

# Discovering and clustering Lyon's neighborhoods

Jean-Vincent VALLEE

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## 1. Introduction

### 1.1 Background

Lyon is one of the main French cities. It is particularly famous for its cuisine and gastronomy as well as for its historical and architectural landmarks. Half a million people live there and every year thousands of new citizens from all over the world move in the city.

### 1.2 Problem

Have you ever moved to a city you did not know? It can be a real headache to find out which neighborhoods would be best for you depending on your way of living. This project will describe Lyon's neighborhoods in order to help new citizens to find out which one they would enjoy the most.

## 2. Data

For this study, we will use the following data from Wikipédia that represents the different neighborhoods of Lyon:

1st arrondissement: Slopes of La Croix-Rousse, Terreaux, Martinière/St-Vincent

2nd arrondissement: Cordeliers, Bellecour, Ainay, Perrache, Confluence, Sainte-Blandine

3rd arrondissement: Guillotière (north), Préfecture, Part-Dieu, Villette, Dauphiné/Sans Souci, Montchat, Grange Blanche (north), Monplaisir (north)

4th arrondissement: Plateau de la Croix-Rousse, Serin

5th arrondissement: Vieux Lyon (Saint-Paul, Saint-Jean, Saint-Georges), Saint-Just, Saint-Irénée, Fourvière, Point du Jour, Ménilval, Battières, Champvert (south)

6th arrondissement: Brotteaux, Bellecombe, Parc de la Tête d'or, Cité Internationale

7th arrondissement: Guillotière (south), Jean Macé, Gerland

8th arrondissement: Monplaisir (south), Bachut, États-Unis, Grand Trou/Moulin à Vent, Grange Blanche (south), Laënnec, Mermoz, Monplaisir-la-Plaine

9th arrondissement: Vaise, Duchère, Roche-cardon, St-Rambert-l'Île-Barbe, Gorge de Loup, Observance, Champvert (north)

We will put this data in a text file and extract the information from the file in order to create a dataframe and to find out the location of all neighborhoods using Google Maps. The following list has been written down into a text file called boroughslyon.txt where the first line is the borough followed by all neighborhoods in the borough line by line. Boroughs are separated by line breaks.

1st arrondissement

Pentes de la Croix-Rousse

Terreaux

Martinière/Saint-Vincent

2nd arrondissement

Cordeliers

Bellecour

Ainay

Perrache

Confluence

Sainte-Blandine

...

9th arrondissement

Vaise

Duchère

Rochecardon

Saint-Rambert

Île-Barbe

Gorge de Loup

Observance

Champvert

We will then use the Foursquare's API to find out about the main venues of these neighborhoods and we will try to determine the main atmosphere of the neighborhoods. Concerning the Foursquare data, we will focus on the best venues for each neighborhood.

### 3. Methodology

As explained in the data section, we used the boroughslyon.txt to create a pandas dataframe with 'Neighborhood' and 'Borough' columns. We then used Geopy to determine the latitude and the longitude of each neighborhood and we added them to the dataframe.

	Neighborhood	Borough	Latitude	Longitude
0	Pentes de la Croix-Rousse	1st arrondissement	45.771915	4.830748
1	Terreaux	1st arrondissement	45.768442	4.832414
2	Martinière/Saint-Vincent	1st arrondissement	45.768221	4.827626
3	Cordeliers	2nd arrondissement	45.763129	4.835797
4	Bellecour	2nd arrondissement	45.757362	4.833009

We also grouped the neighborhoods appearing twice in different boroughs.

9	La Guillotière	45.752698	4.846050	3rd arrondissement, 7th arrondissement
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We then printed a map with a radius of 500m around each neighborhood point.



You will notice that many neighborhoods are overlapping each other but it is not important as venues do not have to be in the exact neighborhood but around it.

The next step was to get the venues from Foursquare using their API.

	Neighborhood	Neighborhood Latitude	Neighborhood Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
0	Pentes de la Croix-Rousse	45.771915	4.830748	Balthaz'art	45.773297	4.832122	Restaurant
1	Pentes de la Croix-Rousse	45.771915	4.830748	Place de l'Esplanade	45.772420	4.831818	Plaza
2	Pentes de la Croix-Rousse	45.771915	4.830748	Le Desjeuner	45.773597	4.832150	Restaurant
3	Pentes de la Croix-Rousse	45.771915	4.830748	Café J'Adore	45.771290	4.831567	Café
4	Pentes de la Croix-Rousse	45.771915	4.830748	Pentes de la Croix Rousse	45.771141	4.828272	Neighborhood

We then used the `get_dummies` method to transform the dataframe and group the different venues by means.

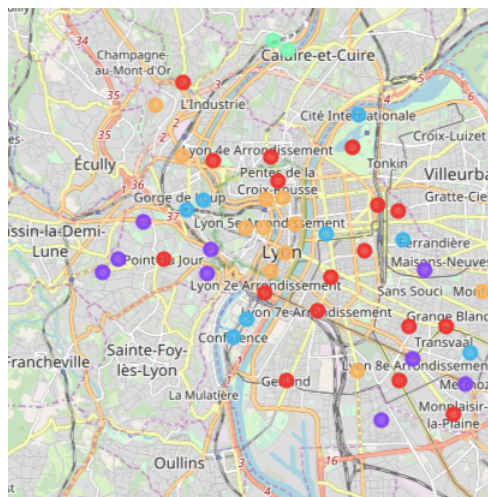
Neighborhoods	American Restaurant	Art Gallery	Art Museum	Arts & Crafts Store	Arts & Entertainment	Asian Restaurant	Athletics & Sports	Auto Dealership	Auto Workshop	...	Trail	Train Station	Tram Station	Turkish Restaurant
0 Pentes de la Croix-Rousse	0	0	0	0	0	0	0	0	0	...	0	0	0	0
1 Pentes de la Croix-Rousse	0	0	0	0	0	0	0	0	0	...	0	0	0	0
2 Pentes de la Croix-Rousse	0	0	0	0	0	0	0	0	0	...	0	0	0	0
3 Pentes de la Croix-Rousse	0	0	0	0	0	0	0	0	0	...	0	0	0	0

Finally, we got the 5 most common venues for each neighborhood and put them in a dataframe in order to use a clustering model to classify each neighborhood.

Neighborhoods	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue
0 Ainaly	New American Restaurant	Restaurant	Wine Bar	Art Museum	Cupcake Shop
1 Bachut	Food & Drink Shop	Bus Stop	Supermarket	Grocery Store	Comedy Club
2 Battières	Pizza Place	Supermarket	Recording Studio	Basketball Court	Bus Stop
3 Bellecombe	Restaurant	Nightclub	Japanese Restaurant	Diner	Bar
4 Bellecour	Plaza	Dessert Shop	Hotel	Café	Bookstore

## 4. Results

The results of our model are displayed on the following map.



After testing different numbers of clusters, we defined that 5 clusters was best. Here are the results we determined:

#### CLUSTER 0:

	Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue
0	Pentes de la Croix-Rousse	Restaurant	Plaza	Neighborhood	Bakery	Café
6	Perrache	Restaurant	Plaza	Music Venue	Indian Restaurant	Coffee Shop
9	La Guillotière	Bistro	Hostel	Restaurant	Bar	Hobby Shop
11	Part-Dieu	Restaurant	Wine Shop	Indian Restaurant	Concert Hall	Hotel
15	Grange Blanche	Restaurant	Museum	Metro Station	Garden	Bakery
16	Monplaisir	Museum	Restaurant	Food & Drink Shop	Plaza	Brasserie
17	Croix-Rousse	Restaurant	Pub	Plaza	Farmers Market	Street Art
18	Serin	River	Home Service	Park	Outdoors & Recreation	Restaurant
23	Point du Jour	Restaurant	Optical Shop	Wings Joint	Paper / Office Supplies Store	Farmers Market
27	Brotteaux	Restaurant	Italian Restaurant	Train Station	Japanese Restaurant	Speakeasy
28	Bellecombe	Restaurant	Nightclub	Japanese Restaurant	Diner	Bar
29	Parc de la Tête d'or	Zoo	Exhibit	Park	Bar	Theme Park Ride / Attraction
31	Jean Macé	Restaurant	Smoke Shop	Tea Room	Diner	Bar
32	Gerland	Sandwich Place	Brasserie	Seafood Restaurant	Plaza	Child Care Service
34	États-Unis	Tram Station	Supermarket	Theater	Museum	Donut Shop
39	Monplaisir-la-Plaine	Taco Place	Arts & Crafts Store	Stadium	Bakery	Electronics Store
42	Rochecardon	Dessert Shop	Pool	Pharmacy	Gas Station	Zoo

Lively neighborhoods in different places in Lyon. There are restaurants, plazas, bars and other places to go out and do activities with friends. It is perfect for people wanting to stay in a very dynamic neighborhood and liking to go out with friends.

#### CLUSTER 1:

	Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue
13	Dauphiné/Sans Souci	Food & Drink Shop	Bus Stop	Bar	Bakery	Plaza
20	Saint-Just	Bus Stop	Lawyer	Hotel	Plaza	Cable Car
21	Saint-Irénée	Bus Stop	Arts & Entertainment	Fast Food Restaurant	Zoo	Garden
24	Ménival	Business Service	Bus Stop	Pizza Place	Supermarket	Zoo
25	Battières	Pizza Place	Supermarket	Recording Studio	Basketball Court	Bus Stop
26	Champvert	Playground	Pizza Place	Food & Drink Shop	Tennis Court	Grocery Store
33	Bachut	Food & Drink Shop	Bus Stop	Supermarket	Grocery Store	Comedy Club
36	Moulin à Vent	Bus Stop	Turkish Restaurant	Pizza Place	Soccer Stadium	Zoo
38	Mermoz	Bus Stop	Kebab Restaurant	Pizza Place	Gas Station	Metro Station

Bus Stops are the most important venues of these neighborhoods. We notice as well that they are not in the center of Lyon. Main venues are supermarkets, a few restaurants and sport facilities. These places seem to be very residential and perfect for families or people looking for some quiet.

## CLUSTER 2:

	Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue
7	Confluence	Fast Food Restaurant	Electronics Store	Art Gallery	Deli / Bodega	Concert Hall
8	Sainte-Blandine	Hotel	Multiplex	Playground	Concert Hall	Deli / Bodega
10	Préfecture	Hotel	Lyonese Bouchon	Bar	Chinese Restaurant	Plaza
12	La Villette	Hotel	Italian Restaurant	Sandwich Place	Supermarket	Diner
30	Cité Internationale	Restaurant	Hotel	Concert Hall	Coffee Shop	Café
37	Laënnec	Hotel	Auto Dealership	Zoo	Food & Drink Shop	Convenience Store
45	Gorge de Loup	Gas Station	Hotel	Flower Shop	Train Station	Motel
46	Observance	Train Station	Hotel	Motel	Hostel	Dessert Shop

Many hotels and train stations in these neighborhoods as well as food places. They are perfect neighborhoods for tourist staying a few days or business travelers.

## CLUSTER 3:

	Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue
43	Saint-Rambert	Restaurant	Bakery	Supermarket	Flower Shop	Concert Hall
44	Île-Barbe	Restaurant	Bakery	Garden	Convenience Store	Cupcake Shop

These 2 neighborhoods are very close, and some venues are probably the same for both. It seems to be a perfect place for people liking nature and food, but it is hard to tell more about it as there are only 2 neighborhoods...

## CLUSTER 4:

	Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue
1	Terreaux	Bar	Japanese Restaurant	Cocktail Bar	Plaza	Café
2	Martinière/Saint-Vincent	Bar	Cocktail Bar	Restaurant	Wine Bar	Public Art
3	Cordeliers	Plaza	Lyonese Bouchon	Bar	Burger Joint	Café
4	Bellecour	Plaza	Dessert Shop	Hotel	Café	Bookstore
5	Ainay	New American Restaurant	Restaurant	Wine Bar	Art Museum	Cupcake Shop
14	Montchat	Plaza	Pool	Supermarket	Park	Athletics & Sports
19	Vieux Lyon	Lyonese Bouchon	Ice Cream Shop	Church	Beer Bar	Café
22	Fourvière	Historic Site	Lyonese Bouchon	Church	Neighborhood	Park
35	Grand Trou	Plaza	Rental Car Location	Auto Workshop	Zoo	Food & Drink Shop
40	Vaise	Train Station	Auto Workshop	Department Store	Electronics Store	Food & Drink Shop
41	Duchère	Café	Track Stadium	Park	IT Services	Pool

A lot of plazas as well as bars and restaurants. While cluster 0 was more about going out, this cluster seems to be more about sitting down for a coffee or a brunch in a nice place as French people love to do.

## 5. Conclusion

This analysis allowed us to divide Lyon's neighborhoods in 4 main clusters:

- Very lively and active neighborhoods. Perfect for afterworks or a night out. (cluster 0)
- Lively neighborhoods with plazas and restaurants mainly in the center of Lyon. Perfect for a café or a brunch (cluster 4)
- Residential neighborhoods with transports but not very lively. Perfect for families.
- Travelers neighborhoods. Perfect for tourists or business travelers.

It would be interesting to go even deeper in this study and to define neighborhoods depending on people wishes (such as having a swimming pool or a supermarket around).