0        0.0    0.000000     0.0  0.000000         0.0    0.0       0.0
1        0.0    0.000000     0.0  0.000000         0.0    0.0       0.0
2        0.0    0.000000     0.0  0.000000         0.0    0.0       0.0
3        0.0    0.029412     0.0  0.000000         0.0    0.0       0.0
4        0.0    0.000000     0.0  0.142857         0.0    0.0       0.0

   Beer Store  Belgian Restaurant  Big Box Store  Blini House  Board Shop  \
0         0.0                 0.0            0.0     0.000000         0.0
1         0.0                 0.0            0.0     0.000000         0.0
2         0.0                 0.0            0.0     0.000000         0.0
3         0.0                 0.0            0.0     0.029412         0.0
4         0.0                 0.0            0.0     0.000000         0.0

   Bookstore  Botanical Garden  Boutique  Bowling Alley  Boxing Gym  \
0   0.000000               0.0  0.000000            0.0         0.0
1   0.000000               0.0  0.000000            0.0         0.0
2   0.000000               0.0  0.000000            0.0         0.0
3   0.029412               0.0  0.029412            0.0         0.0
4   0.000000               0.0  0.000000            0.0         0.0

   Brazilian Restaurant  Breakfast Spot  Burger Joint  Bus Station  Butcher  \
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
```

```
       Café  Camera Store  Campground  Cantonese Restaurant  \
0  0.000000           0.0         0.0                   0.0
1  0.000000           0.0         0.0                   0.0
2  0.111111           0.0         0.0                   0.0
3  0.000000           0.0         0.0                   0.0
4  0.000000           0.0         0.0                   0.0

   Caucasian Restaurant  Chinese Restaurant  Climbing Gym  Clothing Store  \
0              0.035714                 0.0           0.0        0.000000
1              0.000000                 0.0           0.0        0.000000
2              0.000000                 0.0           0.0        0.111111
3              0.029412                 0.0           0.0        0.029412
4              0.000000                 0.0           0.0        0.000000

   Cocktail Bar  Coffee Shop  College Gym  Comic Shop  Concert Hall  \
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

   Convenience Store  Cosmetics Shop  Coworking Space  Dairy Store  \
0           0.000000        0.035714              0.0          0.0
1           0.000000        0.000000              0.0          0.0
2           0.000000        0.000000              0.0          0.0
3           0.029412        0.088235              0.0          0.0
4           0.000000        0.000000              0.0          0.0

   Dance Studio  Department Store  Design Studio  Dessert Shop  Dive Spot  \
0      0.035714               0.0            0.0           0.0        0.0
1      0.000000               0.0            0.0           0.0        0.0
2      0.000000               0.0            0.0           0.0        0.0
3      0.000000               0.0            0.0           0.0        0.0
4      0.000000               0.0            0.0           0.0        0.0

    Dog Run  Donut Shop  Dry Cleaner  Dumpling Restaurant  \
0  0.035714         0.0        0.000                  0.0
1  0.000000         0.0        0.125                  0.0
2  0.000000         0.0        0.000                  0.0
3  0.000000         0.0        0.000                  0.0
4  0.000000         0.0        0.000                  0.0

   Eastern European Restaurant  Electronics Store  Exhibit  Fabric Shop  \
0                          0.0           0.000000      0.0     0.000000
1                          0.0           0.000000      0.0     0.000000
2                          0.0           0.000000      0.0     0.000000
3                          0.0           0.029412      0.0     0.029412
```

```
4                         0.0           0.000000      0.0     0.000000

   Farmers Market  Fast Food Restaurant  Film Studio  Fish Market  \
0        0.035714              0.000000          0.0          0.0
1        0.000000              0.000000          0.0          0.0
2        0.000000              0.000000          0.0          0.0
3        0.000000              0.029412          0.0          0.0
4        0.000000              0.142857          0.0          0.0

   Flower Shop  Food & Drink Shop  Food Court  Forest  Fountain  \
0          0.0           0.000000         0.0     0.0       0.0
1          0.0           0.000000         0.0     0.0       0.0
2          0.0           0.000000         0.0     0.0       0.0
3          0.0           0.029412         0.0     0.0       0.0
4          0.0           0.000000         0.0     0.0       0.0

   Frozen Yogurt Shop  Furniture / Home Store  Garden  Garden Center  \
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

   Gastropub  Gift Shop  Gourmet Shop  Greek Restaurant  Grocery Store  \
0        0.0   0.035714           0.0               0.0          0.000
1        0.0   0.000000           0.0               0.0          0.125
2        0.0   0.000000           0.0               0.0          0.000
3        0.0   0.000000           0.0               0.0          0.000
4        0.0   0.000000           0.0               0.0          0.000

   Gun Range       Gym  Gym / Fitness Center  Gym Pool  Gymnastics Gym  \
0        0.0  0.000000              0.071429       0.0             0.0
1        0.0  0.000000              0.000000       0.0             0.0
2        0.0  0.000000              0.000000       0.0             0.0
3        0.0  0.029412              0.029412       0.0             0.0
4        0.0  0.000000              0.000000       0.0             0.0

   Hardware Store  Health & Beauty Service  Health Food Store  Historic Site  \
0             0.0                      0.0           0.035714            0.0
1             0.0                      0.0           0.000000            0.0
2             0.0                      0.0           0.000000            0.0
3             0.0                      0.0           0.029412            0.0
4             0.0                      0.0           0.000000            0.0

   History Museum  Hobby Shop  Hockey Rink  Hookah Bar  Hot Dog Joint  \
0             0.0         0.0          0.0         0.0       0.000000
1             0.0         0.0          0.0         0.0       0.000000
```

```
2            0.0         0.0          0.0         0.0       0.000000
3            0.0         0.0          0.0         0.0       0.029412
4            0.0         0.0          0.0         0.0       0.000000

      Hotel  Ice Cream Shop  Indie Theater  Indoor Play Area  \
0  0.107143            0.0            0.0               0.0
1  0.000000            0.0            0.0               0.0
2  0.000000            0.0            0.0               0.0
3  0.000000            0.0            0.0               0.0
4  0.000000            0.0            0.0               0.0

   Israeli Restaurant  Italian Restaurant  Japanese Restaurant  Jazz Club  \
0                 0.0                 0.0             0.000000   0.000000
1                 0.0                 0.0             0.000000   0.000000
2                 0.0                 0.0             0.000000   0.111111
3                 0.0                 0.0             0.029412   0.000000
4                 0.0                 0.0             0.000000   0.000000

   Jewelry Store  Jewish Restaurant  Karaoke Bar  Kids Store   Lake  \
0            0.0                0.0          0.0    0.000000  0.000
1            0.0                0.0          0.0    0.000000  0.125
2            0.0                0.0          0.0    0.000000  0.000
3            0.0                0.0          0.0    0.029412  0.000
4            0.0                0.0          0.0    0.000000  0.000

   Lighthouse  Lingerie Store  Liquor Store  Locksmith  Market  \
0         0.0             0.0      0.000000        0.0     0.0
1         0.0             0.0      0.000000        0.0     0.0
2         0.0             0.0      0.000000        0.0     0.0
3         0.0             0.0      0.029412        0.0     0.0
4         0.0             0.0      0.000000        0.0     0.0

   Martial Arts Dojo  Massage Studio  Medical Center  Men's Store  \
0           0.000000             0.0        0.035714          0.0
1           0.000000             0.0        0.000000          0.0
2           0.111111             0.0        0.000000          0.0
3           0.000000             0.0        0.000000          0.0
4           0.000000             0.0        0.000000          0.0

   Mexican Restaurant  Middle Eastern Restaurant  Miscellaneous 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

   Mobile Phone Shop  Modern European Restaurant  Movie Theater  Multiplex  \
```

```
0           0.035714                          0.0            0.0        0.0
1           0.000000                          0.0            0.0        0.0
2           0.000000                          0.0            0.0        0.0
3           0.029412                          0.0            0.0        0.0
4           0.000000                          0.0            0.0        0.0

   Museum  Music Venue  Nightclub  Noodle House  Optical Shop  \
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

   Other Great Outdoors  Other Repair Shop  Outdoor Gym  Outdoor Sculpture  \
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

   Paper / Office Supplies Store      Park  Pedestrian Plaza  Pelmeni House  \
0                       0.000000  0.035714               0.0            0.0
1                       0.000000  0.000000               0.0            0.0
2                       0.000000  0.000000               0.0            0.0
3                       0.029412  0.000000               0.0            0.0
4                       0.000000  0.142857               0.0            0.0

   Performing Arts Venue  Pet Store  Pharmacy  Photography Studio  Pie Shop  \
0                    0.0   0.000000  0.000000                 0.0       0.0
1                    0.0   0.000000  0.000000                 0.0       0.0
2                    0.0   0.000000  0.222222                 0.0       0.0
3                    0.0   0.029412  0.058824                 0.0       0.0
4                    0.0   0.000000  0.000000                 0.0       0.0

   Pizza Place  Playground     Plaza  Pool  Pool Hall  Print Shop    Pub  \
0     0.071429         0.0  0.000000   0.0        0.0    0.000000  0.000
1     0.000000         0.0  0.000000   0.0        0.0    0.000000  0.125
2     0.000000         0.0  0.000000   0.0        0.0    0.000000  0.000
3     0.000000         0.0  0.029412   0.0        0.0    0.029412  0.000
4     0.000000         0.0  0.142857   0.0        0.0    0.000000  0.000

   Public Art  Recording Studio  Recreation Center  Rental Car Location  \
0         0.0          0.035714                0.0                  0.0
1         0.0          0.000000                0.0                  0.0
2         0.0          0.000000                0.0                  0.0
3         0.0          0.000000                0.0                  0.0
4         0.0          0.000000                0.0                  0.0
```

	Restaurant	Rock Climbing Spot	Rock Club	Russian Restaurant	Salad Place
0	0.035714	0.0	0.0	0.0	0.0
1	0.000000	0.0	0.0	0.0	0.0
2	0.000000	0.0	0.0	0.0	0.0
3	0.000000	0.0	0.0	0.0	0.0
4	0.000000	0.0	0.0	0.0	0.0

	Salon / Barbershop	Scenic Lookout	Science Museum	Sculpture Garden
0	0.000000	0.0	0.0	0.0
1	0.125000	0.0	0.0	0.0
2	0.111111	0.0	0.0	0.0
3	0.000000	0.0	0.0	0.0
4	0.000000	0.0	0.0	0.0

	Seafood Restaurant	Shawarma Place	Shipping Store	Shoe 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

	Shopping Mall	Skate Park	Skating Rink	Smoke Shop	Snack Place
0	0.0	0.0	0.0	0.000000	0.035714
1	0.0	0.0	0.0	0.000000	0.000000
2	0.0	0.0	0.0	0.111111	0.000000
3	0.0	0.0	0.0	0.000000	0.000000
4	0.0	0.0	0.0	0.000000	0.000000

	Soccer Field	Soccer Stadium	Spa	Sporting Goods Shop	Sports Club
0	0.000	0.0	0.0	0.0	0.035714
1	0.125	0.0	0.0	0.0	0.000000
2	0.000	0.0	0.0	0.0	0.000000
3	0.000	0.0	0.0	0.0	0.000000
4	0.000	0.0	0.0	0.0	0.000000

	Stables	Stadium	Strip Club	Supermarket	Supplement Shop	Surf Spot
0	0.0	0.0	0.0	0.071429	0.0	0.0
1	0.0	0.0	0.0	0.000000	0.0	0.0
2	0.0	0.0	0.0	0.000000	0.0	0.0
3	0.0	0.0	0.0	0.029412	0.0	0.0
4	0.0	0.0	0.0	0.142857	0.0	0.0

	Sushi Restaurant	Tattoo Parlor	Tea Room	Tennis Court	Theater
0	0.000000	0.0	0.0	0.0	0.0
1	0.000000	0.0	0.0	0.0	0.0
2	0.000000	0.0	0.0	0.0	0.0

```
3          0.029412            0.0       0.0           0.0      0.0
4          0.000000            0.0       0.0           0.0      0.0

   Toy / Game Store  Track  Track Stadium  Trail  Train Station  Tram Station  \
0          0.000000    0.0            0.0    0.0            0.0           0.0
1          0.000000    0.0            0.0    0.0            0.0           0.0
2          0.000000    0.0            0.0    0.0            0.0           0.0
3          0.029412    0.0            0.0    0.0            0.0           0.0
4          0.000000    0.0            0.0    0.0            0.0           0.0

   Tree  Vape Store  Vegetarian / Vegan Restaurant  Vietnamese 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

   Volleyball Court  Warehouse Store  Wine Shop  Women's Store  Yoga Studio
0               0.0              0.0        0.0            0.0     0.035714
1               0.0              0.0        0.0            0.0     0.000000
2               0.0              0.0        0.0            0.0     0.111111
3               0.0              0.0        0.0            0.0     0.029412
4               0.0              0.0        0.0            0.0     0.000000
```

0.8 Cluster Neighborhoods

Run k-means to cluster the neighborhood into 4 clusters.

[46]:
```
# set number of clusters
kclusters = 4

moscow_grouped_clustering = moscow_grouped.drop('Neighborhood', 1)

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

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

[46]:
```
array([2, 2, 3, 0, 2, 0, 0, 2, 0, 0], dtype=int32)
```

Let's create a new dataframe that includes the cluster as well as the top 10 venues for each neighborhood.

[47]:
```
# add clustering labels
neighborhoods_venues_sorted.insert(0, 'Cluster Labels', kmeans.labels_)
```

```
moscow_merged = moscow_df

# merge moscow_grouped with moscow_data to add latitude/longitude for each␣
 ↪neighborhood
moscow_merged = moscow_merged.join(neighborhoods_venues_sorted.
 ↪set_index('Neighborhood'), on='Neighborhood')

moscow_merged
```

[47]:

	Neighborhood	Borough	Latitude	Longitude	Cluster Labels
0			55.748708	37.474149	0.0
1			55.612560	37.280081	2.0
2			55.798118	37.475900	0.0
3			55.886669	37.529184	0.0
4			55.865166	37.486793	0.0
5			55.704913	37.383375	2.0
6	-		55.650576	37.354337	2.0
7			55.797015	37.392717	0.0
8			55.943791	37.381299	0.0
9			55.855051	37.360428	2.0
10			55.892015	37.378868	1.0
11			55.765999	37.416811	2.0
12			55.642583	37.398145	2.0
13			55.848161	37.503539	2.0
14			55.844646	37.421538	0.0
15			55.855324	37.423243	3.0
16	-		55.826513	37.446410	2.0
17	-		55.774477	37.475388	0.0
18	-		55.706315	37.452668	2.0
19	-		55.666194	37.478399	0.0
20			55.867730	37.465845	0.0
21	-		55.717706	37.471783	1.0
22			55.827699	37.498243	0.0
23			55.804283	37.509413	0.0
24			55.875493	37.519462	0.0
25			55.678449	37.494415	0.0
26			55.778313	37.529088	0.0
27			55.830160	37.525658	3.0
28			55.801448	37.549368	3.0
29			55.942667	37.552130	1.0
30			55.866847	37.552988	2.0
31			55.829539	37.559509	0.0
32			55.901305	37.568914	0.0
33			55.873777	37.560752	0.0
34			55.799518	37.566503	0.0
35			55.881136	37.589701	2.0
36			55.835338	37.589365	3.0

```
37                          55.865559  37.614190             0.0
38                          55.808049  37.586794             0.0
39                          55.836305  37.617413             0.0
40                          55.889685  37.611491             0.0
41                          55.790632  37.608042             0.0
42                          55.855019  37.644431             2.0
43                          55.873908  37.630261             0.0
44                          55.885997  37.654836             0.0
45                          55.834181  37.652304             2.0
46                          55.814850  37.652527             2.0
47                          55.870001  37.665404             0.0
48                          55.859651  37.701189             2.0
49                          55.879053  37.683302             0.0
50                          55.745892  37.104304             NaN

   1st Most Common Venue        2nd Most Common Venue  \
0           Concert Hall           Athletics & Sports
1           Soccer Field         Fast Food Restaurant
2                 Plaza                  Coffee Shop
3            Supermarket   Modern European Restaurant
4            Supermarket         Gym / Fitness Center
5   Fast Food Restaurant               Clothing Store
6               Gym Pool                 Tennis Court
7            Supermarket             Department Store
8             Restaurant         Other Great Outdoors
9    Japanese Restaurant             Pedestrian Plaza
10                 Park                   Restaurant
11          Pizza Place           Athletics & Sports
12    Recreation Center            Convenience Store
13    Food & Drink Shop                  Supermarket
14                 Park               Cosmetics Shop
15    Convenience Store                     Pharmacy
16  Fast Food Restaurant               Soccer Stadium
17          Coffee Shop         Caucasian Restaurant
18                Hotel         Fast Food Restaurant
19          Coffee Shop               Cosmetics Shop
20   Sporting Goods Shop            Convenience Store
21                 Park           Italian Restaurant
22       Clothing Store                   Shoe Store
23               Bakery            Electronics Store
24       Cosmetics Shop            Health Food Store
25            Bookstore             Sushi Restaurant
26          Supermarket                  Coffee Shop
27                Café            Convenience Store
28             Pharmacy                  Yoga Studio
29             Fountain                         Park
30                 Park                       Plaza
```

31	Stables	Garden
32	Playground	Theater
33	Supermarket	Bookstore
34	Pharmacy	Supermarket
35	Soccer Field	Pub
36	Botanical Garden	Gym / Fitness Center
37	Pharmacy	Eastern European Restaurant
38	Coffee Shop	Photography Studio
39	Café	Museum
40	Italian Restaurant	Department Store
41	Caucasian Restaurant	Health Food Store
42	Pizza Place	Gym / Fitness Center
43	Bakery	Restaurant
44	Pharmacy	Flower Shop
45	Gym / Fitness Center	Middle Eastern Restaurant
46	Hotel	Auto Workshop
47	Cosmetics Shop	Pharmacy
48	Breakfast Spot	Hotel
49	Restaurant	Supermarket
50	NaN	NaN

	3rd Most Common Venue	4th Most Common Venue	\
0	Beach	BBQ Joint	
1	Scenic Lookout	Yoga Studio	
2	Dessert Shop	Sporting Goods Shop	
3	Gym	Pizza Place	
4	Café	Pizza Place	
5	Cosmetics Shop	Big Box Store	
6	Gym / Fitness Center	Spa	
7	Tram Station	Bakery	
8	Lake	Yoga Studio	
9	Gym Pool	Forest	
10	Scenic Lookout	Yoga Studio	
11	Auto Workshop	Track	
12	Food & Drink Shop	Pizza Place	
13	Park	Stadium	
14	Gastropub	Gym	
15	Gym / Fitness Center	Wine Shop	
16	Auto Workshop	Farmers Market	
17	Italian Restaurant	Sushi Restaurant	
18	Lighthouse	Auto Workshop	
19	Bakery	Gym / Fitness Center	
20	Café	Sushi Restaurant	
21	Gym / Fitness Center	Hotel	
22	Lingerie Store	Sporting Goods Shop	
23	Beer Bar	Bookstore	
24	Eastern European Restaurant	Pharmacy	

```
25                Gourmet Shop           Gym / Fitness Center
26              Clothing Store                      Multiplex
27                    Pharmacy                 Farmers Market
28           Martial Arts Dojo                     Smoke Shop
29  Eastern European Restaurant                   Yoga Studio
30                Supermarket                Asian Restaurant
31                        Gym             Frozen Yogurt Shop
32                Flower Shop                      Skate Park
33                  Pet Store             Miscellaneous Shop
34                  Pet Store                 Cosmetics Shop
35                       Lake                    Dry Cleaner
36                       Pool              Convenience Store
37                 Beer Store              Electronics Store
38                 Kids Store              Martial Arts Dojo
39              Science Museum                         Garden
40               Skating Rink                       Pharmacy
41                 Restaurant                     Hookah Bar
42                  Pool Hall                  Movie Theater
43        Gym / Fitness Center           Caucasian Restaurant
44                     Bakery  Paper / Office Supplies Store
45          Outdoor Sculpture                     Supermarket
46                Pizza Place                     Supermarket
47                Yoga Studio              Electronics Store
48              Concert Hall                  Grocery Store
49                       Park              Convenience Store
50                        NaN                           NaN

   5th Most Common Venue      6th Most Common Venue  \
0               Tea Room                Yoga Studio
1                Exhibit                     Forest
2     Food & Drink Shop                  Multiplex
3             Restaurant                   Pharmacy
4           Coffee Shop                  Pet Store
5           Blini House          Mobile Phone Shop
6           Yoga Studio                     Forest
7      Pedestrian Plaza           Toy / Game Store
8                Exhibit                     Forest
9          Shopping Mall       Fast Food Restaurant
10               Exhibit                     Forest
11                  Park                Yoga Studio
12           Supermarket              Auto Workshop
13            Playground                Pizza Place
14           Supermarket                Karaoke Bar
15            Beer Store                      Café
16             Gun Range                    Market
17            Kids Store             Massage Studio
18                  Park                  Pet Store
```

19	Multiplex	Noodle House
20	Film Studio	Liquor Store
21	Restaurant	Dog Run
22	Coffee Shop	Shopping Mall
23	Pharmacy	Cosmetics Shop
24	Salon / Barbershop	Café
25	Supermarket	Middle Eastern Restaurant
26	Blini House	Gastropub
27	Park	Middle Eastern Restaurant
28	Jazz Club	Café
29	Fabric Shop	Forest
30	Fast Food Restaurant	Bar
31	Fountain	Forest
32	Café	Pizza Place
33	Café	Gym
34	Automotive Shop	Garden
35	Auto Workshop	Salon / Barbershop
36	Arts & Entertainment	Sushi Restaurant
37	Park	Soccer Field
38	Clothing Store	Accessories Store
39	Surf Spot	Restaurant
40	Gym	Bar
41	College Gym	Shawarma Place
42	Sporting Goods Shop	Board Shop
43	Supermarket	Athletics & Sports
44	Gym Pool	Sushi Restaurant
45	Park	Track Stadium
46	Gym / Fitness Center	Yoga Studio
47	Boutique	Caucasian Restaurant
48	Auto Workshop	Yoga Studio
49	Shipping Store	Pharmacy
50	NaN	NaN

	7th Most Common Venue	8th Most Common Venue
0	Fast Food Restaurant	Frozen Yogurt Shop
1	Food Court	Food & Drink Shop
2	Fast Food Restaurant	Boxing Gym
3	Park	Eastern European Restaurant
4	Farmers Market	Sushi Restaurant
5	Sushi Restaurant	Gym / Fitness Center
6	Food Court	Food & Drink Shop
7	Restaurant	Rental Car Location
8	Food Court	Food & Drink Shop
9	Middle Eastern Restaurant	Campground
10	Food Court	Food & Drink Shop
11	Fabric Shop	Fountain
12	Yoga Studio	Fabric Shop

13	Middle Eastern Restaurant	Gourmet Shop
14	Arts & Crafts Store	Convenience Store
15	Grocery Store	Park
16	Gym / Fitness Center	Blini House
17	Gourmet Shop	Modern European Restaurant
18	Yoga Studio	Fabric Shop
19	Bookstore	Middle Eastern Restaurant
20	Fish Market	Supermarket
21	Athletics & Sports	Food Court
22	Toy / Game Store	Seafood Restaurant
23	Pizza Place	Coffee Shop
24	Supermarket	Dance Studio
25	Rock Club	Health & Beauty Service
26	Salon / Barbershop	Salad Place
27	Gym / Fitness Center	Big Box Store
28	Clothing Store	Salon / Barbershop
29	Food Court	Food & Drink Shop
30	Yoga Studio	Fountain
31	Food Court	Food & Drink Shop
32	Stables	Supermarket
33	Baby Store	Dumpling Restaurant
34	Sushi Restaurant	Middle Eastern Restaurant
35	Grocery Store	Exhibit
36	Fountain	Forest
37	Gym	Supermarket
38	Sushi Restaurant	Dance Studio
39	Eastern European Restaurant	Flower Shop
40	Farmers Market	Forest
41	Pizza Place	Middle Eastern Restaurant
42	Fast Food Restaurant	Farmers Market
43	Pharmacy	Middle Eastern Restaurant
44	Farmers Market	Grocery Store
45	Fabric Shop	Athletics & Sports
46	Farmers Market	Sports Club
47	Clothing Store	Convenience Store
48	Fabric Shop	Forest
49	Gym / Fitness Center	Food & Drink Shop
50	NaN	NaN

	9th Most Common Venue	10th Most Common Venue
0	Fountain	Forest
1	Flower Shop	Fish Market
2	Fountain	Furniture / Home Store
3	Café	Soccer Field
4	Grocery Store	Salon / Barbershop
5	Boutique	Hot Dog Joint
6	Flower Shop	Fish Market

7	Gym / Fitness Center	Pet Store
8	Flower Shop	Fish Market
9	Martial Arts Dojo	Sushi Restaurant
10	Flower Shop	Fish Market
11	Forest	Food Court
12	Forest	Food Court
13	Exhibit	Flower Shop
14	Wine Shop	Bath House
15	Yoga Studio	Food Court
16	Clothing Store	Park
17	Fast Food Restaurant	Park
18	Forest	Food Court
19	Blini House	Mexican Restaurant
20	Climbing Gym	Big Box Store
21	Food & Drink Shop	Flower Shop
22	Garden Center	Bookstore
23	Food & Drink Shop	Café
24	History Museum	Food & Drink Shop
25	Pedestrian Plaza	Historic Site
26	Greek Restaurant	Shopping Mall
27	Hardware Store	Exhibit
28	Food Court	Food & Drink Shop
29	Flower Shop	Fish Market
30	Forest	Food Court
31	Flower Shop	Fish Market
32	Restaurant	Liquor Store
33	Fish Market	Fountain
34	Liquor Store	Flower Shop
35	Food Court	Food & Drink Shop
36	Food Court	Food & Drink Shop
37	Gymnastics Gym	Sushi Restaurant
38	Music Venue	Boutique
39	Fountain	Caucasian Restaurant
40	Food Court	Food & Drink Shop
41	Electronics Store	Gastropub
42	Belgian Restaurant	Caucasian Restaurant
43	Café	Pizza Place
44	Multiplex	Café
45	Food & Drink Shop	Women's Store
46	Mobile Phone Shop	Snack Place
47	Plaza	Pet Store
48	Food Court	Food & Drink Shop
49	Wine Shop	Exhibit
50	NaN	NaN

Finally, let's visualize the resulting clusters

[48]:
```
moscow_merged['Cluster Labels'].value_counts()
```

[48]:
```
0.0    28
2.0    15
3.0     4
1.0     3
Name: Cluster Labels, dtype: int64
```

Now let's create map of Moscow with clustered neighborhoods marked in different colors.

[49]:
```
moscow_merged['Cluster Labels'].isna().value_counts()
```

[49]:
```
False    50
True      1
Name: Cluster Labels, dtype: int64
```

[50]:
```
moscow_merged.dropna(inplace=True)
```

[51]:
```
moscow_merged=moscow_merged.astype({'Cluster Labels':'int32'})
```

[62]:
```
# create map
map_clusters = folium.Map(location=[55.7, 37.4], zoom_start=11)

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

# add markers to the map
markers_colors = []
for lat, lon, poi, cluster in zip(moscow_merged['Latitude'],␣
 ↪moscow_merged['Longitude'], moscow_merged['Neighborhood'],␣
 ↪moscow_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
```

[62]:
```
<folium.folium.Map at 0x7f7ef41c70b8>
```

0.9 Examine Clusters

Now, we can examine each cluster and determine the discriminating venue categories that distinguish each cluster.

Cluster 1

[53]:
```
moscow_merged.loc[moscow_merged['Cluster Labels'] == 0, moscow_merged.
↪columns[[0] + list(range(5, moscow_merged.shape[1]))]]
```

[53]:

	Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue
0		Concert Hall	Athletics & Sports	Beach	BBQ Joint
2		Plaza	Coffee Shop	Dessert Shop	Sporting Goods Shop
3		Supermarket	Modern European Restaurant	Gym	Pizza Place
4		Supermarket	Gym / Fitness Center	Café	Pizza Place
7		Supermarket	Department Store	Tram Station	Bakery
8		Restaurant	Other Great Outdoors	Lake	Yoga Studio
14		Park	Cosmetics Shop	Gastropub	Gym
17	-	Coffee Shop	Caucasian Restaurant	Italian Restaurant	Sushi Restaurant
19	-	Coffee Shop	Cosmetics Shop		
20		Sporting Goods Shop	Convenience Store		
22		Clothing Store	Shoe Store		
23		Bakery	Electronics Store		
24		Cosmetics Shop	Health Food Store		
25		Bookstore	Sushi Restaurant		
26		Supermarket	Coffee Shop		
31		Stables	Garden		
32		Playground	Theater		
33		Supermarket	Bookstore		
34		Pharmacy	Supermarket		
37		Pharmacy	Eastern European Restaurant		
38		Coffee Shop	Photography Studio		
39		Café	Museum		
40		Italian Restaurant	Department Store		
41		Caucasian Restaurant	Health Food Store		
43		Bakery	Restaurant		
44		Pharmacy	Flower Shop		
47		Cosmetics Shop	Pharmacy		
49		Restaurant	Supermarket		

19	Bakery	Gym / Fitness Center
20	Café	Sushi Restaurant
22	Lingerie Store	Sporting Goods Shop
23	Beer Bar	Bookstore
24	Eastern European Restaurant	Pharmacy
25	Gourmet Shop	Gym / Fitness Center
26	Clothing Store	Multiplex
31	Gym	Frozen Yogurt Shop
32	Flower Shop	Skate Park
33	Pet Store	Miscellaneous Shop
34	Pet Store	Cosmetics Shop
37	Beer Store	Electronics Store
38	Kids Store	Martial Arts Dojo
39	Science Museum	Garden
40	Skating Rink	Pharmacy
41	Restaurant	Hookah Bar
43	Gym / Fitness Center	Caucasian Restaurant
44	Bakery	Paper / Office Supplies Store
47	Yoga Studio	Electronics Store
49	Park	Convenience Store

	5th Most Common Venue	6th Most Common Venue	\
0	Tea Room	Yoga Studio	
2	Food & Drink Shop	Multiplex	
3	Restaurant	Pharmacy	
4	Coffee Shop	Pet Store	
7	Pedestrian Plaza	Toy / Game Store	
8	Exhibit	Forest	
14	Supermarket	Karaoke Bar	
17	Kids Store	Massage Studio	
19	Multiplex	Noodle House	
20	Film Studio	Liquor Store	
22	Coffee Shop	Shopping Mall	
23	Pharmacy	Cosmetics Shop	
24	Salon / Barbershop	Café	
25	Supermarket	Middle Eastern Restaurant	
26	Blini House	Gastropub	
31	Fountain	Forest	
32	Café	Pizza Place	
33	Café	Gym	
34	Automotive Shop	Garden	
37	Park	Soccer Field	
38	Clothing Store	Accessories Store	
39	Surf Spot	Restaurant	
40	Gym	Bar	
41	College Gym	Shawarma Place	
43	Supermarket	Athletics & Sports	

```
44              Gym Pool           Sushi Restaurant
47              Boutique       Caucasian Restaurant
49        Shipping Store                  Pharmacy

          7th Most Common Venue        8th Most Common Venue  \
0          Fast Food Restaurant           Frozen Yogurt Shop
2          Fast Food Restaurant                    Boxing Gym
3                          Park  Eastern European Restaurant
4                Farmers Market              Sushi Restaurant
7                    Restaurant          Rental Car Location
8                    Food Court            Food & Drink Shop
14          Arts & Crafts Store            Convenience Store
17                Gourmet Shop   Modern European Restaurant
19                   Bookstore    Middle Eastern Restaurant
20                 Fish Market                  Supermarket
22            Toy / Game Store           Seafood Restaurant
23                 Pizza Place                 Coffee Shop
24                 Supermarket                Dance Studio
25                   Rock Club      Health & Beauty Service
26           Salon / Barbershop                Salad Place
31                   Food Court            Food & Drink Shop
32                      Stables                  Supermarket
33                   Baby Store          Dumpling Restaurant
34             Sushi Restaurant    Middle Eastern Restaurant
37                          Gym                  Supermarket
38             Sushi Restaurant                Dance Studio
39  Eastern European Restaurant                 Flower Shop
40               Farmers Market                      Forest
41                  Pizza Place    Middle Eastern Restaurant
43                     Pharmacy    Middle Eastern Restaurant
44               Farmers Market               Grocery Store
47               Clothing Store            Convenience Store
49         Gym / Fitness Center            Food & Drink Shop

   9th Most Common Venue  10th Most Common Venue
0                Fountain                 Forest
2                Fountain  Furniture / Home Store
3                    Café            Soccer Field
4           Grocery Store      Salon / Barbershop
7    Gym / Fitness Center              Pet Store
8             Flower Shop             Fish Market
14              Wine Shop              Bath House
17   Fast Food Restaurant                    Park
19            Blini House      Mexican Restaurant
20           Climbing Gym           Big Box Store
22          Garden Center              Bookstore
23      Food & Drink Shop                   Café
```

```
24        History Museum       Food & Drink Shop
25      Pedestrian Plaza           Historic Site
26      Greek Restaurant           Shopping Mall
31           Flower Shop             Fish Market
32            Restaurant            Liquor Store
33           Fish Market                Fountain
34         Liquor Store             Flower Shop
37        Gymnastics Gym        Sushi Restaurant
38           Music Venue                Boutique
39              Fountain    Caucasian Restaurant
40           Food Court       Food & Drink Shop
41     Electronics Store                Gastropub
43                  Café             Pizza Place
44             Multiplex                   Café
47                 Plaza              Pet Store
49             Wine Shop                Exhibit
```

Cluster 2

[54]:
```
moscow_merged.loc[moscow_merged['Cluster Labels'] == 1, moscow_merged.
↪columns[[0] + list(range(5, moscow_merged.shape[1]))]]
```

[54]:
```
      Neighborhood 1st Most Common Venue 2nd Most Common Venue  \
10                                  Park            Restaurant
21    -                             Park    Italian Restaurant
29                               Fountain                  Park

          3rd Most Common Venue 4th Most Common Venue 5th Most Common Venue  \
10               Scenic Lookout           Yoga Studio               Exhibit
21        Gym / Fitness Center                 Hotel            Restaurant
29  Eastern European Restaurant           Yoga Studio           Fabric Shop

   6th Most Common Venue 7th Most Common Venue 8th Most Common Venue  \
10                Forest            Food Court     Food & Drink Shop
21               Dog Run    Athletics & Sports            Food Court
29                Forest            Food Court     Food & Drink Shop

   9th Most Common Venue 10th Most Common Venue
10           Flower Shop            Fish Market
21     Food & Drink Shop            Flower Shop
29           Flower Shop            Fish Market
```

Cluster 3

[55]:
```
moscow_merged.loc[moscow_merged['Cluster Labels'] == 2, moscow_merged.
↪columns[[0] + list(range(5, moscow_merged.shape[1]))]]
```

[55]:

	Neighborhood	1st Most Common Venue	2nd Most Common Venue
1		Soccer Field	Fast Food Restaurant
5		Fast Food Restaurant	Clothing Store
6	-	Gym Pool	Tennis Court
9		Japanese Restaurant	Pedestrian Plaza
11		Pizza Place	Athletics & Sports
12		Recreation Center	Convenience Store
13		Food & Drink Shop	Supermarket
16	-	Fast Food Restaurant	Soccer Stadium
18	-	Hotel	Fast Food Restaurant
30		Park	Plaza
35		Soccer Field	Pub
42		Pizza Place	Gym / Fitness Center
45		Gym / Fitness Center	Middle Eastern Restaurant
46		Hotel	Auto Workshop
48		Breakfast Spot	Hotel

	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue
1	Scenic Lookout	Yoga Studio	Exhibit
5	Cosmetics Shop	Big Box Store	Blini House
6	Gym / Fitness Center	Spa	Yoga Studio
9	Gym Pool	Forest	Shopping Mall
11	Auto Workshop	Track	Park
12	Food & Drink Shop	Pizza Place	Supermarket
13	Park	Stadium	Playground
16	Auto Workshop	Farmers Market	Gun Range
18	Lighthouse	Auto Workshop	Park
30	Supermarket	Asian Restaurant	Fast Food Restaurant
35	Lake	Dry Cleaner	Auto Workshop
42	Pool Hall	Movie Theater	Sporting Goods Shop
45	Outdoor Sculpture	Supermarket	Park
46	Pizza Place	Supermarket	Gym / Fitness Center
48	Concert Hall	Grocery Store	Auto Workshop

	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue
1	Forest	Food Court	Food & Drink Shop
5	Mobile Phone Shop	Sushi Restaurant	Gym / Fitness Center
6	Forest	Food Court	Food & Drink Shop
9	Fast Food Restaurant	Middle Eastern Restaurant	Campground
11	Yoga Studio	Fabric Shop	Fountain
12	Auto Workshop	Yoga Studio	Fabric Shop
13	Pizza Place	Middle Eastern Restaurant	Gourmet Shop
16	Market	Gym / Fitness Center	Blini House
18	Pet Store	Yoga Studio	Fabric Shop
30	Bar	Yoga Studio	Fountain
35	Salon / Barbershop	Grocery Store	Exhibit
42	Board Shop	Fast Food Restaurant	Farmers Market

```
45         Track Stadium                Fabric Shop    Athletics & Sports
46           Yoga Studio             Farmers Market          Sports Club
48           Yoga Studio                Fabric Shop               Forest

   9th Most Common Venue 10th Most Common Venue
1            Flower Shop            Fish Market
5               Boutique          Hot Dog Joint
6            Flower Shop            Fish Market
9      Martial Arts Dojo       Sushi Restaurant
11                Forest             Food Court
12                Forest             Food Court
13               Exhibit            Flower Shop
16        Clothing Store                   Park
18                Forest             Food Court
30                Forest             Food Court
35           Food Court      Food & Drink Shop
42    Belgian Restaurant   Caucasian Restaurant
45     Food & Drink Shop          Women's Store
46     Mobile Phone Shop            Snack Place
48           Food Court      Food & Drink Shop
```

Cluster 4

[56]:
```
moscow_merged.loc[moscow_merged['Cluster Labels'] == 3, moscow_merged.
↪columns[[0] + list(range(5, moscow_merged.shape[1]))]]
```

[56]:
```
       Neighborhood 1st Most Common Venue 2nd Most Common Venue  \
15               Convenience Store              Pharmacy
27                           Café     Convenience Store
28                       Pharmacy           Yoga Studio
36              Botanical Garden  Gym / Fitness Center

   3rd Most Common Venue 4th Most Common Venue 5th Most Common Venue  \
15  Gym / Fitness Center             Wine Shop            Beer Store
27              Pharmacy        Farmers Market                  Park
28     Martial Arts Dojo            Smoke Shop             Jazz Club
36                  Pool     Convenience Store  Arts & Entertainment

      6th Most Common Venue 7th Most Common Venue 8th Most Common Venue  \
15                    Café         Grocery Store                  Park
27  Middle Eastern Restaurant  Gym / Fitness Center         Big Box Store
28                    Café        Clothing Store    Salon / Barbershop
36          Sushi Restaurant              Fountain                Forest

   9th Most Common Venue 10th Most Common Venue
15          Yoga Studio             Food Court
27       Hardware Store                Exhibit
```

```
28            Food Court      Food & Drink Shop
36            Food Court      Food & Drink Shop
```

0.10 Conclusion

The neighborhood I currently reside in is located in the Cluster 0. This cluster is characterized by a lot of shops, cafes and restaurants. So, as possible neighborhoods for relocation I could select other neighborhoods from that cluster, for example or - .

[ ]: