The Battle of Neighbourhoods (Week 2)

August 6, 2020

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Introduction and description of the problem

The objective of this project is to help entrepreneurs in the city of Madrid (Capital of Spain) to find the best neighborhood to open a business depending on what type of businesses are the most frequent in each neighborhood.

In this case I will follow the example proposed by the problem statement: if someone is looking to open a restaurant, where would you recommend that they open it?

0.0.1 Data

The data will be obtained from the URL https://es.wikipedia.org/wiki/Anexo:Distritos_de_Madrid, corresponding to the information on districts and inhabitants of the city of Madrid. This information is taken from Wikipedia.

0.0.2 Steps to follow

The necessary libraries will be loaded for the execution of the project.

The https://es.wikipedia.org/wiki/Anexo:Distritos_de_Madrid data will be obtained and transformed.

Obtain the coordinate data for each neighborhood in Madrid.

Get the top 100 venues that are in all the neighborhoods in Madrid from Foursquare.

Analyze Each Neighborhood and extract the top 3 most common venues.

0.0.3 Import necessary Libraries

```python
[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
     !conda install -c conda-forge lxml --yes
     !conda install -c conda-forge beautifulsoup4 --yes

     import json # library to handle JSON files
```

```
!conda install -c conda-forge geopy --yes # uncomment this line if you haven't
 ↪completed the Foursquare API lab
from geopy.geocoders import Nominatim # convert an address into latitude and
 ↪longitude values

from pandas.io.json import json_normalize # tranform JSON file into a pandas
 ↪dataframe

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

#import k-means from clustering stage
from sklearn.cluster import KMeans

# #!conda install -c conda-forge folium=0.5.0 --yes # uncomment this line if
 ↪you haven't completed the Foursquare API lab
import folium # map rendering library

print('Libraries imported.')
```

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

# All requested packages already installed.

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

# All requested packages already installed.

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

# All requested packages already installed.

Libraries imported.
```

0.0.4 Define Foursquare Credentials and Version

```
[2]: CLIENT_ID = 'FGHDQZFOEA3OHDQUDDUOYCOUKJG5UNISL55BC4H3SFOZVIPQ' # your
      ↪Foursquare ID
     CLIENT_SECRET = 'HBRE2I2LJQAIVWLO35BTKQNRIHOYX43OMAN3IOQKFY5JCUQD' # your
      ↪Foursquare Secret
     VERSION = '20180604'
     LIMIT = 30
     print('Your credentails:')
```

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

Your credentails:
CLIENT_ID: FGHDQZFOEA3OHDQUDDUOYCOUKJG5UNISL55BC4H3SFOZVIPQ
CLIENT_SECRET:HBRE2I2LJQAIVWLO35BTKQNRIHOYX43OMAN3IOQKFY5JCUQD

0.0.5 We obtain the data from 'https://es.wikipedia.org/wiki/Anexo:Distritos__de__Madrid', perform the necessary transformations and obtain the coordinate data for each neighborhood.

```
[3]: url = 'https://es.wikipedia.org/wiki/Anexo:Distritos_de_Madrid'
     df = pd.read_html(url, header=0)[0]
     df.rename(columns={'Nombre':'Name'}, inplace=True)  # Translate
     df = df[['Name']] + ", Madrid"
     df['Latitude'] = ""
     df['Longitude'] = ""
     df = df.drop(len(df)-1)   # Erase the last row for totals

     for i in df.index:
         address = df["Name"][i]
         geolocator = Nominatim(user_agent="mad_explorer")
         location = geolocator.geocode(address)
         df['Latitude'][i] = location.latitude
         df['Longitude'][i] = location.longitude

     df
```

```
[3]:                          Name  Latitude  Longitude
     0             Centro, Madrid   40.4177   -3.70791
     1          Arganzuela, Madrid  40.3981   -3.69373
     2              Retiro, Madrid  40.4111   -3.67606
     3           Salamanca, Madrid   40.427    -3.6806
     4           Chamartín, Madrid   40.459   -3.67613
     5              Tetuán, Madrid  40.4606   -3.69828
     6            Chamberí, Madrid  40.4362   -3.70383
     7   Fuencarral-El Pardo, Madrid  40.5563  -3.77859
     8      Moncloa-Aravaca, Madrid  40.4395    -3.7442
     9              Latina, Madrid  40.4035   -3.73615
     10        Carabanchel, Madrid  40.3742   -3.74468
     11               Usera, Madrid  40.3839   -3.70645
     12   Puente de Vallecas, Madrid  40.3836  -3.65454
     13           Moratalaz, Madrid  40.4059   -3.64487
     14        Ciudad Lineal, Madrid  40.4484  -3.65049
     15           Hortaleza, Madrid  40.4725   -3.64255
     16          Villaverde, Madrid  40.3456   -3.69596
     17    Villa de Vallecas, Madrid   40.374  -3.61216
```

```
18              Vicálvaro, Madrid  40.3966  -3.57662
19  San Blas-Canillejas, Madrid  40.4289    -3.604
20                Barajas, Madrid  40.4733  -3.57984
```

0.0.6 We obtain the geographical location of the center of Madrid

```python
[4]:  address = 'Madrid'

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

```
The geograpical coordinate of Madrid City are 40.4167047, -3.7035825.
```

0.0.7 Create a map of Madrid with neighborhoods superimposed on top.

```python
[14]:  # create map of Madrid using latitude and longitude values
       map_madrid = folium.Map(location=[latitude, longitude], zoom_start=10)

       # add markers to map
       for lat, lng, name in zip(df['Latitude'], df['Longitude'], df['Name']):
           label = '{}'.format(name)
           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_madrid)

       map_madrid
```

```
[14]:  <folium.folium.Map at 0x7f78f4072978>
```

0.0.8 Let's get the top 100 venues that are in all the neighborhoods in Madrid within a radius of 500 meters.

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

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

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

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

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

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

    return(nearby_venues)
```

```python
[7]: madrid_venues = getNearbyVenues(names=df['Name'],
                                   latitudes=df['Latitude'],
                                   longitudes=df['Longitude']
                                  )
     print(madrid_venues.shape)        # print shape
```

```
(371, 7)
```

```python
[8]: madrid_venues.groupby('Neighbourhood').count()
```

```
[8]:                      Neighbourhood Latitude  Neighbourhood Longitude  \
     Neighbourhood
     Arganzuela, Madrid                      30                       30
     Barajas, Madrid                         30                       30
     Carabanchel, Madrid                     15                       15
     Centro, Madrid                          30                       30
     Chamartín, Madrid                       30                       30
     Chamberí, Madrid                        30                       30
     Ciudad Lineal, Madrid                   29                       29
     Hortaleza, Madrid                       20                       20
     Latina, Madrid                           8                        8
     Moncloa-Aravaca, Madrid                  3                        3
     Moratalaz, Madrid                       16                       16
     Puente de Vallecas, Madrid               9                        9
     Retiro, Madrid                          23                       23
     Salamanca, Madrid                       30                       30
     San Blas-Canillejas, Madrid              7                        7
     Tetuán, Madrid                          30                       30
     Usera, Madrid                           18                       18
     Vicálvaro, Madrid                        1                        1
     Villa de Vallecas, Madrid                9                        9
     Villaverde, Madrid                       3                        3

                                  Venue  Venue Latitude  Venue Longitude  \
     Neighbourhood
     Arganzuela, Madrid              30              30               30
     Barajas, Madrid                 30              30               30
     Carabanchel, Madrid             15              15               15
     Centro, Madrid                  30              30               30
     Chamartín, Madrid               30              30               30
     Chamberí, Madrid                30              30               30
     Ciudad Lineal, Madrid           29              29               29
     Hortaleza, Madrid               20              20               20
     Latina, Madrid                   8               8                8
     Moncloa-Aravaca, Madrid          3               3                3
     Moratalaz, Madrid               16              16               16
     Puente de Vallecas, Madrid       9               9                9
     Retiro, Madrid                  23              23               23
     Salamanca, Madrid               30              30               30
     San Blas-Canillejas, Madrid      7               7                7
     Tetuán, Madrid                  30              30               30
     Usera, Madrid                   18              18               18
     Vicálvaro, Madrid                1               1                1
     Villa de Vallecas, Madrid        9               9                9
     Villaverde, Madrid               3               3                3

                                  Venue Category
     Neighbourhood
```

```
Neighbourhood
Arganzuela, Madrid                    30
Barajas, Madrid                       30
Carabanchel, Madrid                   15
Centro, Madrid                        30
Chamartín, Madrid                     30
Chamberí, Madrid                      30
Ciudad Lineal, Madrid                 29
Hortaleza, Madrid                     20
Latina, Madrid                         8
Moncloa-Aravaca, Madrid                3
Moratalaz, Madrid                     16
Puente de Vallecas, Madrid             9
Retiro, Madrid                        23
Salamanca, Madrid                     30
San Blas-Canillejas, Madrid            7
Tetuán, Madrid                        30
Usera, Madrid                         18
Vicálvaro, Madrid                      1
Villa de Vallecas, Madrid              9
Villaverde, Madrid                     3
```

0.0.9 Analyze Each Neighborhood and group rows by neighborhood and by taking the mean of the frequency of occurrence of each category

```python
[9]: # one hot encoding
     madrid_onehot = pd.get_dummies(madrid_venues[['Venue Category']], prefix="",
      ↪prefix_sep="")

     # add neighborhood column back to dataframe
     madrid_onehot['Neighbourhood'] = madrid_venues['Neighbourhood']

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

     madrid_grouped = madrid_onehot.groupby('Neighbourhood').mean().reset_index()
     madrid_grouped
```

```
[9]:                 Neighbourhood  American Restaurant    Arcade  \
     0             Arganzuela, Madrid            0.000000  0.000000
     1               Barajas, Madrid            0.000000  0.000000
     2           Carabanchel, Madrid            0.000000  0.000000
     3                Centro, Madrid            0.000000  0.000000
     4             Chamartín, Madrid            0.000000  0.033333
     5              Chamberí, Madrid            0.033333  0.000000
     6         Ciudad Lineal, Madrid            0.000000  0.000000
```

```
7             Hortaleza, Madrid              0.000000  0.000000
8               Latina, Madrid              0.000000  0.000000
9      Moncloa-Aravaca, Madrid              0.000000  0.000000
10            Moratalaz, Madrid             0.000000  0.000000
11   Puente de Vallecas, Madrid             0.000000  0.000000
12               Retiro, Madrid             0.000000  0.000000
13            Salamanca, Madrid             0.033333  0.000000
14  San Blas-Canillejas, Madrid             0.000000  0.000000
15               Tetuán, Madrid             0.000000  0.000000
16                Usera, Madrid             0.000000  0.000000
17            Vicálvaro, Madrid             0.000000  0.000000
18     Villa de Vallecas, Madrid            0.000000  0.000000
19           Villaverde, Madrid             0.000000  0.000000


    Argentinian Restaurant  Asian Restaurant  BBQ Joint    Bakery       Bar  \
0                 0.000000          0.000000   0.000000  0.066667  0.033333
1                 0.066667          0.000000   0.000000  0.000000  0.000000
2                 0.000000          0.000000   0.000000  0.066667  0.000000
3                 0.000000          0.000000   0.000000  0.000000  0.000000
4                 0.000000          0.000000   0.000000  0.033333  0.033333
5                 0.000000          0.000000   0.000000  0.033333  0.100000
6                 0.068966          0.000000   0.000000  0.034483  0.000000
7                 0.000000          0.000000   0.000000  0.000000  0.050000
8                 0.000000          0.000000   0.000000  0.125000  0.000000
9                 0.000000          0.000000   0.000000  0.000000  0.000000
10                0.000000          0.000000   0.000000  0.062500  0.125000
11                0.000000          0.111111   0.000000  0.000000  0.000000
12                0.000000          0.000000   0.000000  0.000000  0.000000
13                0.000000          0.000000   0.000000  0.066667  0.000000
14                0.000000          0.000000   0.000000  0.000000  0.000000
15                0.000000          0.033333   0.000000  0.000000  0.033333
16                0.000000          0.055556   0.055556  0.055556  0.000000
17                0.000000          0.000000   0.000000  0.000000  0.000000
18                0.000000          0.111111   0.000000  0.000000  0.111111
19                0.000000          0.000000   0.000000  0.000000  0.000000


    Beer Garden    Bistro  Board Shop  Boarding House  Bookstore  Boutique  \
0      0.066667  0.000000    0.000000        0.000000   0.000000  0.000000
1      0.000000  0.033333    0.000000        0.033333   0.000000  0.000000
2      0.000000  0.000000    0.000000        0.000000   0.000000  0.000000
3      0.000000  0.033333    0.000000        0.000000   0.066667  0.000000
4      0.000000  0.000000    0.000000        0.000000   0.000000  0.000000
5      0.000000  0.000000    0.000000        0.000000   0.000000  0.000000
6      0.000000  0.000000    0.000000        0.000000   0.000000  0.000000
7      0.000000  0.000000    0.000000        0.000000   0.000000  0.000000
8      0.000000  0.000000    0.000000        0.000000   0.000000  0.000000
9      0.000000  0.000000    0.000000        0.000000   0.000000  0.000000
```

10	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
11	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
12	0.000000	0.000000	0.043478	0.000000	0.000000	0.000000
13	0.000000	0.000000	0.000000	0.000000	0.000000	0.033333
14	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
15	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
16	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
17	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
18	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
19	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000

	Boxing Gym	Brazilian Restaurant	Breakfast Spot	Brewery \
0	0.000000	0.000000	0.000000	0.000000
1	0.000000	0.000000	0.033333	0.033333
2	0.000000	0.000000	0.000000	0.000000
3	0.000000	0.000000	0.000000	0.000000
4	0.000000	0.000000	0.000000	0.000000
5	0.033333	0.000000	0.000000	0.000000
6	0.000000	0.000000	0.000000	0.000000
7	0.000000	0.000000	0.050000	0.050000
8	0.000000	0.000000	0.000000	0.000000
9	0.000000	0.000000	0.000000	0.000000
10	0.000000	0.000000	0.000000	0.062500
11	0.000000	0.000000	0.000000	0.000000
12	0.000000	0.000000	0.000000	0.043478
13	0.000000	0.000000	0.000000	0.000000
14	0.000000	0.000000	0.000000	0.000000
15	0.000000	0.066667	0.033333	0.066667
16	0.000000	0.000000	0.000000	0.000000
17	0.000000	0.000000	0.000000	0.000000
18	0.000000	0.000000	0.000000	0.000000
19	0.000000	0.000000	0.333333	0.000000

	Bubble Tea Shop	Burger Joint	Burrito Place	Bus Stop	Café \
0	0.000000	0.000000	0.000000	0.000000	0.033333
1	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.000000	0.000000	0.000000	0.000000	0.066667
3	0.000000	0.000000	0.000000	0.000000	0.000000
4	0.000000	0.033333	0.000000	0.000000	0.000000
5	0.000000	0.033333	0.033333	0.000000	0.066667
6	0.000000	0.068966	0.000000	0.000000	0.034483
7	0.000000	0.000000	0.000000	0.000000	0.050000
8	0.000000	0.000000	0.000000	0.000000	0.000000
9	0.000000	0.000000	0.000000	0.333333	0.000000
10	0.000000	0.000000	0.000000	0.000000	0.062500
11	0.000000	0.000000	0.000000	0.000000	0.000000
12	0.000000	0.000000	0.000000	0.000000	0.000000

13	0.000000	0.033333	0.000000	0.000000	0.033333
14	0.000000	0.000000	0.000000	0.000000	0.000000
15	0.000000	0.000000	0.000000	0.000000	0.000000
16	0.055556	0.000000	0.000000	0.000000	0.000000
17	0.000000	0.000000	0.000000	0.000000	0.000000
18	0.000000	0.000000	0.000000	0.000000	0.000000
19	0.000000	0.000000	0.000000	0.000000	0.000000

	Candy Store	Castle	Chinese Restaurant	Chocolate Shop	Church \
0	0.000000	0.000000	0.033333	0.000000	0.000000
1	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.066667	0.000000	0.000000	0.000000	0.000000
3	0.000000	0.000000	0.000000	0.033333	0.033333
4	0.000000	0.000000	0.000000	0.000000	0.000000
5	0.000000	0.000000	0.000000	0.000000	0.000000
6	0.000000	0.000000	0.034483	0.000000	0.000000
7	0.000000	0.000000	0.000000	0.000000	0.000000
8	0.000000	0.000000	0.000000	0.000000	0.000000
9	0.000000	0.333333	0.000000	0.000000	0.000000
10	0.000000	0.000000	0.000000	0.000000	0.000000
11	0.000000	0.000000	0.000000	0.000000	0.000000
12	0.000000	0.000000	0.000000	0.000000	0.000000
13	0.000000	0.000000	0.000000	0.000000	0.000000
14	0.000000	0.000000	0.000000	0.000000	0.000000
15	0.000000	0.000000	0.066667	0.000000	0.000000
16	0.000000	0.000000	0.166667	0.000000	0.000000
17	0.000000	0.000000	0.000000	0.000000	0.000000
18	0.000000	0.000000	0.000000	0.000000	0.000000
19	0.000000	0.000000	0.000000	0.000000	0.000000

	Clothing Store	Cocktail Bar	Coffee Shop	Convenience Store \
0	0.00	0.000000	0.033333	0.000000
1	0.00	0.000000	0.000000	0.000000
2	0.00	0.000000	0.000000	0.000000
3	0.00	0.000000	0.000000	0.000000
4	0.00	0.033333	0.000000	0.000000
5	0.00	0.000000	0.033333	0.000000
6	0.00	0.034483	0.000000	0.000000
7	0.05	0.000000	0.000000	0.000000
8	0.00	0.000000	0.000000	0.000000
9	0.00	0.000000	0.000000	0.000000
10	0.00	0.000000	0.000000	0.000000
11	0.00	0.000000	0.111111	0.000000
12	0.00	0.000000	0.000000	0.000000
13	0.00	0.000000	0.000000	0.000000
14	0.00	0.000000	0.000000	0.000000
15	0.00	0.000000	0.066667	0.000000

16	0.00	0.000000	0.000000	0.000000
17	0.00	0.000000	0.000000	0.000000
18	0.00	0.000000	0.000000	0.000000
19	0.00	0.000000	0.000000	0.333333

	Cosmetics Shop	Creperie	Dessert Shop	Diner	Dog Run	Donut Shop \
0	0.000000	0.000000	0.033333	0.000000	0.000000	0.00
1	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
2	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
3	0.033333	0.033333	0.000000	0.000000	0.000000	0.00
4	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
5	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
6	0.000000	0.000000	0.000000	0.034483	0.000000	0.00
7	0.000000	0.000000	0.000000	0.000000	0.000000	0.05
8	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
9	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
10	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
11	0.000000	0.000000	0.000000	0.111111	0.000000	0.00
12	0.000000	0.000000	0.043478	0.043478	0.043478	0.00
13	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
14	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
15	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
16	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
17	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
18	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
19	0.000000	0.000000	0.000000	0.000000	0.000000	0.00

	Electronics Store	Falafel Restaurant	Farmers Market \
0	0.000000	0.033333	0.000000
1	0.000000	0.000000	0.000000
2	0.000000	0.000000	0.000000
3	0.033333	0.000000	0.000000
4	0.000000	0.000000	0.000000
5	0.000000	0.000000	0.000000
6	0.000000	0.000000	0.000000
7	0.000000	0.000000	0.000000
8	0.000000	0.000000	0.000000
9	0.000000	0.000000	0.000000
10	0.000000	0.000000	0.000000
11	0.000000	0.000000	0.000000
12	0.000000	0.000000	0.000000
13	0.033333	0.000000	0.000000
14	0.000000	0.000000	0.000000
15	0.000000	0.000000	0.033333
16	0.000000	0.000000	0.000000
17	0.000000	0.000000	0.000000
18	0.000000	0.000000	0.000000

19	0.000000	0.000000	0.000000

	Fast Food Restaurant	Fish Market	Flea Market	Food & Drink Shop \
0	0.000000	0.000000	0.033333	0.000000
1	0.000000	0.000000	0.000000	0.000000
2	0.000000	0.000000	0.000000	0.066667
3	0.000000	0.000000	0.000000	0.000000
4	0.033333	0.033333	0.000000	0.000000
5	0.000000	0.000000	0.000000	0.000000
6	0.000000	0.000000	0.000000	0.000000
7	0.050000	0.000000	0.000000	0.000000
8	0.000000	0.000000	0.000000	0.000000
9	0.000000	0.000000	0.000000	0.000000
10	0.000000	0.000000	0.000000	0.000000
11	0.000000	0.000000	0.000000	0.111111
12	0.000000	0.000000	0.000000	0.000000
13	0.000000	0.000000	0.000000	0.000000
14	0.000000	0.000000	0.000000	0.000000
15	0.000000	0.000000	0.000000	0.000000
16	0.055556	0.000000	0.000000	0.000000
17	0.000000	0.000000	0.000000	0.000000
18	0.000000	0.000000	0.000000	0.000000
19	0.000000	0.000000	0.000000	0.000000

	Food Truck	French Restaurant	Fried Chicken Joint	Frozen Yogurt Shop \
0	0.000000	0.000000	0.000000	0.000000
1	0.000000	0.000000	0.000000	0.000000
2	0.000000	0.000000	0.000000	0.000000
3	0.000000	0.033333	0.000000	0.000000
4	0.000000	0.000000	0.033333	0.000000
5	0.000000	0.000000	0.000000	0.000000
6	0.000000	0.000000	0.000000	0.000000
7	0.000000	0.000000	0.000000	0.000000
8	0.000000	0.000000	0.000000	0.000000
9	0.000000	0.000000	0.000000	0.000000
10	0.000000	0.000000	0.000000	0.000000
11	0.000000	0.000000	0.000000	0.000000
12	0.000000	0.000000	0.000000	0.000000
13	0.000000	0.000000	0.000000	0.000000
14	0.000000	0.000000	0.000000	0.000000
15	0.000000	0.000000	0.000000	0.033333
16	0.000000	0.000000	0.000000	0.000000
17	0.000000	0.000000	0.000000	0.000000
18	0.111111	0.000000	0.000000	0.000000
19	0.000000	0.000000	0.000000	0.000000

Furniture / Home Store   Garden   Gastropub   Gourmet Shop   Grocery Store \

0	0.000000	0.000000	0.033333	0.000000	0.066667
1	0.000000	0.000000	0.033333	0.000000	0.033333
2	0.000000	0.000000	0.000000	0.000000	0.066667
3	0.000000	0.000000	0.000000	0.066667	0.000000
4	0.033333	0.000000	0.033333	0.000000	0.033333
5	0.000000	0.000000	0.000000	0.000000	0.000000
6	0.000000	0.000000	0.068966	0.000000	0.000000
7	0.000000	0.000000	0.000000	0.000000	0.000000
8	0.000000	0.000000	0.000000	0.000000	0.375000
9	0.000000	0.000000	0.000000	0.000000	0.000000
10	0.000000	0.000000	0.000000	0.000000	0.000000
11	0.000000	0.000000	0.000000	0.000000	0.000000
12	0.000000	0.086957	0.000000	0.000000	0.043478
13	0.033333	0.000000	0.000000	0.000000	0.000000
14	0.000000	0.000000	0.000000	0.000000	0.000000
15	0.000000	0.000000	0.000000	0.000000	0.066667
16	0.000000	0.000000	0.055556	0.000000	0.055556
17	0.000000	0.000000	0.000000	0.000000	0.000000
18	0.000000	0.000000	0.000000	0.000000	0.111111
19	0.000000	0.000000	0.000000	0.000000	0.000000

	Gym	Gym / Fitness Center	Health & Beauty Service \
0	0.000000	0.033333	0.000000
1	0.000000	0.000000	0.000000
2	0.000000	0.000000	0.000000
3	0.033333	0.000000	0.000000
4	0.000000	0.000000	0.033333
5	0.000000	0.000000	0.000000
6	0.000000	0.034483	0.000000
7	0.000000	0.000000	0.000000
8	0.000000	0.000000	0.000000
9	0.000000	0.000000	0.000000
10	0.000000	0.000000	0.000000
11	0.111111	0.000000	0.000000
12	0.043478	0.000000	0.000000
13	0.000000	0.000000	0.000000
14	0.142857	0.000000	0.000000
15	0.033333	0.000000	0.000000
16	0.000000	0.000000	0.000000
17	0.000000	0.000000	0.000000
18	0.000000	0.000000	0.000000
19	0.000000	0.000000	0.000000

	Himalayan Restaurant	Historic Site	Hostel	Hotel	Ice Cream Shop \
0	0.000000	0.000000	0.0	0.000000	0.033333
1	0.033333	0.000000	0.0	0.233333	0.000000
2	0.000000	0.000000	0.0	0.066667	0.000000

3	0.000000	0.033333	0.1	0.033333	0.033333
4	0.000000	0.000000	0.0	0.000000	0.000000
5	0.000000	0.000000	0.0	0.000000	0.000000
6	0.000000	0.000000	0.0	0.034483	0.034483
7	0.000000	0.000000	0.0	0.000000	0.000000
8	0.000000	0.000000	0.0	0.000000	0.000000
9	0.000000	0.000000	0.0	0.000000	0.000000
10	0.000000	0.000000	0.0	0.000000	0.062500
11	0.000000	0.000000	0.0	0.000000	0.000000
12	0.000000	0.000000	0.0	0.000000	0.043478
13	0.000000	0.000000	0.0	0.033333	0.033333
14	0.000000	0.000000	0.0	0.000000	0.000000
15	0.000000	0.000000	0.0	0.033333	0.000000
16	0.000000	0.000000	0.0	0.000000	0.000000
17	0.000000	0.000000	0.0	0.000000	0.000000
18	0.000000	0.000000	0.0	0.000000	0.000000
19	0.000000	0.000000	0.0	0.000000	0.000000

	Indian Restaurant	Italian Restaurant	Japanese Restaurant	Jazz Club \
0	0.000000	0.000000	0.000000	0.000000
1	0.000000	0.000000	0.033333	0.000000
2	0.000000	0.000000	0.000000	0.000000
3	0.000000	0.000000	0.000000	0.000000
4	0.033333	0.000000	0.000000	0.000000
5	0.000000	0.000000	0.033333	0.000000
6	0.000000	0.000000	0.000000	0.000000
7	0.000000	0.000000	0.000000	0.000000
8	0.000000	0.000000	0.000000	0.000000
9	0.000000	0.000000	0.000000	0.000000
10	0.000000	0.000000	0.000000	0.000000
11	0.000000	0.000000	0.000000	0.000000
12	0.000000	0.000000	0.000000	0.043478
13	0.033333	0.033333	0.000000	0.000000
14	0.000000	0.000000	0.000000	0.000000
15	0.000000	0.000000	0.000000	0.000000
16	0.000000	0.000000	0.000000	0.000000
17	0.000000	0.000000	0.000000	0.000000
18	0.000000	0.000000	0.000000	0.000000
19	0.000000	0.000000	0.000000	0.000000

	Juice Bar	Korean Restaurant	Lounge	Market \
0	0.000000	0.033333	0.000000	0.033333
1	0.000000	0.000000	0.000000	0.000000
2	0.000000	0.000000	0.000000	0.000000
3	0.000000	0.000000	0.000000	0.033333
4	0.000000	0.000000	0.000000	0.033333
5	0.000000	0.000000	0.000000	0.033333

6	0.000000	0.000000	0.000000	0.000000
7	0.000000	0.000000	0.000000	0.000000
8	0.000000	0.000000	0.000000	0.000000
9	0.000000	0.000000	0.000000	0.000000
10	0.000000	0.000000	0.000000	0.000000
11	0.000000	0.000000	0.000000	0.000000
12	0.000000	0.000000	0.000000	0.000000
13	0.033333	0.000000	0.033333	0.000000
14	0.000000	0.000000	0.000000	0.000000
15	0.000000	0.000000	0.000000	0.000000
16	0.000000	0.000000	0.000000	0.000000
17	0.000000	0.000000	0.000000	0.000000
18	0.000000	0.000000	0.000000	0.000000
19	0.000000	0.000000	0.000000	0.000000

	Mediterranean Restaurant	Metro Station	Mexican Restaurant \
0	0.033333	0.000000	0.000000
1	0.000000	0.000000	0.033333
2	0.000000	0.066667	0.000000
3	0.000000	0.000000	0.033333
4	0.033333	0.000000	0.000000
5	0.033333	0.000000	0.000000
6	0.000000	0.000000	0.000000
7	0.000000	0.050000	0.000000
8	0.000000	0.000000	0.000000
9	0.000000	0.000000	0.000000
10	0.000000	0.062500	0.000000
11	0.000000	0.000000	0.000000
12	0.043478	0.000000	0.043478
13	0.033333	0.000000	0.066667
14	0.000000	0.000000	0.000000
15	0.000000	0.000000	0.000000
16	0.000000	0.000000	0.000000
17	1.000000	0.000000	0.000000
18	0.000000	0.111111	0.000000
19	0.000000	0.000000	0.000000

	Motorcycle Shop	Movie Theater	Multiplex	Museum	Music Venue \
0	0.000000	0.033333	0.000000	0.033333	0.000000
1	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.000000	0.000000	0.000000	0.000000	0.000000
3	0.000000	0.000000	0.000000	0.000000	0.000000
4	0.000000	0.000000	0.000000	0.000000	0.000000
5	0.033333	0.000000	0.033333	0.000000	0.000000
6	0.000000	0.000000	0.000000	0.000000	0.034483
7	0.000000	0.000000	0.000000	0.000000	0.000000
8	0.000000	0.000000	0.000000	0.000000	0.000000

9	0.000000	0.000000	0.000000	0.000000	0.000000
10	0.000000	0.000000	0.000000	0.000000	0.000000
11	0.000000	0.000000	0.000000	0.000000	0.000000
12	0.000000	0.000000	0.000000	0.000000	0.000000
13	0.000000	0.000000	0.000000	0.000000	0.000000
14	0.000000	0.000000	0.000000	0.000000	0.000000
15	0.033333	0.000000	0.000000	0.000000	0.033333
16	0.000000	0.000000	0.000000	0.000000	0.000000
17	0.000000	0.000000	0.000000	0.000000	0.000000
18	0.000000	0.000000	0.000000	0.000000	0.000000
19	0.000000	0.000000	0.000000	0.000000	0.000000

	Neighborhood	Nightclub	Noodle House	Opera House	Park	Pastry Shop \
0	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
1	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
3	0.000000	0.000000	0.000000	0.033333	0.000000	0.066667
4	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
5	0.033333	0.000000	0.000000	0.000000	0.000000	0.000000
6	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
7	0.000000	0.000000	0.000000	0.000000	0.100000	0.000000
8	0.000000	0.000000	0.000000	0.000000	0.125000	0.000000
9	0.000000	0.000000	0.000000	0.000000	0.333333	0.000000
10	0.000000	0.062500	0.000000	0.000000	0.062500	0.000000
11	0.000000	0.000000	0.000000	0.000000	0.222222	0.000000
12	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
13	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
14	0.000000	0.000000	0.000000	0.000000	0.142857	0.000000
15	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
16	0.000000	0.055556	0.055556	0.000000	0.000000	0.000000
17	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
18	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
19	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000

	Perfume Shop	Pharmacy	Pizza Place	Plaza	Pool	Pub \
0	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000
1	0.000000	0.000000	0.033333	0.033333	0.000000	0.0000
2	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000
3	0.000000	0.000000	0.000000	0.100000	0.000000	0.0000
4	0.000000	0.000000	0.000000	0.033333	0.000000	0.0000
5	0.000000	0.000000	0.000000	0.066667	0.000000	0.0000
6	0.000000	0.034483	0.068966	0.000000	0.000000	0.0000
7	0.000000	0.050000	0.050000	0.050000	0.000000	0.0000
8	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000
9	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000
10	0.000000	0.000000	0.062500	0.187500	0.000000	0.0625
11	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000

12	0.000000	0.000000	0.043478	0.043478	0.000000	0.0000
13	0.033333	0.000000	0.000000	0.033333	0.000000	0.0000
14	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000
15	0.000000	0.000000	0.033333	0.000000	0.000000	0.0000
16	0.000000	0.000000	0.000000	0.000000	0.055556	0.0000
17	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000
18	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000
19	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000

	Ramen Restaurant	Resort	Restaurant	Rock Club	Sandwich Place \
0	0.000000	0.000000	0.066667	0.000000	0.033333
1	0.000000	0.000000	0.066667	0.000000	0.033333
2	0.000000	0.000000	0.133333	0.000000	0.000000
3	0.000000	0.000000	0.033333	0.033333	0.000000
4	0.000000	0.000000	0.133333	0.000000	0.000000
5	0.000000	0.000000	0.033333	0.000000	0.000000
6	0.000000	0.000000	0.068966	0.000000	0.000000
7	0.000000	0.000000	0.000000	0.000000	0.050000
8	0.000000	0.000000	0.125000	0.000000	0.000000
9	0.000000	0.000000	0.000000	0.000000	0.000000
10	0.000000	0.000000	0.000000	0.000000	0.000000
11	0.000000	0.000000	0.000000	0.000000	0.000000
12	0.000000	0.000000	0.000000	0.000000	0.000000
13	0.033333	0.000000	0.100000	0.000000	0.000000
14	0.000000	0.000000	0.142857	0.000000	0.000000
15	0.000000	0.033333	0.066667	0.000000	0.000000
16	0.000000	0.000000	0.055556	0.000000	0.000000
17	0.000000	0.000000	0.000000	0.000000	0.000000
18	0.000000	0.000000	0.000000	0.000000	0.000000
19	0.000000	0.000000	0.000000	0.000000	0.000000

	Science Museum	Seafood Restaurant	Shopping Mall	Snack Place \
0	0.033333	0.000000	0.000000	0.000000
1	0.000000	0.000000	0.000000	0.000000
2	0.000000	0.000000	0.000000	0.000000
3	0.000000	0.033333	0.000000	0.000000
4	0.000000	0.033333	0.000000	0.000000
5	0.000000	0.000000	0.000000	0.000000
6	0.000000	0.000000	0.034483	0.034483
7	0.000000	0.000000	0.000000	0.000000
8	0.000000	0.000000	0.000000	0.000000
9	0.000000	0.000000	0.000000	0.000000
10	0.000000	0.000000	0.000000	0.000000
11	0.000000	0.000000	0.000000	0.000000
12	0.000000	0.000000	0.000000	0.000000
13	0.000000	0.000000	0.000000	0.000000
14	0.000000	0.285714	0.000000	0.000000

	0.000000	0.033333	0.000000	0.000000
15	0.000000	0.033333	0.000000	0.000000
16	0.000000	0.111111	0.000000	0.000000
17	0.000000	0.000000	0.000000	0.000000
18	0.000000	0.000000	0.000000	0.000000
19	0.000000	0.000000	0.000000	0.000000

	Soccer Field	Spanish Restaurant	Steakhouse	Student Center	Supermarket \\
0	0.000000	0.000000	0.000000	0.000	0.000000
1	0.000000	0.133333	0.000000	0.000	0.000000
2	0.000000	0.133333	0.000000	0.000	0.066667
3	0.000000	0.000000	0.000000	0.000	0.000000
4	0.000000	0.133333	0.033333	0.000	0.066667
5	0.000000	0.066667	0.000000	0.000	0.033333
6	0.000000	0.137931	0.000000	0.000	0.068966
7	0.000000	0.150000	0.000000	0.000	0.100000
8	0.000000	0.000000	0.000000	0.125	0.125000
9	0.000000	0.000000	0.000000	0.000	0.000000
10	0.000000	0.000000	0.000000	0.000	0.062500
11	0.000000	0.111111	0.000000	0.000	0.000000
12	0.000000	0.217391	0.000000	0.000	0.086957
13	0.000000	0.066667	0.000000	0.000	0.000000
14	0.142857	0.000000	0.000000	0.000	0.142857
15	0.000000	0.166667	0.000000	0.000	0.000000
16	0.000000	0.055556	0.000000	0.000	0.000000
17	0.000000	0.000000	0.000000	0.000	0.000000
18	0.000000	0.000000	0.000000	0.000	0.111111
19	0.000000	0.333333	0.000000	0.000	0.000000

	Sushi Restaurant	Tapas Restaurant	Theater	Thrift / Vintage Store \\
0	0.000000	0.133333	0.000000	0.000000
1	0.000000	0.066667	0.000000	0.000000
2	0.000000	0.200000	0.000000	0.000000
3	0.000000	0.033333	0.000000	0.000000
4	0.033333	0.033333	0.000000	0.000000
5	0.000000	0.166667	0.066667	0.000000
6	0.000000	0.034483	0.000000	0.000000
7	0.000000	0.050000	0.000000	0.000000
8	0.000000	0.000000	0.000000	0.000000
9	0.000000	0.000000	0.000000	0.000000
10	0.062500	0.000000	0.000000	0.000000
11	0.000000	0.111111	0.000000	0.000000
12	0.000000	0.043478	0.000000	0.000000
13	0.000000	0.066667	0.000000	0.033333
14	0.000000	0.000000	0.000000	0.000000
15	0.033333	0.000000	0.000000	0.000000
16	0.000000	0.000000	0.055556	0.000000
17	0.000000	0.000000	0.000000	0.000000

```
18           0.000000          0.333333  0.000000              0.000000
19           0.000000          0.000000  0.000000              0.000000

    Trade School   Wine Bar   Wine Shop   Women's Store
0       0.033333   0.000000    0.000000        0.000000
1       0.000000   0.033333    0.000000        0.000000
2       0.000000   0.000000    0.000000        0.000000
3       0.000000   0.000000    0.000000        0.000000
4       0.000000   0.000000    0.000000        0.000000
5       0.000000   0.000000    0.000000        0.000000
6       0.000000   0.000000    0.000000        0.000000
7       0.000000   0.000000    0.000000        0.000000
8       0.000000   0.000000    0.000000        0.000000
9       0.000000   0.000000    0.000000        0.000000
10      0.000000   0.000000    0.000000        0.000000
11      0.000000   0.000000    0.000000        0.000000
12      0.000000   0.000000    0.000000        0.000000
13      0.000000   0.000000    0.033333        0.033333
14      0.000000   0.000000    0.000000        0.000000
15      0.000000   0.000000    0.000000        0.000000
16      0.000000   0.000000    0.000000        0.000000
17      0.000000   0.000000    0.000000        0.000000
18      0.000000   0.000000    0.000000        0.000000
19      0.000000   0.000000    0.000000        0.000000
```

0.0.10 Let's print each neighborhood along with the top 3 most common venues and put that into a pandas dataframe

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

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

```python
[11]: num_top_venues = 3

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

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

      # create a new dataframe
```

```
neighbourhoods_venues_sorted = pd.DataFrame(columns=columns)
neighbourhoods_venues_sorted['Neighbourhood'] = madrid_grouped['Neighbourhood']

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

neighbourhoods_venues_sorted
```

[11]:

	Neighbourhood	1st Most Common Venue
0	Arganzuela, Madrid	Tapas Restaurant
1	Barajas, Madrid	Hotel
2	Carabanchel, Madrid	Tapas Restaurant
3	Centro, Madrid	Plaza
4	Chamartín, Madrid	Restaurant
5	Chamberí, Madrid	Tapas Restaurant
6	Ciudad Lineal, Madrid	Spanish Restaurant
7	Hortaleza, Madrid	Spanish Restaurant
8	Latina, Madrid	Grocery Store
9	Moncloa-Aravaca, Madrid	Castle
10	Moratalaz, Madrid	Plaza
11	Puente de Vallecas, Madrid	Park
12	Retiro, Madrid	Spanish Restaurant
13	Salamanca, Madrid	Restaurant
14	San Blas-Canillejas, Madrid	Seafood Restaurant
15	Tetuán, Madrid	Spanish Restaurant
16	Usera, Madrid	Chinese Restaurant
17	Vicálvaro, Madrid	Mediterranean Restaurant
18	Villa de Vallecas, Madrid	Tapas Restaurant
19	Villaverde, Madrid	Convenience Store

	2nd Most Common Venue	3rd Most Common Venue
0	Grocery Store	Bakery
1	Spanish Restaurant	Argentinian Restaurant
2	Restaurant	Spanish Restaurant
3	Hostel	Bookstore
4	Spanish Restaurant	Supermarket
5	Bar	Theater
6	Restaurant	Gastropub
7	Park	Supermarket
8	Supermarket	Park
9	Bus Stop	Park
10	Bar	Park
11	Spanish Restaurant	Gym
12	Garden	Supermarket
13	Bakery	Mexican Restaurant
14	Park	Supermarket

20

```
15   Brazilian Restaurant              Grocery Store
16    Seafood Restaurant               Grocery Store
17          Women's Store      Gym / Fitness Center
18          Grocery Store               Metro Station
19     Spanish Restaurant               Breakfast Spot
```

[12]:
```
df_filtered = neighbourhoods_venues_sorted.filter(items=['Neighbourhood', '1st␣
 ↪Most Common Venue'])
df_filtered = df_filtered.loc[(df_filtered['1st Most Common Venue'] == 'Spanish␣
 ↪Restaurant')]
df_filtered.reset_index(inplace=True, drop = True)
df_filtered
```

[12]:
```
            Neighbourhood 1st Most Common Venue
0  Ciudad Lineal, Madrid    Spanish Restaurant
1      Hortaleza, Madrid    Spanish Restaurant
2         Retiro, Madrid    Spanish Restaurant
3         Tetuán, Madrid    Spanish Restaurant
```

0.0.11 Conclusion

Once we have obtained the list of neighborhoods, we can recommend one of these to open a local with typical national food or, better said: "Spanish Restaurant". The reason for recommending opening a business of this type in neighborhoods with more of this type of business is that it can be very touristy or gastronomic areas and therefore a greater possibility of having more clients. So we can recommend opening a "Spanish Restaurant" in the following neighborhoods:

[13]:
```
df_filtered[['Neighbourhood']]
```

[13]:
```
            Neighbourhood
0  Ciudad Lineal, Madrid
1      Hortaleza, Madrid
2         Retiro, Madrid
3         Tetuán, Madrid
```