

The Battle of Neighborhoods



Source image: <https://it.wikivoyage.org/wiki/Roma>

Visit to Rome

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1. Introduction

Rome is one of the most interesting tourist destinations in the world, due to its immense artistic and cultural heritage. There are a lot of monuments: Colosseo, Il Vittoriano (or Altare della Patria), Pantheon, Fontana di Trevi, ... [<https://www.expedia.it/>]. Beside to many monuments, in Rome there are many other places of interest for a tourist. In particular, as the Italian capital, there are a lot of restaurants that allow tourists to eat wonderful Italian food! If you are going to go to Rome, you cannot taste some of the most typical Italian and Roman dishes, such as cacio e pepe, gnocchi alla romana, abbacchio a scottadito, carciofi alla giudia, crostata di ricotta, ... [<https://www.gamberorosso.it/>].

In order plan a travel in Rome, and to decide where it is better to reserve a hotel, it is important to evaluate where different interesting venues are located. Beside a global analysis about venues, I would like to focus my analysis on both main monuments and Italian restaurants.

In order to perform my analysis, it is important to know how Rome is organized. Its territory is divided into three types of areas: administrative, urban and historical areas. Since 2013, the Rome Capital Statute has reorganized the administrative areas dividing Rome in 15 municipalities. Rome is also divided into differing types of non-administrative units. The historic centre is divided into 22 "rioni", externally there are 35 "quartieri", 6 "suburbi" and 52 "zone". For more uniformity, I consider the 15 municipalities.

2. Data

For this project, I need data information about Rome's neighborhoods (called Municipi). Data about neighborhoods are available in the Italian web portal of Open Data (<http://www.datiopen.it/>): "Municipi di Roma". I downloaded the shape file that I elaborated it using QGIS (<https://www.qgis.org/>) to export a geojson file that associates for each neighborhood the latitude and the longitude of its centroid. The resulting file is available here: [municipi_centroidi_js.geojson](#). Figure 1 shows the map in QGIS.

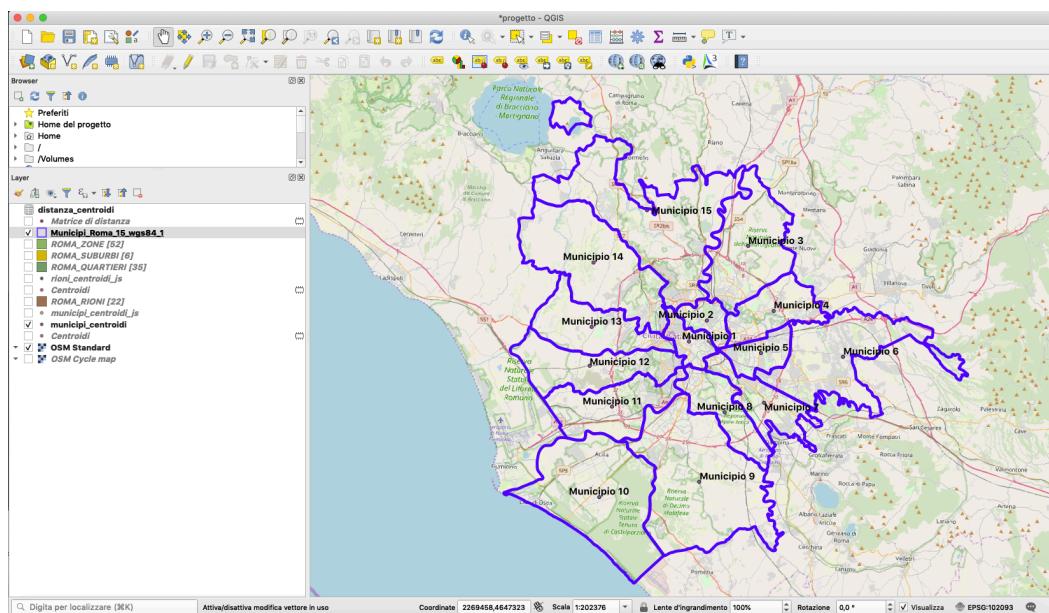


Figure 1. Rome's neighborhoods in QGIS.

Next, I need data about venues in Rome, as hotels, monuments and restaurants. I obtained them working with the Foursquare API. As an example of data, Figure 2 shows the map of venues obtained with an explore in Foursquare with respect each Rome's neighbourhood centroid (blue in the map) using a radius equals to 6000 (the value is defined checking the distances between the neighborhoods' centroids).

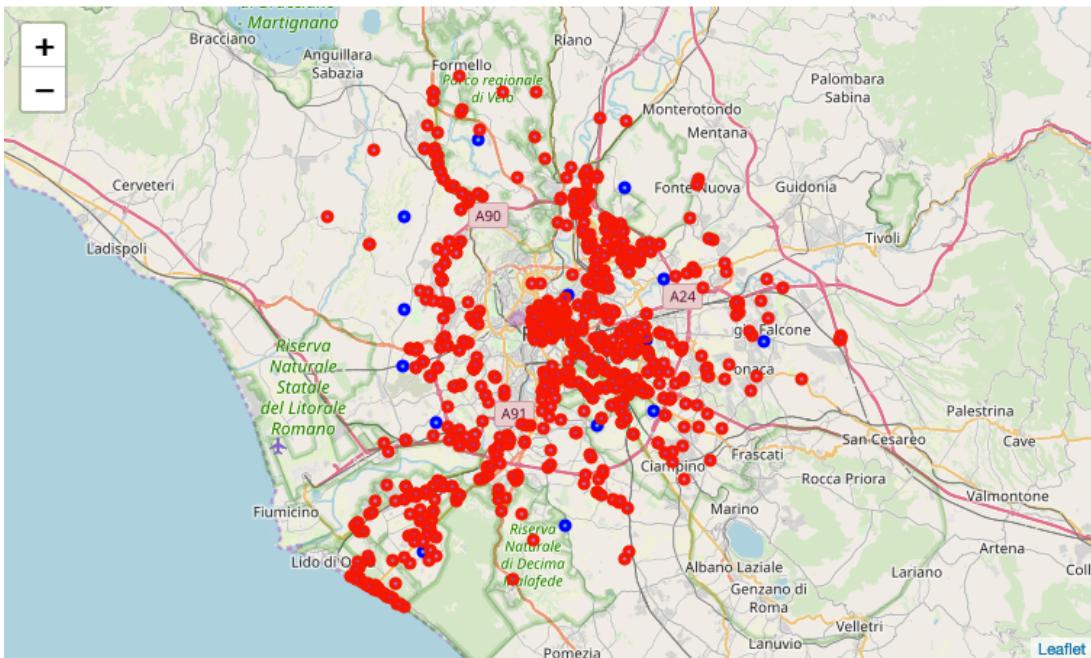


Figure 2. Rome's venues (red) and centroids of neighborhoods (blue) in folium (Python).

An example of alphanumeric data of venues is also visible in Figure 3. For each venue there is the name of the neighbourhood, its latitude and longitude, the name of the venue, its latitude and longitude, and its category.

| | Neighborhood | Neighborhood Latitude | Neighborhood Longitude | Venue | Venue Latitude | Venue Longitude | Venue Category |
|---|--------------|-----------------------|------------------------|----------------------|----------------|-----------------|---------------------|
| 0 | Municipio 1 | 41.898628 | 12.47795 | Pantheon | 41.899133 | 12.476805 | Monument / Landmark |
| 1 | Municipio 1 | 41.898628 | 12.47795 | Pizza e Mozzarella | 41.897598 | 12.479097 | Pizza Place |
| 2 | Municipio 1 | 41.898628 | 12.47795 | Il Panino Ingegnoso | 41.899982 | 12.479195 | Sandwich Place |
| 3 | Municipio 1 | 41.898628 | 12.47795 | Piazza della Rotonda | 41.899253 | 12.476779 | Plaza |
| 4 | Municipio 1 | 41.898628 | 12.47795 | Venchi | 41.900042 | 12.480883 | Ice Cream Shop |

Figure 3. An example of venues' dataset.

This is only a short description of used datasets, more details are available in Sections 0, and in the Notebook used for the development of the project [https://github.com/gubiani/Coursera_Capstone/blob/master/battleOfNeighborhoods.ipyn].

3. Methodology

The synthesis of my work is described in Figure 4. A description of different steps of the work is described in the following.

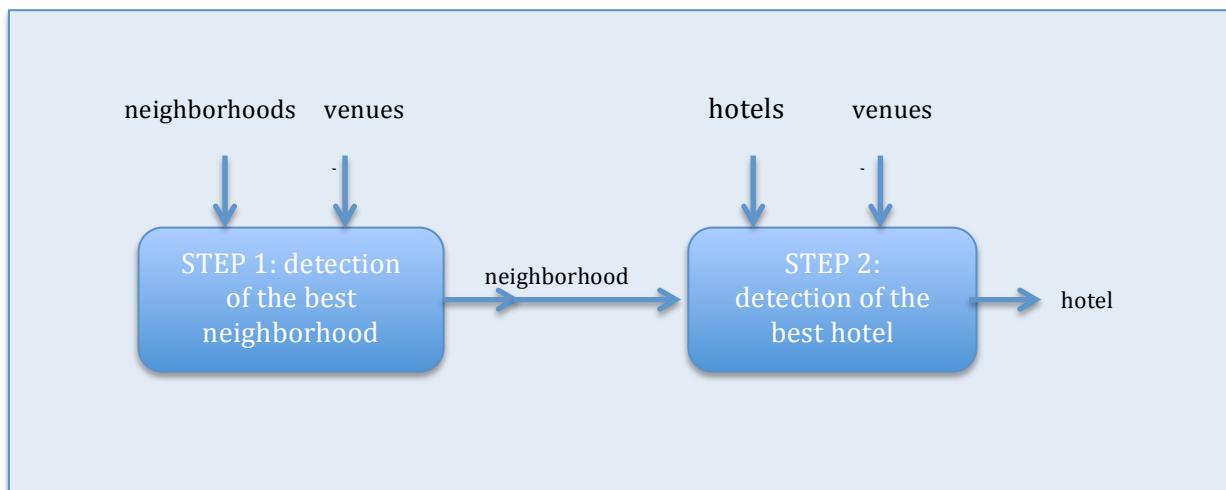


Figure 4. Schema of the work.

STEP 1. Detection of the best neighbourhood

For each neighbourhood's centroid, by Foursquare, a venue "explore" allows one to obtain the venues (of all categories) within a specific radius.

Starting from this dataset, after a look to data, a clustering of neighbours allows one to detect the neighbours that better satisfy specific requests.

STEP 2. Detection of the best hotel(s)

For the selected neighbourhood, by Foursquare, a venue "explore" allows one to obtain the hotels (categoryId='4bf58dd8d48988d1fa931735') within a specific radius.

For each hotel, by Foursquare, a venue "explore" allows one to obtain the venues within a specific radius.

Starting from this dataset, after a look to data, a clustering of hotels allows one to detect one or more hotels that satisfy specific requests.

4. Results

In the following subsections, I present and discuss, step by step, the results achieved applying the methodology described in the previous section on data introduced in Section 2.

STEP 1. Detection of the best neighbourhood

From a first analysis on the most common venues for each neighborhood (Figure 5), I can see that the most common venue for several neighborhoods is represented by the “Italian restaurants” or “Pizza place”. If they are not the most common, they usually are in the first following places. “Hotel”s are frequently from 2nd to 3rd position (6 neighborhoods). Differently, “Historical Site” is the 3rd most common venue in Municipio 1, the 4th in Municipio 2 and 8, the 6th in Municipio 7 and 10. Moreover, “Monument/Landmark” is in the 5th position in Municipio 7 and 9th in Municipio 1.

| | Neighborhood | 1st Most Common Venue | 2nd Most Common Venue | 3rd Most Common Venue | 4th Most Common Venue | 5th Most Common Venue | 6th Most Common Venue | 7th Most Common Venue | 8th Most Common Venue | 9th Most Common Venue | 10th Most Common Venue |
|----|--------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|------------------------|-----------------------|-----------------------|-----------------------|------------------------|
| 0 | Municipio 1 | Plaza | Ice Cream Shop | Historic Site | Italian Restaurant | Sandwich Place | Wine Bar | Church | Fountain | Monument / Landmark | Pizza Place |
| 1 | Municipio 10 | Italian Restaurant | Beach | Seafood Restaurant | Ice Cream Shop | Fast Food Restaurant | Historic Site | Park | Pizza Place | Restaurant | Campground |
| 2 | Municipio 11 | Italian Restaurant | Pizza Place | Hotel | Café | Park | Pool | Ice Cream Shop | Fast Food Restaurant | Gym / Fitness Center | Steakhouse |
| 3 | Municipio 12 | Italian Restaurant | Hotel | Supermarket | Electronics Store | American Restaurant | Event Space | Sandwich Place | Pizza Place | Park | Department Store |
| 4 | Municipio 13 | Italian Restaurant | Café | Department Store | Hotel | Sandwich Place | Furniture / Home Store | Steakhouse | Supermarket | Cafeteria | Gym / Fitness Center |
| 5 | Municipio 14 | Italian Restaurant | Hotel | Pub | Asian Restaurant | Pool | Supermarket | Deli / Bodega | Restaurant | Clothing Store | Electronics Store |
| 6 | Municipio 15 | Italian Restaurant | Gym / Fitness Center | Hotel | Café | Supermarket | Restaurant | Pub | Asian Restaurant | BBQ Joint | Pool |
| 7 | Municipio 2 | Plaza | Ice Cream Shop | Hotel | Historic Site | Monument / Landmark | Sandwich Place | Art Museum | Italian Restaurant | Pizza Place | History Museum |
| 8 | Municipio 3 | Italian Restaurant | Pizza Place | Café | Steakhouse | Gym / Fitness Center | Hotel | Grocery Store | Supermarket | Electronics Store | Clothing Store |
| 9 | Municipio 4 | Italian Restaurant | Pizza Place | Café | Ice Cream Shop | Gastropub | Restaurant | Nightclub | Park | Gym / Fitness Center | Beer Garden |
| 10 | Municipio 5 | Pizza Place | Ice Cream Shop | Park | Italian Restaurant | Hotel | Cocktail Bar | Café | Dessert Shop | Gastropub | Gym / Fitness Center |
| 11 | Municipio 6 | Clothing Store | Italian Restaurant | Fast Food Restaurant | Café | Rest Area | Electronics Store | Shopping Mall | Discount Store | Restaurant | Ice Cream Shop |
| 12 | Municipio 7 | Italian Restaurant | Pizza Place | Park | Café | Ice Cream Shop | Historic Site | Wine Bar | Hotel | Burger Joint | Gym |
| 13 | Municipio 8 | Pizza Place | Park | Café | Historic Site | Italian Restaurant | Ice Cream Shop | Pub | Bakery | Hotel | Kebab Restaurant |
| 14 | Municipio 9 | Italian Restaurant | Hotel | Soccer Field | Farm | Café | Pizza Place | Rock Club | Fast Food Restaurant | Food | Food Court |

Figure 5. Most common venues in each neighborhood.

For a more global analysis, I cluster the neighborhoods with respect to venues. Considering the number of neighborhoods (15), I decided to apply k-Means with k=5 (supposing a general average of 3 neighborhoods per cluster). The resulting clustering is visible in Figure 6.



Figure 6. Map of neighborhoods' clusters.

From an exploration of the clusters (Figure 7), I can try to characterize them:

- The **1st cluster** (red on the map) is the most populated and includes neighbourhoods with Italian restaurants, pizza places and other restaurants, coffee, bars and ice-cream. Only in some cases, Municipio 8, 7 and 10, there are available also historical sites, respectively in the 4th position and 6th for last two;
- The **2nd cluster** (violet on the map) is in the north-west of the center and, besides Italian restaurants and hotels, supermarkets and stores, pools and fitness centers;
- The **3rd cluster** (blue on the map) is the center of Rome (two neighbourhoods) and it is characterized by plazas, historical sites, monuments/landmarks, churches and fountains, with ice-cream, sandwich and snack places;
- The **4th cluster** (green on the map) includes neighborhoods with mainly Italian restaurants and hotels;
- The **5th cluster** (orange on the map) includes only one neighbourhood and is the neighbourhood of the shopping.

The goal of this first step of the analysis is to determine the neighbourhood where I want to reserve a hotel. Since my starting requirements, monuments (historical sites, plazas, ...) and Italian restaurants are relevant venues. Only for monuments and historical sites, I could choose a neighbourhood in the cluster 3rd but considering also Italian restaurants, which should be close to the hotel for good Italian dinners, I select the 1st cluster.

| # Cluster 1 rome_merged.loc[rome_merged['Cluster Labels'] == 0, rome_merged.columns[[0] + list(range(4, rome_merged.shape[1]))]] | | | | | | | | | | |
|-------------------------------------------------------------------------------------------------------------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|------------------------|-----------------------|-----------------------|-----------------------|------------------------|
| Neighborhood | 1st Most Common Venue | 2nd Most Common Venue | 3rd Most Common Venue | 4th Most Common Venue | 5th Most Common Venue | 6th Most Common Venue | 7th Most Common Venue | 8th Most Common Venue | 9th Most Common Venue | 10th Most Common Venue |
| 2 Municipio 3 | Italian Restaurant | Pizza Place | Café | Steakhouse | Gym / Fitness Center | Hotel | Grocery Store | Supermarket | Electronics Store | Clothing Store |
| 3 Municipio 4 | Italian Restaurant | Pizza Place | Café | Ice Cream Shop | Gastropub | Restaurant | Nightclub | Park | Gym / Fitness Center | Beer Garden |
| 4 Municipio 5 | Pizza Place | Ice Cream Shop | Park | Italian Restaurant | Hotel | Cocktail Bar | Café | Dessert Shop | Gastropub | Gym / Fitness Center |
| 6 Municipio 7 | Italian Restaurant | Pizza Place | Park | Café | Ice Cream Shop | Historic Site | Wine Bar | Hotel | Burger Joint | Gym |
| 7 Municipio 8 | Pizza Place | Park | Café | Historic Site | Italian Restaurant | Ice Cream Shop | Pub | Bakery | Hotel | Kebab Restaurant |
| 9 Municipio 10 | Italian Restaurant | Beach | Seafood Restaurant | Ice Cream Shop | Fast Food Restaurant | Historic Site | Park | Pizza Place | Restaurant | Campground |
| 10 Municipio 11 | Italian Restaurant | Pizza Place | Hotel | Café | Park | Pool | Ice Cream Shop | Fast Food Restaurant | Gym / Fitness Center | Steakhouse |
| # Cluster 2 rome_merged.loc[rome_merged['Cluster Labels'] == 1, rome_merged.columns[[0] + list(range(4, rome_merged.shape[1]))]] | | | | | | | | | | |
| Neighborhood | 1st Most Common Venue | 2nd Most Common Venue | 3rd Most Common Venue | 4th Most Common Venue | 5th Most Common Venue | 6th Most Common Venue | 7th Most Common Venue | 8th Most Common Venue | 9th Most Common Venue | 10th Most Common Venue |
| 13 Municipio 14 | Italian Restaurant | Hotel | Pub | Asian Restaurant | Pool | Supermarket | Deli / Bodega | Restaurant | Clothing Store | Electronics Store |
| 14 Municipio 15 | Italian Restaurant | Gym / Fitness Center | Hotel | Café | Supermarket | Restaurant | Pub | Asian Restaurant | BBQ Joint | Pool |
| # Cluster 3 rome_merged.loc[rome_merged['Cluster Labels'] == 2, rome_merged.columns[[0] + list(range(4, rome_merged.shape[1]))]] | | | | | | | | | | |
| Neighborhood | 1st Most Common Venue | 2nd Most Common Venue | 3rd Most Common Venue | 4th Most Common Venue | 5th Most Common Venue | 6th Most Common Venue | 7th Most Common Venue | 8th Most Common Venue | 9th Most Common Venue | 10th Most Common Venue |
| 0 Municipio 1 | Plaza | Ice Cream Shop | Historic Site | Italian Restaurant | Sandwich Place | Wine Bar | Church | Fountain | Monument / Landmark | Pizza Place |
| 1 Municipio 2 | Plaza | Ice Cream Shop | Hotel | Historic Site | Monument / Landmark | Sandwich Place | Art Museum | Italian Restaurant | Pizza Place | History Museum |
| # Cluster 4 rome_merged.loc[rome_merged['Cluster Labels'] == 3, rome_merged.columns[[0] + list(range(4, rome_merged.shape[1]))]] | | | | | | | | | | |
| Neighborhood | 1st Most Common Venue | 2nd Most Common Venue | 3rd Most Common Venue | 4th Most Common Venue | 5th Most Common Venue | 6th Most Common Venue | 7th Most Common Venue | 8th Most Common Venue | 9th Most Common Venue | 10th Most Common Venue |
| 8 Municipio 9 | Italian Restaurant | Hotel | Soccer Field | Farm | Café | Pizza Place | Rock Club | Fast Food Restaurant | Food | Food Court |
| 11 Municipio 12 | Italian Restaurant | Hotel | Supermarket | Electronics Store | American Restaurant | Event Space | Sandwich Place | Pizza Place | Park | Department Store |
| 12 Municipio 13 | Italian Restaurant | Café | Department Store | Hotel | Sandwich Place | Furniture / Home Store | Steakhouse | Supermarket | Cafeteria | Gym / Fitness Center |
| # Cluster 5 rome_merged.loc[rome_merged['Cluster Labels'] == 4, rome_merged.columns[[0] + list(range(4, rome_merged.shape[1]))]] | | | | | | | | | | |
| Neighborhood | 1st Most Common Venue | 2nd Most Common Venue | 3rd Most Common Venue | 4th Most Common Venue | 5th Most Common Venue | 6th Most Common Venue | 7th Most Common Venue | 8th Most Common Venue | 9th Most Common Venue | 10th Most Common Venue |
| 5 Municipio 6 | Clothing Store | Italian Restaurant | Fast Food Restaurant | Café | Rest Area | Electronics Store | Shopping Mall | Discount Store | Restaurant | Ice Cream Shop |

Figure 7. Exploration of neighborhoods' clusters.

The 1st cluster has 7 neighborhood but, due to the historical sites, I can focus my selection on 3 of them Municipio 7, 8, 10. From the map, I can see the Municipio 10 is far from the center of Rome and I exclude it. Between 7 and 8, I choose **Municipio 8** because the historical sites are the 4th most common venues (6th for Municipio 7).

STEP 2. Detection of the best hotel

Defined the neighbourhood of interesting, I can proceed with the second step of my analysis.

I have to start retrieving data for Municipio 8. The first set of data concerns hotels in the neighbourhood: I obtain it with an explore in Foursquare focusing my request on the category hotel in a buffer of 5000 from the centroid of the neighborhood. The result includes 40 hotels that are visible in Figure 8 (to the left).

Starting from each hotel, I explore in Foursquare all venues around them (radius=1000, a walking distance) and I obtained 1433 venues, from 5 to 96 for each hotel. All retrieved venues are show in Figure 8 (to the left).

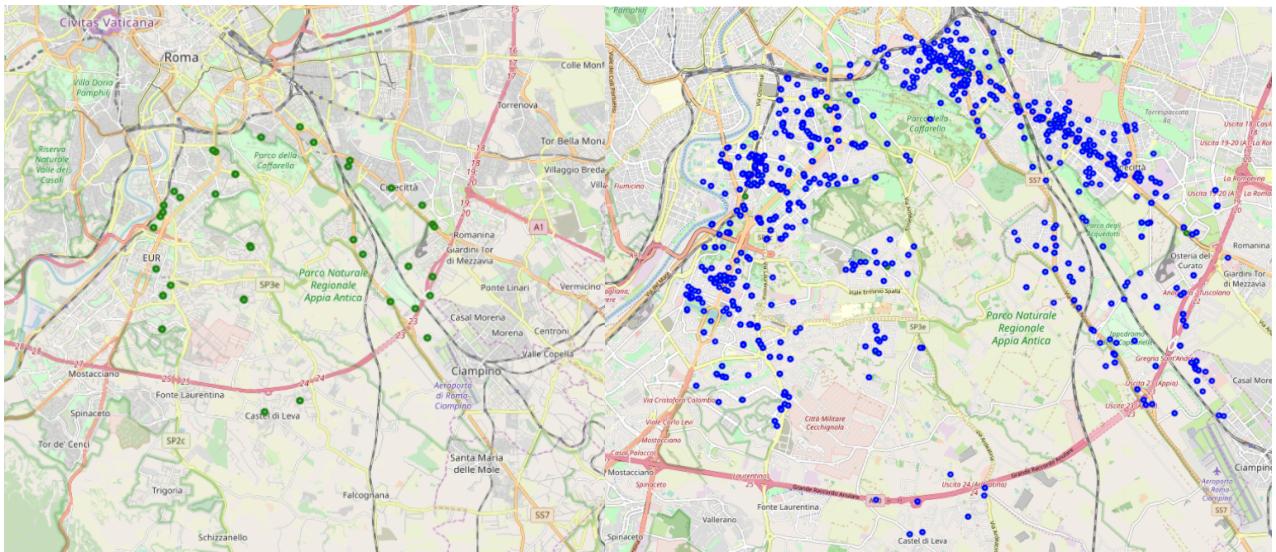


Figure 8. Map of hotels in Municipio 8 (left) and venues around them (right).

I cluster the hotels using k-Means (with k=5) obtaining the clusters depicted in Figure 9: cluster0 – red, cluster 1 – violet, cluster 2 - blue, cluster 3 - green, and cluster 4 - orange.

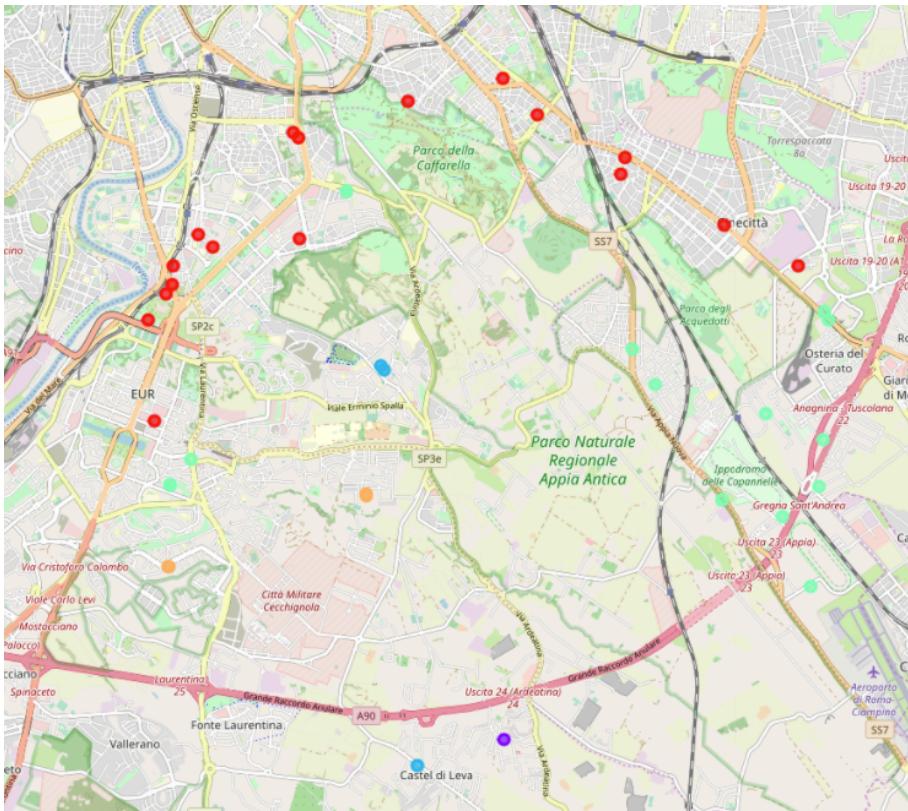


Figure 9. Hotels' clustering.

Exploring clusters (details into the notebook:), I can try to characterize them:

- The **1st cluster** (red on the map – cluster label 0) is the wider one, with 17 hotels. It is characterized mainly by Italian restaurants, pizza places, café and ice-cream shops, that are in the first 4 most common venues;
- The **2nd cluster** (violet on the map – cluster label 1) includes only 1 hotel, beside Italian restaurants and steakhouses, the markets/shops are very frequent;
- The **3rd cluster** (blue on the map – cluster label 2) is a more generic cluster but some particular kind of venues are visible: parks, gas stations, and in one case film studios;
- The **4th cluster** (green on the map – cluster label 3) is another wide cluster with 15 hotels. The most common venue is the hotels, except for one that hotels are in the second position;
- The **5th cluster** (orange on the map – cluster label 4) includes, beside pizza place coffee and hotels, “active” venues: gym/fitness centers, outdoors & recreation, and cultural centers.

Focus on my goal, I need to analysis deeper the hotels of the first cluster and, in particular, I focus my choice on those that are close to the center of Rome (Figure 10) and close to main streets, to have direct connections with the center.

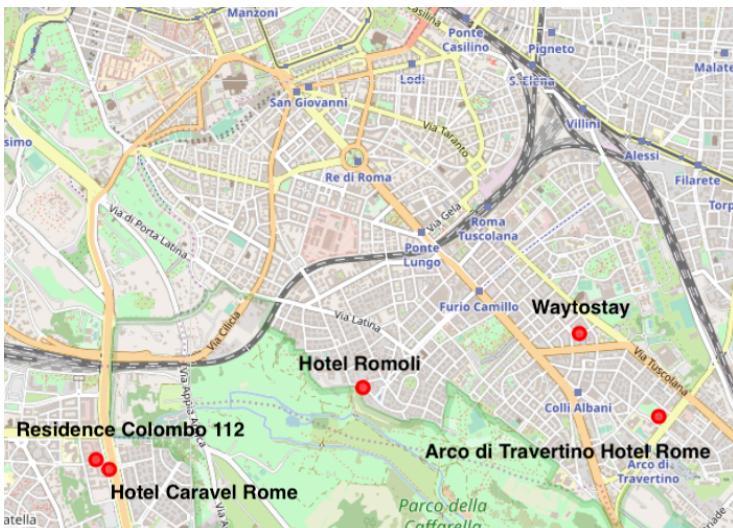


Figure 10. Hotels in the first cluster which are closer to the center of Rome.

For this reason, my choice is defined on one of these hotels:

- Arco di Travertino Hotel Rome;
- Hotel Caravel Rome;
- Residence Colombo 112;
- Waytostay.

To complete my decision, I will check the web sites of each hotel to be able to evaluate each feature and service of the hotel.

5. Conclusion

Using python, Foursquare data and data analysis, I can be able to retrieve a lot of interesting information. In particular, as described in this report, I can be supported the choice of one or more hotels that satisfy my requests, if I want to visit Rome.

I performed a two steps analysis that allows me:

- First, to define which neighborhood satisfy better my requests, and I decided that this neighborhood is Municipio 8;
- Second, focusing on this neighbourhood and their hotels and all venues, to define which hotels better satisfy my requests, and I selected 4 possible hotels.

The analysis could be improved extending it with a detailed analysis of the selected hotels on base of descriptions, ratings and tips.