

# Segmenting and Clustering Neighborhoods in Paris

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## My project description

In my Capstone project I want to study the different tourist places by neighborhood of Paris, the city of lights. Study the different small activities around each tourist place such as restaurants, libraries, etc. Also study the correlation between the population by neighborhood and the number of restaurants and their type.

## Data source

To do this project, I retrieve the data from the opendata site <https://opendata.paris.fr/page/home/> (<https://opendata.paris.fr/page/home/>), by doing web scraping with beautifulsoup, or downloading the data in a csv file or using the restful API.

Collecting bs4

Downloading <https://files.pythonhosted.org/packages/10/ed/7e8b97591f6f456174139ec089c769f89a94a1a4025fe967691de971f314/bs4-0.0.1.tar.gz>

Collecting beautifulsoup4 (from bs4)

Downloading <https://files.pythonhosted.org/packages/cb/a1/c698cf319e9cfed6b17376281bd0efc6bfc8465698f54170ef60a485ab5d/beautifulsoup4-4.8.2-py3-none-any.whl> (106kB)

|██| 112kB 29.8M

B/s eta 0:00:01

Collecting soupsieve>=1.2 (from beautifulsoup4->bs4)

Downloading <https://files.pythonhosted.org/packages/05/cf/ea245e52f55823f19992447b008bcbb7f78efc5960d77f6c34b5b45b36dd/soupsieve-2.0-py2.py3-none-any.whl>

Building wheels for collected packages: bs4

Building wheel for bs4 (setup.py) ... done

Stored in directory: /home/jupyterlab/.cache/pip/wheels/a0/b0/b2/4f80b9456b87abedbc0bf2d52235414c3467d8889be38dd472

Successfully built bs4

Installing collected packages: soupsieve, beautifulsoup4, bs4

Successfully installed beautifulsoup4-4.8.2 bs4-0.0.1 soupsieve-2.0

Collecting lxml

Downloading [https://files.pythonhosted.org/packages/dd/ba/a0e6866057fc0bbd17192925c1d63a3b85cf522965de9bc02364d08e5b84/lxml-4.5.0-cp36-cp36m-manylinux1\\_x86\\_64.whl](https://files.pythonhosted.org/packages/dd/ba/a0e6866057fc0bbd17192925c1d63a3b85cf522965de9bc02364d08e5b84/lxml-4.5.0-cp36-cp36m-manylinux1_x86_64.whl) (5.8MB)

|██| 5.8MB 6.2MB/s

eta 0:00:01

Installing collected packages: lxml

Successfully installed lxml-4.5.0

--2020-02-28 07:39:16-- [https://opendata.paris.fr/explore/dataset/quartier\\_paris/download?format=csv](https://opendata.paris.fr/explore/dataset/quartier_paris/download?format=csv)

Resolving opendata.paris.fr (opendata.paris.fr)... 34.249.199.226, 34.248.20.69

Connecting to opendata.paris.fr (opendata.paris.fr)|34.249.199.226|:443... connected.

HTTP request sent, awaiting response... 200 OK

Length: unspecified [application/csv]

Saving to: 'paris\_quartiers.csv'

paris\_quartiers.csv [ <=> ] 340.17K 779KB/s in 0.4s

2020-02-28 07:39:17 (779 KB/s) - 'paris\_quartiers.csv' saved [348339]

	n_sq_qu	c_qu	c_quinsee	l_qu	c_ar	n_sq_ar	
0	750000021	21	7510601	Monnaie	6	750000006	2
1	750000022	22	7510602	Odéon	6	750000006	3
2	750000029	29	7510801	Champs-Elysées	8	750000008	5
3	750000051	51	7511303	Maison-Blanche	13	750000013	6
4	750000052	52	7511304	Croulebarbe	13	750000013	3

## Data analylis and cleaning data for using it

	Borough	Neighbourhood	Code	Latitude	Longitude
0	6	Monnaie	75106	48.854384	2.340035
1	6	Odéon	75106	48.847801	2.336339
2	8	Champs-Elysées	75108	48.867074	2.308652
3	13	Maison-Blanche	75113	48.823128	2.352433
4	13	Croulebarbe	75113	48.833734	2.347673

## Load data of paris's borough population

	index	Borough	Superficie	Population	Density
<b>0</b>	1	1	183	17100	93
<b>1</b>	2	2	99	22390	227
<b>2</b>	3	3	117	35991	307
<b>3</b>	4	4	160	27769	173
<b>4</b>	5	5	254	60179	236
<b>5</b>	6	6	215	43224	201
<b>6</b>	7	7	409	57092	139
<b>7</b>	8	8	388	38749	99
<b>8</b>	9	9	218	59474	272
<b>9</b>	10	10	289	94474	326
<b>10</b>	11	11	367	155006	422
<b>11</b>	12	12	637	144925	227
<b>12</b>	13	13	715	182386	255
<b>13</b>	14	14	564	141102	250
<b>14</b>	15	15	848	238190	280
<b>15</b>	16	16	791	167613	211
<b>16</b>	17	17	567	170156	300
<b>17</b>	18	18	601	201374	335
<b>18</b>	19	19	679	186116	274
<b>19</b>	20	20	598	197311	329

## Displaying Paris's Map

Solving environment: done

```
==> WARNING: A newer version of conda exists. <==
current version: 4.5.11
latest version: 4.8.2
```

Please update conda by running

```
$ conda update -n base -c defaults conda
```

## Package Plan ##

environment location: /home/jupyterlab/conda/envs/python

```
added / updated specs:
- folium=0.5.0
```

The following packages will be downloaded:

package	build
certifi-2019.11.28	py36_0
149 KB conda-forge	
scikit-learn-0.20.1	py36h22eb022_0
5.7 MB	
liblapack-3.8.0	11_openblas
10 KB conda-forge	
numpy-1.18.1	py36h95a1406_0
5.2 MB conda-forge	
liblapacke-3.8.0	11_openblas
10 KB conda-forge	
libopenblas-0.3.6	h5a2b251_2
7.7 MB	
scipy-1.4.1	py36h921218d_0
18.9 MB conda-forge	
libcblas-3.8.0	11_openblas
10 KB conda-forge	
libblas-3.8.0	11_openblas
10 KB conda-forge	
blas-2.11	openblas
10 KB conda-forge	
-----	
-----	
Total:	
37.8 MB	

The following NEW packages will be INSTALLED:

```
libblas:      3.8.0-11_openblas
conda-forge
libcblas:     3.8.0-11_openblas
conda-forge
liblapack:    3.8.0-11_openblas
conda-forge
liblapacke:   3.8.0-11_openblas
```

```
conda-forge
  libopenblas: 0.3.6-h5a2b251_2
```

The following packages will be UPDATED:

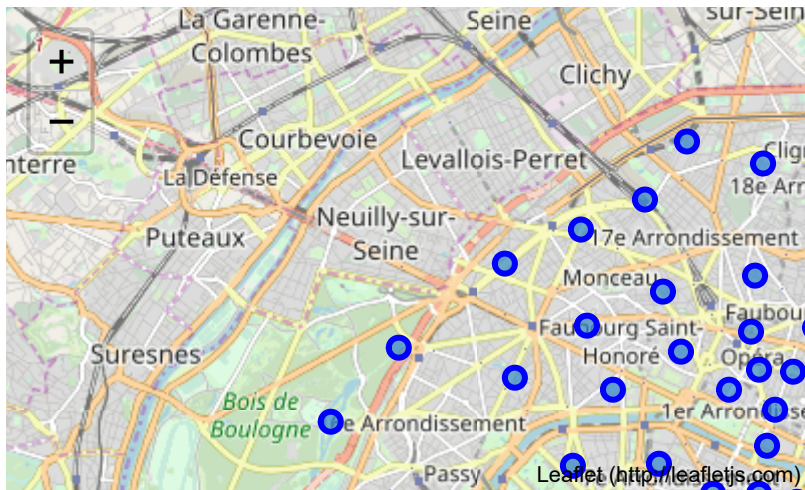
```
blas: 1.1-openblas
conda-forge --> 2.11-openblas conda-forge
certifi: 2019.9.11-py36_0
conda-forge --> 2019.11.28-py36_0 conda-forge
numpy: 1.16.2-py36_blas_openblash1522bff_0
conda-forge [blas_openblas] --> 1.18.1-py36h95a1406_0 conda-forge
scipy: 1.2.1-py36_blas_openblash1522bff_0
conda-forge [blas_openblas] --> 1.4.1-py36h921218d_0
conda-forge
```

The following packages will be DOWNGRADED:

```
scikit-learn: 0.20.1-py36_blas_openblashebf5e3_1200
conda-forge [blas_openblas] --> 0.20.1-py36h22eb022_0
```

#### Downloading and Extracting Packages

```
certifi-2019.11.28 | 149 KB | #####
##### | 100%
scikit-learn-0.20.1 | 5.7 MB | #####
##### | 100%
liblapack-3.8.0 | 10 KB | #####
##### | 100%
numpy-1.18.1 | 5.2 MB | #####
##### | 100%
liblapacke-3.8.0 | 10 KB | #####
##### | 100%
libopenblas-0.3.6 | 7.7 MB | #####
##### | 100%
scipy-1.4.1 | 18.9 MB | #####
##### | 100%
libcbblas-3.8.0 | 10 KB | #####
##### | 100%
libblas-3.8.0 | 10 KB | #####
##### | 100%
blas-2.11 | 10 KB | #####
##### | 100%
Preparing transaction: done
Verifying transaction: done
Executing transaction: done
```



## Using Foursquare data to load Paris's venues

Set credentials

Your credentials:

```
CLIENT_ID: AAXS11JUTRNPPC4LYAQYLTGYUAH13CIHKHXHJEQJ
Y4ERUDM
CLIENT_SECRET: 0QDSFHVBM3Z1DPVSSWXMCESYJNHNPJMR40JU
GZV3IFNDC0
```

Infos for the first dataframe's rows

Latitude and longitude values of Monnaie are 48.8543844036, 2.34003537113.

Build Foursquare URL with geo coordinates

Load data from Foursquare

Display result keys in json file

```
dict_keys(['type', 'name', 'items'])
```

Function that extracts the category of the venue

Normalizing json of venues

	name	categories	lat	lng
0	Prescription Cocktail Club	Cocktail Bar	48.854921	2.337768
1	Chez Nous	Wine Bar	48.855823	2.340271
2	Maison Sauvage	French Restaurant	48.853744	2.337993
3	Chez Le Libanais	Lebanese Restaurant	48.853285	2.341673
4	Ze Kitchen Galerie	Restaurant	48.855101	2.341297

### List of Categories

```
array(['Cocktail Bar', 'Wine Bar', 'French Restaurant',
      'Lebanese Restaurant', 'Restaurant', 'Breton Restaurant', 'Hotel',
      'Bookstore', 'Ice Cream Shop', 'Hotel Bar', 'Japanese Restaurant',
      'Sandwich Place', 'Italian Restaurant', 'Modern European Restaurant', 'Seafood Restaurant',
      'Tapas Restaurant', 'Tea Room', 'Chocolate Shop',
      'Ramen Restaurant', 'Coffee Shop', 'Burger Joint', 'Plaza',
      'Museum', 'Creperie', 'Café', 'Liquor Store', 'Beer Bar', 'Bistro',
      'Spanish Restaurant', 'Gourmet Shop', 'Pub', 'Park',
      'Pedestrian Plaza', 'Fountain', 'Electronics Store', 'Sports Bar',
      'Bar', 'Mexican Restaurant', 'Indie Movie Theater',
      'Asian Restaurant', 'Bakery', 'Clothing Store',
      'Cajun / Creole Restaurant', 'Pastry Shop', 'Brasserie',
      'Pizza Place', 'Juice Bar', 'Candy Store', 'Dessert Shop',
      'Cosmetics Shop'], dtype=object)
```

Number of venues from Foursquare

100 venues were returned by Foursquare.

## Method loading all venues for each neighborhood

## Display data from Foursquare



	Borough	Neighbourhood	Neighbourhood Latitude	Neighbourhood Longitude	
0	6	Monnaie	48.854384	2.340035	Pr
1	6	Monnaie	48.854384	2.340035	Cl
2	6	Monnaie	48.854384	2.340035	
3	6	Monnaie	48.854384	2.340035	
4	6	Monnaie	48.854384	2.340035	Z

Grouping by neighborhood

	Borough	Neighbourhood Latitude	Neighbourhood Longitude	\
Neighbourhood				
Amérique	16	16	16	
Archives	100	100	100	
Arsenal	74	74	74	
Arts-et-Métiers	100	100	100	
Auteuil	14	14	14	
Batignolles	100	100	100	
Bel-Air	5	5	5	
Belleville	41	41	41	
Bercy	70	70	70	
Bonne- Nouvelle	100	100	100	
Chaillot	100	100	100	
Champs- Elysées	100	100	100	
Charonne	29	29	29	
Chaussée- d'Antin	100	100	100	
Clignancourt	62	62	62	
Combat	34	34	34	
Croulebarbe	48	48	48	
Ecole-Militaire	21	21	21	
Enfants- Rouges	100	100	100	
Epinettes	24	24	24	
Europe	67	67	67	
Faubourg- Montmartre	100	100	100	
Faubourg-du- Roule	100	100	100	
Folie-Méricourt	100	100	100	
Gaillon	100	100	100	
Gare	49	49	49	
Goutte-d'Or	28	28	28	
Grandes- Carrières	56	56	56	
Grenelle	46	46	46	
Gros-Caillou	100	100	100	
Halles	100	100	100	
Hôpital-Saint- Louis	100	100	100	

	Borough	Neighbourhood Latitude	Neighbourhood Longitude	\
Neighbourhood				
Invalides	52	52	52	
Jardin-des-Plantes	64	64	64	
Javel	34	34	34	
La Chapelle	17	17	17	
Madeleine	100	100	100	
Mail	100	100	100	
Maison-Blanche	31	31	31	
Monnaie	100	100	100	
Montparnasse	85	85	85	
Muette	7	7	7	
Necker	50	50	50	
Notre-Dame	97	97	97	
Notre-Dame-des-Champs	100	100	100	
Odéon	80	80	80	
Palais-Royal	100	100	100	
Parc-de-Montsouris	20	20	20	
Petit-Montrouge	69	69	69	
Picpus	3	3	3	
Place-Vendôme	100	100	100	
Plaine de Monceaux	67	67	67	
Plaisance	40	40	40	
Pont-de-Flandre	59	59	59	
Porte-Dauphine	11	11	11	
Porte-Saint-Denis	100	100	100	
Porte-Saint-Martin	96	96	96	
Père-Lachaise	43	43	43	
Quinze-Vingts	86	86	86	
Rochechouart	96	96	96	
Roquette	89	89	89	
Saint-Ambroise	86	86	86	
Saint-Fargeau	14	14	14	
Saint-Georges	96	96	96	

	Borough	Neighbourhood Latitude	Neighbourhood Longitude	\
Neighbourhood				
<b>Saint-Germain-des-Prés</b>	100	100	100	
<b>Saint-Germain-l'Auxerrois</b>	88	88	88	
<b>Saint-Gervais</b>	100	100	100	
<b>Saint-Lambert</b>	61	61	61	
<b>Saint-Merri</b>	100	100	100	
<b>Saint-Thomas-d'Aquin</b>	88	88	88	
<b>Saint-Victor</b>	100	100	100	
<b>Saint-Vincent-de-Paul</b>	36	36	36	
<b>Sainte-Avoie</b>	100	100	100	
<b>Sainte-Marguerite</b>	41	41	41	
<b>Salpêtrière</b>	18	18	18	
<b>Sorbonne</b>	100	100	100	
<b>Ternes</b>	68	68	68	
<b>Val-de-Grâce</b>	49	49	49	
<b>Villeite</b>	58	58	58	
<b>Vivienne</b>	100	100	100	

## Correlation between number venus and population by borough

Venue' number by Borough

	Borough	Venue
<b>0</b>	1	388
<b>1</b>	10	332
<b>2</b>	11	316
<b>3</b>	12	164
<b>4</b>	13	146

Join number of venues to population by Borough

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 20 entries, 0 to 19
Data columns (total 3 columns):
Borough      20 non-null object
Population   20 non-null int64
Nb-of-Venues 20 non-null int64
dtypes: int64(2), object(1)
memory usage: 640.0+ bytes
```

Calcul the correlation between number of venues and population by borough

	Population	Nb-of-Venues
Population	1.000000	-0.879811
Nb-of-Venues	-0.879811	1.000000

Solving environment: done

```
==> WARNING: A newer version of conda exists. <==
current version: 4.5.11
latest version: 4.8.2
```

Please update conda by running

```
$ conda update -n base -c defaults conda
```

## Package Plan ##

environment location: /home/jupyterlab/conda/envs/python

```
added / updated specs:
- matplotlib
```

The following packages will be downloaded:

package	build
----- -----	
matplotlib-3.1.3	py36_0
21 KB	
scipy-1.4.1	py36habc2bb6_0
18.8 MB	
openssl-1.1.1d	h7b6447c_4
3.7 MB	
numpy-1.18.1	py36h94c655d_0
5 KB	
qt-5.6.3	h8bf5577_3
45.7 MB	
certifi-2019.11.28	py36_0
156 KB	
sip-4.18.1	py36hf484d3e_2
278 KB	
matplotlib-base-3.1.3	py36hef1b27d_0
6.6 MB	
pyqt-5.6.0	py36h22d08a2_6
5.4 MB	
numpy-base-1.18.1	py36h2f8d375_1
5.2 MB	
-----	
-----	
	Total:
86.0 MB	

The following packages will be UPDATED:

```
certifi:          2019.11.28-py36_0    conda-for
ge --> 2019.11.28-py36_0
matplotlib:       2.2.3-py37hb69df0a_0
--> 3.1.3-py36_0
matplotlib-base: 3.1.1-py36hfd891ef_0  conda-for
ge --> 3.1.3-py36hef1b27d_0
numpy:           1.18.1-py36h95a1406_0  conda-for
```

```

ge --> 1.18.1-py36h94c655d_0
      numpy-base:      1.15.1-py37h81de0dd_0
--> 1.18.1-py36h2f8d375_1
      openssl:         1.1.1d-h516909a_0      conda-for
ge --> 1.1.1d-h7b6447c_4
      scipy:           1.4.1-py36h921218d_0    conda-for
ge --> 1.4.1-py36habc2bb6_0

```

The following packages will be DOWNGRADED:

```

      pyqt:            5.9.2-py37h05f1152_2
--> 5.6.0-py36h22d08a2_6
      qt:              5.9.6-h8703b6f_2
--> 5.6.3-h8bf5577_3
      sip:             4.19.8-py37hf484d3e_0
--> 4.18.1-py36hf484d3e_2

```

#### Downloading and Extracting Packages

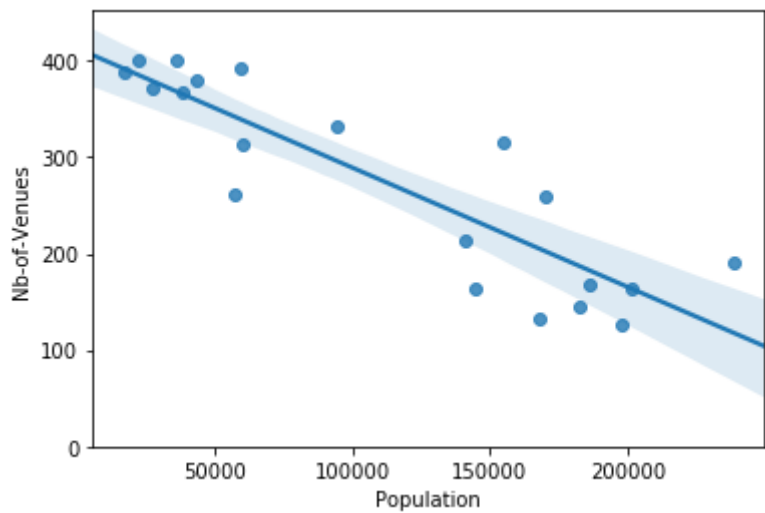
```

matplotlib-3.1.3      | 21 KB      | #####
#####
##### | 100%
scipy-1.4.1           | 18.8 MB    | #####
##### | 100%
openssl-1.1.1d        | 3.7 MB     | #####
##### | 100%
numpy-1.18.1          | 5 KB       | #####
##### | 100%
qt-5.6.3              | 45.7 MB    | #####
##### | 100%
certifi-2019.11.28    | 156 KB     | #####
##### | 100%
sip-4.18.1            | 278 KB     | #####
##### | 100%
matplotlib-base-3.1. | 6.6 MB     | #####
##### | 100%
pyqt-5.6.0            | 5.4 MB     | #####
##### | 100%
numpy-base-1.18.1     | 5.2 MB     | #####
##### | 100%
Preparing transaction: done
Verifying transaction: done
Executing transaction: done

```

	Borough	Population	Nb-of-Venues
0	1	17100	388
1	2	22390	400
2	3	35991	400
3	4	27769	371
4	5	60179	313

(0, 451.6807824606434)



One Hot encoding by "Venue Category"

	Neighbourhood	Accessories Store	Afghan Restaurant	African Restaurant	Alsati Restaura
0	Monnaie	0	0	0	
1	Monnaie	0	0	0	
2	Monnaie	0	0	0	
3	Monnaie	0	0	0	
4	Monnaie	0	0	0	

(5483, 303)

	Neighbourhood	Accessories Store	Afghan Restaurant	African Restaurant	Alsati Restaura
0	Amérique	0.0	0.0	0.0	1.0
1	Archives	0.0	0.0	0.0	1.0
2	Arsenal	0.0	0.0	0.0	1.0
3	Arts-et-Métiers	0.0	0.0	0.0	1.0
4	Auteuil	0.0	0.0	0.0	1.0

(80, 303)



Let's print each neighborhood along with the top 5 most common venues

```

----- Amérique -----
          venue  freq
0      Supermarket  0.12
1          Pool    0.12
2  French Restaurant  0.12
3      Grocery Store  0.06
4  Asian Restaurant  0.06

```

```

----- Archives -----
          venue  freq
0  Clothing Store  0.08
1  French Restaurant  0.07
2      Coffee Shop  0.05
3      Bookstore   0.04
4  Burger Joint   0.04

```

```

----- Arsenal -----
          venue  freq
0  French Restaurant  0.14
1          Hotel    0.11
2  Italian Restaurant  0.05
3          Park    0.04
4      Gastropub   0.04

```

```

----- Arts-et-Métiers -----
          venue  freq
0  French Restaurant  0.09
1          Hotel    0.07
2  Italian Restaurant  0.05
3      Cocktail Bar  0.05
4      Coffee Shop   0.04

```

```

----- Auteuil -----
          venue  freq
0      Tennis Court  0.36
1          Stadium  0.07
2  Outdoors & Recreation  0.07
3          Office   0.07
4  French Restaurant  0.07

```

```

----- Batignolles -----
          venue  freq
0  French Restaurant  0.20
1          Hotel    0.11
2  Italian Restaurant  0.09
3          Bar      0.06
4          Bistro   0.05

```

```

----- Bel-Air -----
          venue  freq
0  Recreation Center  0.2
1          Plaza     0.2
2  French Restaurant  0.2
3      Playground    0.2

```

4 Sports Club 0.2

----- Belleville -----

	venue	freq
0	Bar	0.15
1	French Restaurant	0.12
2	Café	0.07
3	Italian Restaurant	0.05
4	Japanese Restaurant	0.05

----- Bercy -----

	venue	freq
0	Hotel	0.07
1	French Restaurant	0.04
2	Plaza	0.03
3	Bus Stop	0.03
4	Museum	0.03

----- Bonne-Nouvelle -----

	venue	freq
0	Hotel	0.06
1	Cocktail Bar	0.06
2	Wine Bar	0.05
3	French Restaurant	0.05
4	Italian Restaurant	0.04

----- Chaillot -----

	venue	freq
0	Hotel	0.20
1	French Restaurant	0.19
2	Italian Restaurant	0.07
3	Bakery	0.04
4	Café	0.03

----- Champs-Élysées -----

	venue	freq
0	French Restaurant	0.14
1	Hotel	0.10
2	Boutique	0.07
3	Italian Restaurant	0.04
4	Garden	0.04

----- Charonne -----

	venue	freq
0	Supermarket	0.10
1	Tram Station	0.07
2	Park	0.07
3	Bar	0.07
4	French Restaurant	0.07

----- Chaussée-d'Antin -----

	venue	freq
0	Hotel	0.12
1	French Restaurant	0.12

2	Coffee Shop	0.06
3	Department Store	0.04
4	Women's Store	0.04

#### ----- Clignancourt -----

	venue	freq
0	French Restaurant	0.15
1	Bar	0.13
2	Pizza Place	0.05
3	Supermarket	0.03
4	Italian Restaurant	0.03

#### ----- Combat -----

	venue	freq
0	French Restaurant	0.24
1	Restaurant	0.06
2	Pool	0.06
3	Italian Restaurant	0.06
4	Park	0.06

#### ----- Croulebarbe -----

	venue	freq
0	French Restaurant	0.17
1	Bar	0.06
2	Sushi Restaurant	0.06
3	Sandwich Place	0.04
4	Italian Restaurant	0.04

#### ----- Ecole-Militaire -----

	venue	freq
0	Hotel	0.29
1	French Restaurant	0.19
2	Plaza	0.10
3	Garden	0.05
4	Historic Site	0.05

#### ----- Enfants-Rouges -----

	venue	freq
0	Café	0.06
1	French Restaurant	0.05
2	Bistro	0.05
3	Bakery	0.04
4	Coffee Shop	0.04

#### ----- Epinettes -----

	venue	freq
0	French Restaurant	0.12
1	Supermarket	0.08
2	Restaurant	0.08
3	Sushi Restaurant	0.04
4	Bakery	0.04

#### ----- Europe -----

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

0	French Restaurant	0.22
1	Hotel	0.16
2	Pizza Place	0.04
3	Bar	0.03
4	Thai Restaurant	0.03

## ----- Faubourg-Montmartre -----

	venue	freq
0	French Restaurant	0.13
1	Hotel	0.09
2	Bistro	0.04
3	Burger Joint	0.04
4	Coffee Shop	0.03

## ----- Faubourg-du-Roule -----

	venue	freq
0	Hotel	0.20
1	French Restaurant	0.13
2	Clothing Store	0.05
3	Cosmetics Shop	0.04
4	Italian Restaurant	0.03

## ----- Folie-Méricourt -----

	venue	freq
0	French Restaurant	0.13
1	Bar	0.10
2	Restaurant	0.07
3	Bakery	0.06
4	Hotel	0.04

## ----- Gaillon -----

	venue	freq
0	Hotel	0.13
1	Japanese Restaurant	0.07
2	French Restaurant	0.07
3	Italian Restaurant	0.03
4	Coffee Shop	0.03

## ----- Gare -----

	venue	freq
0	Hotel	0.12
1	Japanese Restaurant	0.08
2	Coffee Shop	0.06
3	French Restaurant	0.06
4	Thai Restaurant	0.06

## ----- Goutte-d'Or -----

	venue	freq
0	Bar	0.11
1	Asian Restaurant	0.11
2	Chinese Restaurant	0.07
3	Supermarket	0.07
4	Bus Stop	0.04

```

----- Grandes-Carrières -----
      venue  freq
0  French Restaurant  0.20
1           Bar      0.07
2           Hotel      0.07
3  Italian Restaurant  0.05
4           Restaurant 0.05

```

```

----- Grenelle -----
      venue  freq
0           Hotel  0.22
1 Japanese Restaurant 0.09
2           Bistro  0.07
3   French Restaurant  0.07
4           Bakery  0.07

```

```

----- Gros-Caillou -----
      venue  freq
0  French Restaurant  0.27
1  Italian Restaurant  0.12
2           Hotel      0.09
3           Café      0.05
4   Ice Cream Shop    0.03

```

```

----- Halles -----
      venue  freq
0  French Restaurant  0.17
1           Bakery  0.06
2   Pizza Place      0.04
3           Hotel      0.04
4   Wine Bar         0.03

```

```

----- Hôpital-Saint-Louis -----
      venue  freq
0  French Restaurant  0.16
1           Bar      0.11
2           Café      0.04
3   Wine Bar         0.04
4   Coffee Shop      0.04

```

```

----- Invalides -----
      venue  freq
0  French Restaurant  0.35
1           Plaza     0.10
2           Hotel      0.10
3           Café      0.08
4   History Museum    0.06

```

```

----- Jardin-des-Plantes -----
      venue  freq
0  French Restaurant  0.09
1           Garden     0.06
2   Science Museum    0.06
3           Hotel      0.06
4           Museum     0.05

```

## ----- Javel -----

	venue	freq
0	French Restaurant	0.21
1	Pizza Place	0.12
2	Sushi Restaurant	0.06
3	Hotel	0.06
4	Thrift / Vintage Store	0.03

## ----- La Chapelle -----

	venue	freq
0	Thai Restaurant	0.12
1	Supermarket	0.12
2	Chinese Restaurant	0.12
3	Soccer Field	0.12
4	Garden	0.06

## ----- Madeleine -----

	venue	freq
0	Hotel	0.16
1	French Restaurant	0.13
2	Boutique	0.08
3	Gourmet Shop	0.05
4	Women's Store	0.05

## ----- Mail -----

	venue	freq
0	Cocktail Bar	0.07
1	French Restaurant	0.06
2	Wine Bar	0.05
3	Bakery	0.04
4	Salad Place	0.04

## ----- Maison-Blanche -----

	venue	freq
0	French Restaurant	0.13
1	Bakery	0.13
2	Bistro	0.06
3	Café	0.06
4	Plaza	0.06

## ----- Monnaie -----

	venue	freq
0	French Restaurant	0.14
1	Hotel	0.08
2	Plaza	0.05
3	Wine Bar	0.04
4	Café	0.04

## ----- Montparnasse -----

	venue	freq
0	French Restaurant	0.13
1	Hotel	0.12
2	Bar	0.06

3	Bistro	0.05
4	Italian Restaurant	0.05

----- Muette -----

	venue	freq
0	French Restaurant	0.29
1	Boat or Ferry	0.14
2	Gym / Fitness Center	0.14
3	Pool	0.14
4	Lake	0.14

----- Necker -----

	venue	freq
0	Hotel	0.14
1	French Restaurant	0.14
2	Café	0.10
3	Gym / Fitness Center	0.04
4	Pizza Place	0.04

----- Notre-Dame -----

	venue	freq
0	French Restaurant	0.13
1	Bakery	0.05
2	Japanese Restaurant	0.05
3	Ice Cream Shop	0.04
4	Hotel	0.03

----- Notre-Dame-des-Champs -----

	venue	freq
0	French Restaurant	0.17
1	Hotel	0.10
2	Bakery	0.06
3	Italian Restaurant	0.04
4	Bistro	0.04

----- Odéon -----

	venue	freq
0	Hotel	0.09
1	French Restaurant	0.08
2	Bistro	0.06
3	Plaza	0.05
4	Café	0.05

----- Palais-Royal -----

	venue	freq
0	Japanese Restaurant	0.12
1	French Restaurant	0.08
2	Hotel	0.07
3	Coffee Shop	0.06
4	Ramen Restaurant	0.05

----- Parc-de-Montsouris -----

	venue	freq
0	Italian Restaurant	0.20



1	Middle Eastern Restaurant	0.05
2	Diner	0.05
3	Pharmacy	0.05
4	Sushi Restaurant	0.05

----- Petit-Montrouge -----

	venue	freq
0	Hotel	0.17
1	French Restaurant	0.13
2	Supermarket	0.07
3	Italian Restaurant	0.06
4	Sushi Restaurant	0.04

----- Picpus -----

	venue	freq
0	Hotel	0.33
1	Locksmith	0.33
2	Pastry Shop	0.33
3	Perfume Shop	0.00
4	Pedestrian Plaza	0.00

----- Place-Vendôme -----

	venue	freq
0	French Restaurant	0.16
1	Hotel	0.15
2	Jewelry Store	0.05
3	Boutique	0.04
4	Chocolate Shop	0.04

----- Plaine de Monceaux -----

	venue	freq
0	Hotel	0.13
1	French Restaurant	0.13
2	Italian Restaurant	0.10
3	Bakery	0.09
4	Plaza	0.04

----- Plaisance -----

	venue	freq
0	Hotel	0.22
1	French Restaurant	0.12
2	Bistro	0.08
3	Bar	0.08
4	Japanese Restaurant	0.05

----- Pont-de-Flandre -----

	venue	freq
0	Restaurant	0.07
1	Hotel	0.07
2	French Restaurant	0.05
3	Bistro	0.03
4	Café	0.03

----- Porte-Dauphine -----

	venue	freq
0	Tennis Court	0.18
1	Café	0.18
2	Pizza Place	0.09
3	Gym Pool	0.09
4	Gym / Fitness Center	0.09

----- Porte-Saint-Denis -----

	venue	freq
0	French Restaurant	0.07
1	Hotel	0.06
2	Pizza Place	0.06
3	Bar	0.05
4	Seafood Restaurant	0.03

----- Porte-Saint-Martin -----

	venue	freq
0	Coffee Shop	0.10
1	French Restaurant	0.06
2	Hotel	0.04
3	Theater	0.03
4	Asian Restaurant	0.03

----- Père-Lachaise -----

	venue	freq
0	Bakery	0.09
1	Bistro	0.09
2	Bar	0.09
3	Japanese Restaurant	0.07
4	French Restaurant	0.07

----- Quinze-Vingts -----

	venue	freq
0	French Restaurant	0.15
1	Coffee Shop	0.09
2	Sandwich Place	0.07
3	Hotel	0.06
4	Bar	0.05

----- Rochechouart -----

	venue	freq
0	French Restaurant	0.20
1	Hotel	0.14
2	Bakery	0.05
3	Coffee Shop	0.04
4	Vegetarian / Vegan Restaurant	0.04

----- Roquette -----

	venue	freq
0	French Restaurant	0.10
1	Bistro	0.07
2	Bar	0.07
3	Italian Restaurant	0.04
4	Supermarket	0.03

## ----- Saint-Ambroise -----

	venue	freq
0	Bar	0.13
1	French Restaurant	0.12
2	Restaurant	0.07
3	Bistro	0.03
4	Coffee Shop	0.03

## ----- Saint-Fargeau -----

	venue	freq
0	Supermarket	0.14
1	Bar	0.07
2	Plaza	0.07
3	Bakery	0.07
4	Food Truck	0.07

## ----- Saint-Georges -----

	venue	freq
0	Hotel	0.18
1	French Restaurant	0.11
2	Cocktail Bar	0.09
3	Italian Restaurant	0.06
4	Bar	0.04

## ----- Saint-Germain-des-Prés -----

	venue	freq
0	French Restaurant	0.14
1	Hotel	0.09
2	Italian Restaurant	0.07
3	Café	0.04
4	Sandwich Place	0.03

## ----- Saint-Germain-l'Auxerrois -----

	venue	freq
0	French Restaurant	0.14
1	Hotel	0.11
2	Café	0.06
3	Coffee Shop	0.06
4	Plaza	0.06

## ----- Saint-Gervais -----

	venue	freq
0	French Restaurant	0.13
1	Clothing Store	0.06
2	Pastry Shop	0.04
3	Gourmet Shop	0.03
4	Wine Bar	0.03

## ----- Saint-Lambert -----

	venue	freq
0	French Restaurant	0.16
1	Hotel	0.08
2	Bakery	0.05
3	Thai Restaurant	0.05

## 4 Italian Restaurant 0.03

## ----- Saint-Merri -----

	venue	freq
0	French Restaurant	0.09
1	Art Gallery	0.06
2	Plaza	0.04
3	Ice Cream Shop	0.04
4	Clothing Store	0.03

## ----- Saint-Thomas-d'Aquin -----

	venue	freq
0	French Restaurant	0.23
1	Hotel	0.11
2	Café	0.06
3	Italian Restaurant	0.05
4	Bistro	0.03

## ----- Saint-Victor -----

	venue	freq
0	French Restaurant	0.19
1	Hotel	0.06
2	Bakery	0.06
3	Museum	0.04
4	Italian Restaurant	0.03

## ----- Saint-Vincent-de-Paul -----

	venue	freq
0	French Restaurant	0.17
1	Indian Restaurant	0.17
2	Hotel	0.11
3	Italian Restaurant	0.06
4	African Restaurant	0.06

## ----- Sainte-Avoie -----

	venue	freq
0	French Restaurant	0.11
1	Chinese Restaurant	0.05
2	Restaurant	0.05
3	Bakery	0.04
4	Coffee Shop	0.04

## ----- Sainte-Marguerite -----

	venue	freq
0	French Restaurant	0.24
1	Hotel	0.07
2	Coffee Shop	0.05
3	Bistro	0.05
4	Bar	0.05

## ----- Salpêtrière -----

	venue	freq
0	French Restaurant	0.17
1	Indian Restaurant	0.11

2	Mediterranean Restaurant	0.06
3	Sushi Restaurant	0.06
4	Gym / Fitness Center	0.06

----- Sorbonne -----

	venue	freq
0	Hotel	0.10
1	French Restaurant	0.09
2	Bookstore	0.04
3	Indie Movie Theater	0.04
4	Bakery	0.04

----- Ternes -----

	venue	freq
0	French Restaurant	0.18
1	Italian Restaurant	0.12
2	Hotel	0.10
3	Bistro	0.04
4	Seafood Restaurant	0.04

----- Val-de-Grâce -----

	venue	freq
0	French Restaurant	0.16
1	Bar	0.10
2	Hotel	0.08
3	Science Museum	0.04
4	Creperie	0.04

----- Villette -----

	venue	freq
0	Bar	0.09
1	Hotel	0.07
2	Café	0.07
3	French Restaurant	0.05
4	Multiplex	0.03

----- Vivienne -----

	venue	freq
0	French Restaurant	0.14
1	Japanese Restaurant	0.07
2	Italian Restaurant	0.05
3	Bistro	0.05
4	Café	0.03

## Let's put that into a pandas dataframe

Function to sort the venues in descending order

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

	Neighbourhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue
0	Amérique	French Restaurant	Pool	Supermarket	Grocery Store
1	Archives	Clothing Store	French Restaurant	Coffee Shop	Japanese Restaurant
2	Arsenal	French Restaurant	Hotel	Italian Restaurant	Park
3	Arts-et-Métiers	French Restaurant	Hotel	Cocktail Bar	Italian Restaurant
4	Auteuil	Tennis Court	Racecourse	Outdoors & Recreation	Office

## Cluster Neighborhoods¶

Run k-means to cluster the neighborhood into 5 clusters.

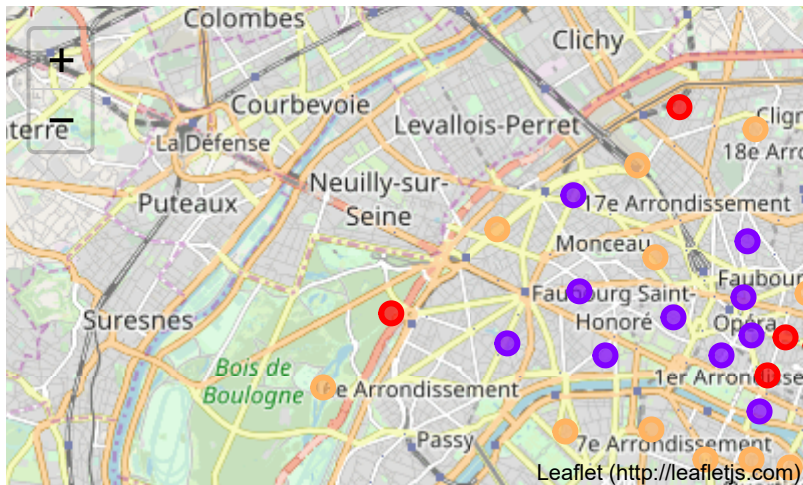
```
array([0, 0, 4, 0, 2, 4, 0, 0, 0, 0], dtype=int32)

array([0, 0, 4, 0, 2, 4, 0, 0, 0, 0, 1, 1, 0, 1, 0,
       4, 4, 1, 0, 0, 4, 4,
        1, 0, 1, 0, 0, 4, 1, 4, 4, 0, 4, 0, 4, 0, 1,
       0, 0, 4, 4, 4, 1, 0,
        4, 0, 0, 0, 1, 3, 1, 1, 1, 0, 0, 0, 0, 0, 0,
       4, 0, 0, 0, 1, 4, 1,
        0, 4, 0, 4, 4, 4, 0, 4, 4, 0, 4, 4, 0, 0], dt
      ype=int32)
```

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

	Borough	Neighbourhood	Code	Latitude	Longitude	Cluster Label
0	6	Monnaie	75106	48.854384	2.340035	
1	6	Odéon	75106	48.847801	2.336339	
2	8	Champs-Elysées	75108	48.867074	2.308652	
3	13	Maison-Blanche	75113	48.823128	2.352433	
4	13	Croulebarbe	75113	48.833734	2.347673	

Let's visualize the resulting clusters¶



Cluster 0 venues

	Neighbourhood	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue
0	Monnaie	0	French Restaurant	Hotel	PI
1	Odéon	0	French Restaurant	Hotel	Bi
2	Champs-Elysées	0	French Restaurant	Hotel	Bouti
5	Notre-Dame-des-Champs	0	French Restaurant	Hotel	Bal
6	Petit-Montrouge	0	Hotel	French Restaurant	Superma
9	Chaillot	0	Hotel	French Restaurant	Ita Restau
10	Epinettes	0	Hotel	French Restaurant	Restau
11	Sorbonne	0	Hotel	French Restaurant	Indie M The
12	Saint-Georges	0	Hotel	French Restaurant	Cocktail
13	Chaussée-d'Antin	0	French Restaurant	Hotel	Coffee S
14	Palais-Royal	0	Japanese Restaurant	French Restaurant	H
19	Faubourg-Montmartre	0	French Restaurant	Hotel	Burger J
20	Gaillon	0	Hotel	Japanese Restaurant	Fre Restau
22	Arsenal	0	French Restaurant	Hotel	F
23	Jardin-des-Plantes	0	French Restaurant	Garden	H
27	Plaisance	0	Hotel	French Restaurant	Bi
29	Madeleine	0	Hotel	French Restaurant	Bouti
36	Parc-de-Montsouris	0	Italian Restaurant	Hotel	Restau
39	Ecole-Militaire	0	Hotel	French Restaurant	PI
40	Grenelle	0	Hotel	Japanese Restaurant	Bal
44	Place-Vendôme	0	French Restaurant	Hotel	Jew S
49	Necker	0	French Restaurant	Hotel	C
54	Faubourg-du-Roule	0	Hotel	French Restaurant	Clott S



	Neighbourhood	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue
60	Gare	0	Hotel	Japanese Restaurant	Italian Restaurant
65	Saint-Germain-des-Prés	0	French Restaurant	Hotel	Italian Restaurant
69	Montparnasse	0	French Restaurant	Hotel	
70	Plaine de Monceaux	0	Hotel	French Restaurant	Bar
74	Saint-Germain-l'Auxerrois	0	French Restaurant	Hotel	Café

Cluster 1 venues

	Neighbourhood	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue
2	Champs-Elysées	1	French Restaurant	Hotel	Boutique
6	Petit-Montrouge	1	Hotel	French Restaurant	Supermarket
9	Chaillot	1	Hotel	French Restaurant	Italian Restaurant
12	Saint-Georges	1	Hotel	French Restaurant	Cocktail Bar
13	Chaussée-d'Antin	1	Hotel	French Restaurant	Coffee Shop
20	Gaillon	1	Hotel	Japanese Restaurant	French Restaurant
27	Plaisance	1	Hotel	French Restaurant	Bistro
29	Madeleine	1	Hotel	French Restaurant	Boutique
39	Ecole-Militaire	1	Hotel	French Restaurant	Plaza
40	Grenelle	1	Hotel	Japanese Restaurant	Bistro
44	Place-Vendôme	1	French Restaurant	Hotel	Jewelry Store
49	Necker	1	Hotel	French Restaurant	Café
54	Faubourg-du-Roule	1	Hotel	French Restaurant	Clothing Store
70	Plaine de Monceaux	1	French Restaurant	Hotel	Italian Restaurant
74	Saint-Germain-l'Auxerrois	1	French Restaurant	Hotel	Plaza

## Cluster 2 venues

	Neighbourhood	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Common V
26	Picpus	3	Locksmith	Pastry Shop	Hotel	F (