Finding the best place for Italian restaurant in Paris

Lesnichenko Nikita

October 28, 2020

1. Introduction

1.1. Background

Since childhood, I dreamed of opening my own business. When I grew up a little, I began to think about which area to start my business in. Immediately I got the idea to open my own food place. But then I still could not analyze how to do it better. Now I realized that I need to start by choosing the most optimal place in the city.

1.2. Problem

Paris area data can contain information about various venues, including restaurants: their ratings, number, and so on. I need to find a place where the Italian restaurant will be most profitable.

1.3. Interest

This study can be useful for people of France (and maybe not only France) who also want to open a restaurant or other establishment, but do not know which place to choose for this.

2. Data

2.1. Data needed

Based on definition of problem, factors that were influence our decission are:

- number of existing restaurants in the neighborhood;
- number of and distance to Italian restaurants in the neighborhood, if any;
- distance of neighborhood from city center.

I decided to use regularly spaced grid of locations, centered around city center, to define our neighborhoods.

2.2. Data sources:

Following data sources were be needed to extract/generate the required information:

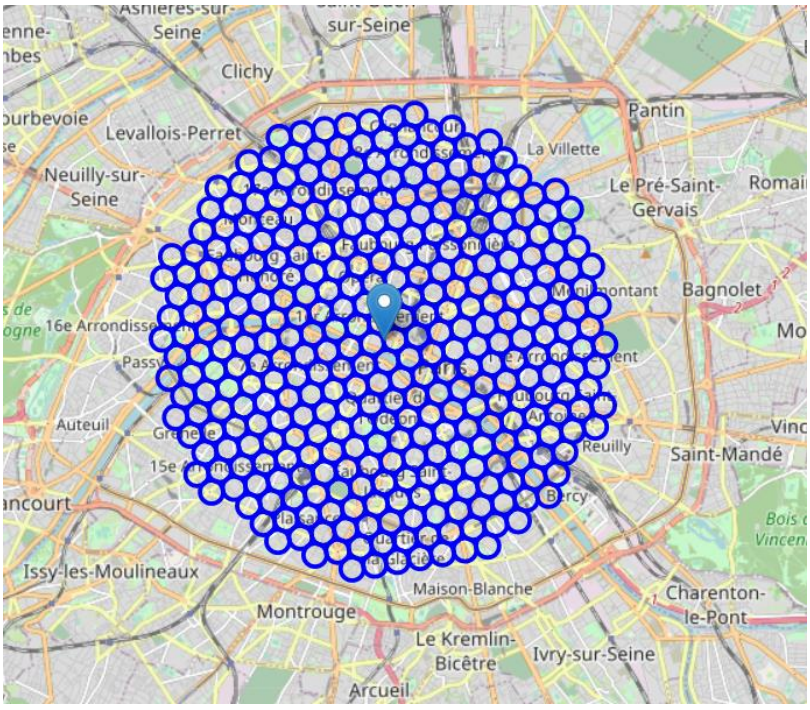
- centers of candidate areas will be generated algorithmically and approximate addresses of centers of those areas will be obtained using **Google Maps API reverse geocoding;**
- number of restaurants and their type and location in every neighborhood will be obtained using **Foursquare API;**
- coordinate of Atlanta center will be obtained using **Google Maps API geocoding.**

3. Methodology

3.1. Neighborhood Candidates

Initially, I found out what is the center of Paris. This place turned out to be the beautiful Louvre. Using Google Maps geocoding API, I found its coordinates. My plans were to create a grid of cells covering an area of interest (the area that I will analyze to accommodate an Italian restaurant there), which is aproximately 8x8 killometers centered around Paris city center, Louvre.

The result was the following grid (each circle had a radius of 200 meters):

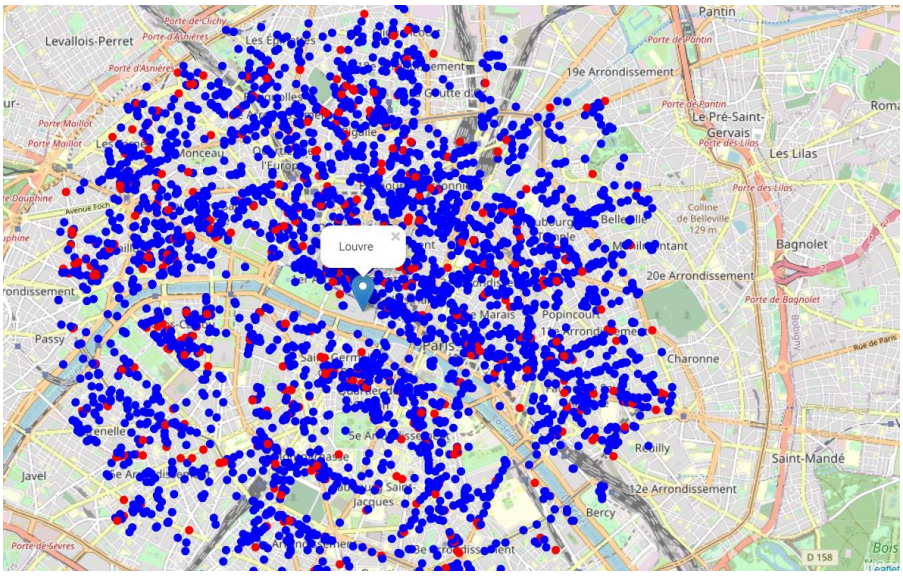


A total of 364 such circles (neighborhoods) turned out - a candidate for the best location for an Italian restaurant.

Next, I got the coordinates of the centers of all segments (their longitudes, latitudes, coordinates in 2D in a Cartesian coordinate system and their distances from the center, that is, the Louvre.)

	Address	Latitude	Longitude	X	Y	Distance from center
0	31 Rue du Père Corentin, 75014 Paris, France	48.825385	2.330262	-428872.766202	5.485943e+06	3994.996871
1	53 Avenue René Coty, 75014 Paris, France	48.825979	2.335578	-428472.766202	5.485943e+06	3893.584467
2	1 bis Rue d'Alésia, 75014 Paris, France	48.826573	2.340896	-428072.766202	5.485943e+06	3831.448812
3	13 Villa Daviel, 75013 Paris, France	48.827166	2.346213	-427672.766202	5.485943e+06	3810.511777
4	2 Rue Chéreau, 75013 Paris, France	48.827760	2.351530	-427272.766202	5.485943e+06	3831.448812
5	23 Avenue d'Italie, 75013 Paris, France	48.828353	2.356848	-426872.766202	5.485943e+06	3893.584467
6	44 Avenue Edison, 75013 Paris, France	48.828945	2.362166	-426472.766202	5.485943e+06	3994.996871
7	36 Rue Antoine Chantin, 75014 Paris, France	48.827534	2.321507	-429472.766202	5.486290e+06	3903.844259
8	Alésia, 75014 Paris, France	48.828128	2.326824	-429072.766202	5.486290e+06	3736.308338
9	3 Rue du Commandeur, 75014 Paris, France	48.828723	2.332141	-428672.766202	5.486290e+06	3605.551275

With the coordinates, we could already start using the Foursquare API to find venues in each circle of the grid. As a result of inquiries, it was received that within the network there are **~3700 various restaurants, ~ 430 Italian restaurants**. That is, Italian restaurants accounted for almost 12% of the total. And on one circle of the grid there were >7 restaurants on average.
I marked the points on the area of interest where the restaurants were located: red for Italian restaurants, blue for all the others:



Thus, all the data needed for further analysis was collected.

3.2. Analysis

I counted the number of restaurants in every area candidate:

```
Average number of restaurants in every area with radius=300m: 7.428571428571429
```

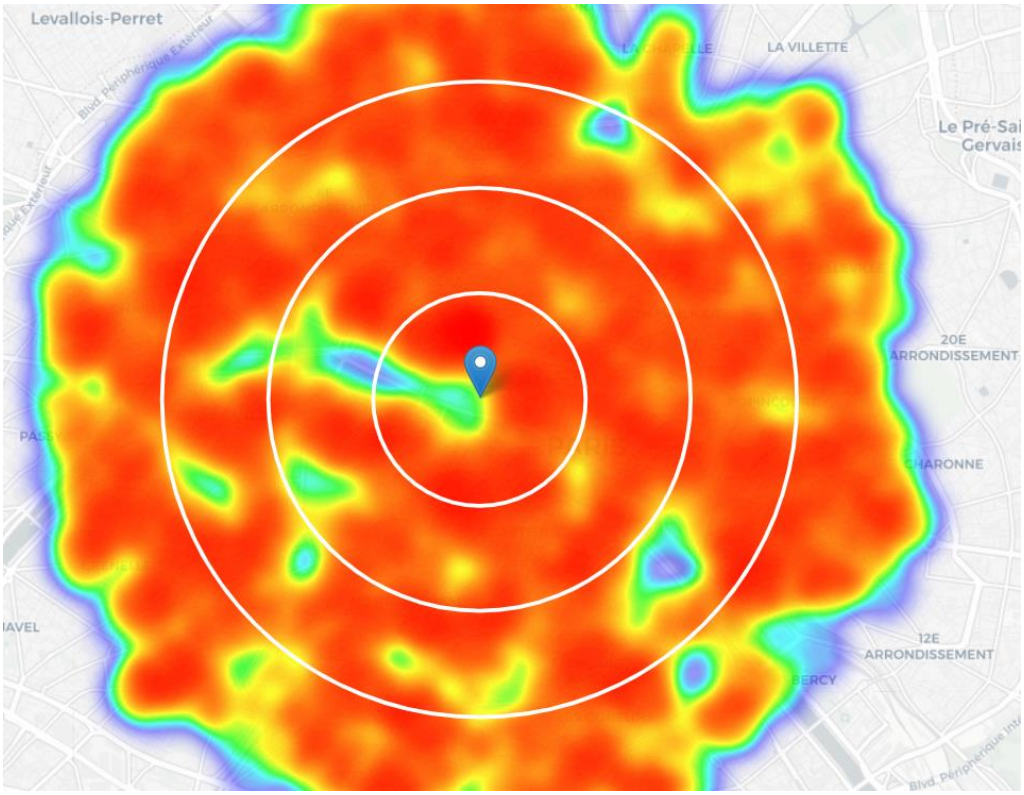
	Address	Latitude	Longitude	X	Y	Distance from center	Restaurants in area
0	31 Rue du Père Corentin, 75014 Paris, France	48.825385	2.330262	-428872.766202	5.485943e+06	3994.996871	3
1	53 Avenue René Coty, 75014 Paris, France	48.825979	2.335578	-428472.766202	5.485943e+06	3893.584467	1
2	1 bis Rue d'Alésia, 75014 Paris, France	48.826573	2.340896	-428072.766202	5.485943e+06	3831.448812	5
3	13 Villa Daviel, 75013 Paris, France	48.827166	2.346213	-427672.766202	5.485943e+06	3810.511777	4
4	2 Rue Chéreau, 75013 Paris, France	48.827760	2.351530	-427272.766202	5.485943e+06	3831.448812	19
5	23 Avenue d'Italie, 75013 Paris, France	48.828353	2.356848	-426872.766202	5.485943e+06	3893.584467	9
6	44 Avenue Edison, 75013 Paris, France	48.828945	2.362166	-426472.766202	5.485943e+06	3994.996871	1
7	36 Rue Antoine Chantin, 75014 Paris, France	48.827534	2.321507	-429472.766202	5.486290e+06	3903.844259	1
8	Alésia, 75014 Paris, France	48.828128	2.326824	-429072.766202	5.486290e+06	3736.308338	6
9	3 Rue du Commandeur, 75014 Paris, France	48.828723	2.332141	-428672.766202	5.486290e+06	3605.551275	3

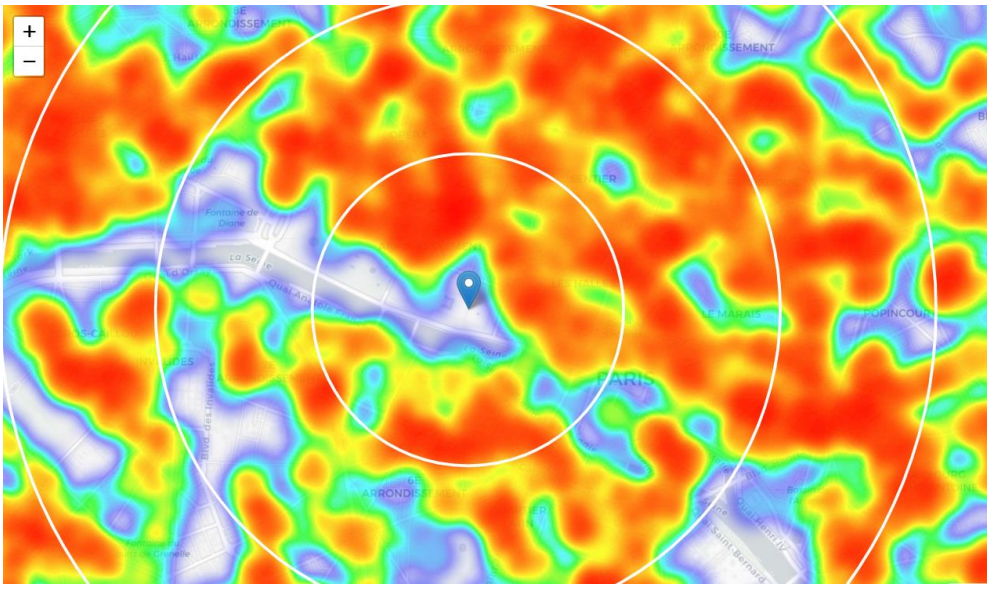
Then I counted the distance to nearest Italian restaurant from every area candidate center:

	Address	Latitude	Longitude	X	Y	Distance from center	Restaurants in area	Distance to italian restaurant
0	31 Rue du Père Corentin, 75014 Paris, France	48.825385	2.330262	-428872.766202	5.485943e+06	3994.996871	3	199.579758
1	53 Avenue René Coty, 75014 Paris, France	48.825979	2.335578	-428472.766202	5.485943e+06	3893.584467	1	283.367859
2	1 bis Rue d'Alésia, 75014 Paris, France	48.826573	2.340896	-428072.766202	5.485943e+06	3831.448812	5	123.449354
3	13 Villa Daviel, 75013 Paris, France	48.827166	2.346213	-427672.766202	5.485943e+06	3810.511777	4	113.650714
4	2 Rue Chéreau, 75013 Paris, France	48.827760	2.351530	-427272.766202	5.485943e+06	3831.448812	19	150.072825
5	23 Avenue d'Italie, 75013 Paris, France	48.828353	2.356848	-426872.766202	5.485943e+06	3893.584467	9	82.848414
6	44 Avenue Edison, 75013 Paris, France	48.828945	2.362166	-426472.766202	5.485943e+06	3994.996871	1	434.488096
7	36 Rue Antoine Chantin, 75014 Paris, France	48.827534	2.321507	-429472.766202	5.486290e+06	3903.844259	1	286.476357
8	Alésia, 75014 Paris, France	48.828128	2.326824	-429072.766202	5.486290e+06	3736.308338	6	245.411004
9	3 Rue du Commandeur, 75014 Paris, France	48.828723	2.332141	-428672.766202	5.486290e+06	3605.551275	3	152.170701

Average distance to closest Italian restaurant from each area center was 207.8m.
So, that is, on **average**, we could find a restaurant within a radius of **210 meters** from the center of each circle. It's pretty close, so it had to be more accurate.

I created a map showing **heatmap */* density of restaurants** and try to extract some meaningfull info from that. Also, I showed a few circles indicating distance of 1km, 2km and 3km from Louvre.





Looks like a few pockets of low restaurant density closest to city center can be found **south-west and west from Louvre**.

I created another heatmap map showing **heatmap/density of Italian restaurants** only:

This map is not so 'hot' (Italian restaurants represent a subset of ~12% of all restaurants in Paris) but it also indicates higher density of existing Italian restaurants directly south, north and east from Louvre, with closest pockets of **low Italian restaurant density positioned west and south-west from city center**.

Paris is divided into 20 administrative regions. Each district is like a separate city. The mayor is here, and the living conditions for tourists are different. We will tell you about each district from the point of view of the position for tourists. Here is a map of Paris with districts to better understand what we are talking about. And at the end of the article, you will find a video with all the districts.

Based on this we will now focus our analysis on areas *west and south-west from Paris center* - we will move the center of our area of interest and reduce it's size to have a radius of **1.5km**. This places our location candidates mostly in boroughs **7E arroundissement and 8E arroundissement**.

3.3. 7E and 8E arroundissements

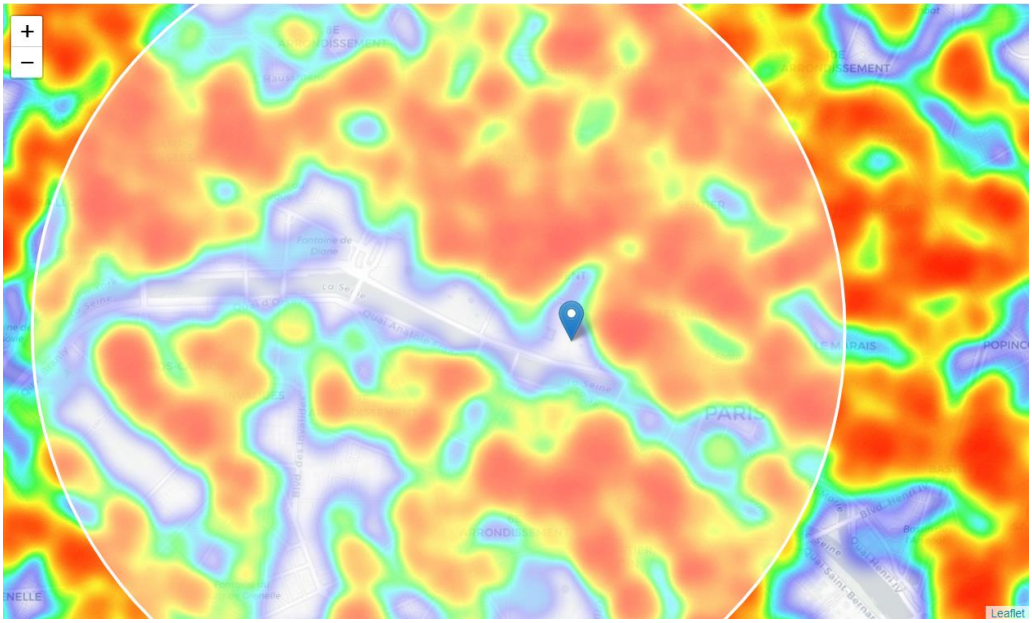
Analysis of popular travel guides and web sites often mention 7E and 8E arroundissements as beautifull, interesting, rich with culture, 'hip' and 'cool' Paris neighborhoods popular with tourists and loved by parisians.

"*This is where happiness is! The 7th arrondissement is home to the Eiffel Tower. Here you can find a hotel with a view of it. There are many museums in the area, such as Orsay. And also in the 7th district there is a huge number of official structures - parliament, various ministries and embassies. So the area is safe, but there are a lot of tourists*." (paris10.ru)

"*The 8th arrondissement is, first of all, the Champs Elysees. Here you will find the main avenue of Paris, the oldest train station - Saint-Lazare, and one of the symbols of France - the Arc de Triomphe. The French president himself lives in the eighth arrondissement. The Champs Elysees is located just outside the Champs Elysees. Living in the eighth arrondissement is, to put it mildly, not cheap, but extremely prestigious!*" (paris10.ru)

Popular with tourists, expensive but booming and trendy, relatively close to the city center and well-developed networks with some of the most famous attractions, these areas seem to warrant further analysis.

I decided to move the circle of interest so that it mainly covers the areas of 7E and 8 E erroundissements, that is, the areas where the density of Italian restaurants is least:

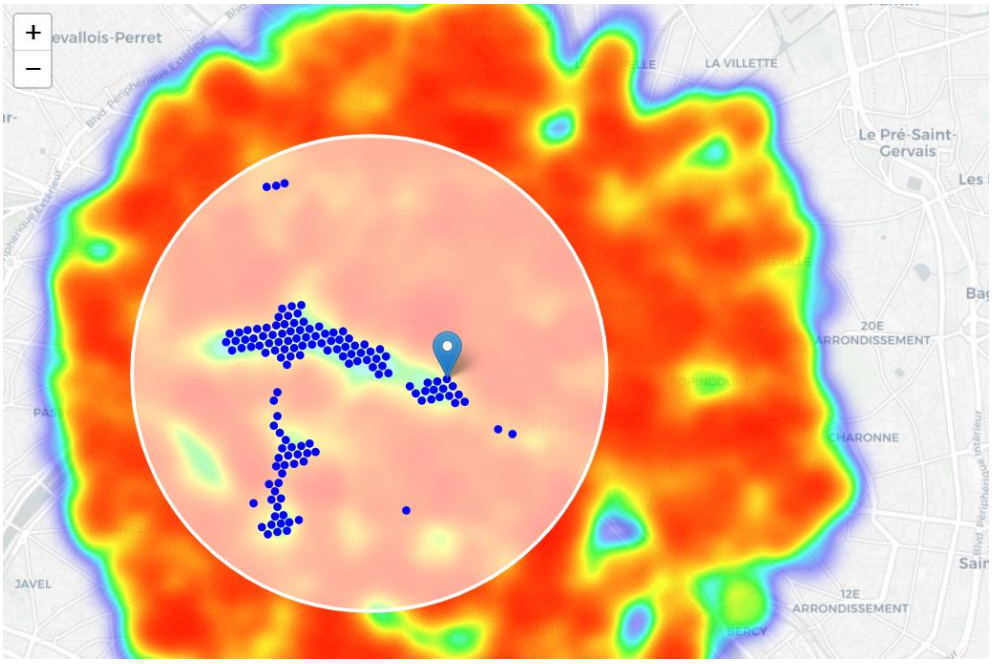


I created new, more dense grid of location candidates restricted to my new region of interest (location candidates 100m appart). Then I created a table in which each point had coordinates (as before, latitude, longitude, 2D), the number of restaurants within a radius of 200 meters, and the distance to the nearest Italian restaurant.

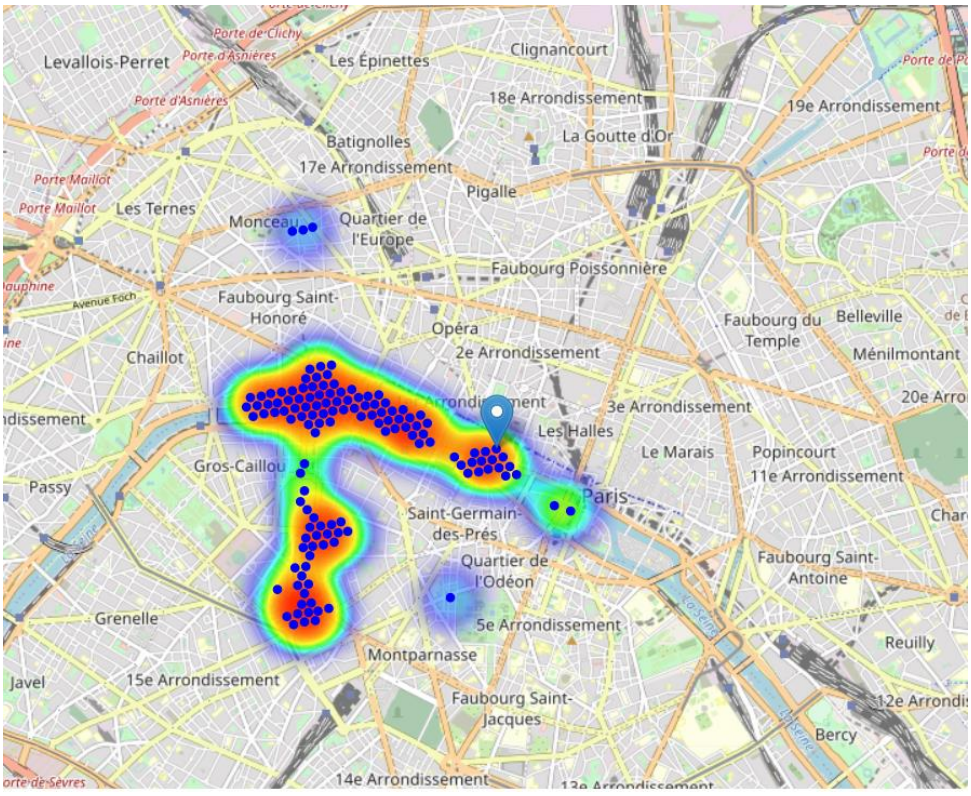
	Latitude	Longitude	X	Y	Restaurants nearby	Distance to Italian restaurant
0	48.845857	2.310649	-429922.766202	5.488454e+06	2	220.743715
1	48.846006	2.311979	-429822.766202	5.488454e+06	2	300.072111
2	48.846155	2.313308	-429722.766202	5.488454e+06	0	375.379051
3	48.846304	2.314638	-429622.766202	5.488454e+06	0	349.931459
4	48.846452	2.315968	-429522.766202	5.488454e+06	0	280.963068
5	48.846601	2.317297	-429422.766202	5.488454e+06	5	235.432507
6	48.846750	2.318627	-429322.766202	5.488454e+06	8	220.558870
7	48.846898	2.319957	-429222.766202	5.488454e+06	13	220.608405
8	48.847047	2.321287	-429122.766202	5.488454e+06	12	217.784361
9	48.847196	2.322616	-429022.766202	5.488454e+06	9	171.212800

There were 1667 such points in total.

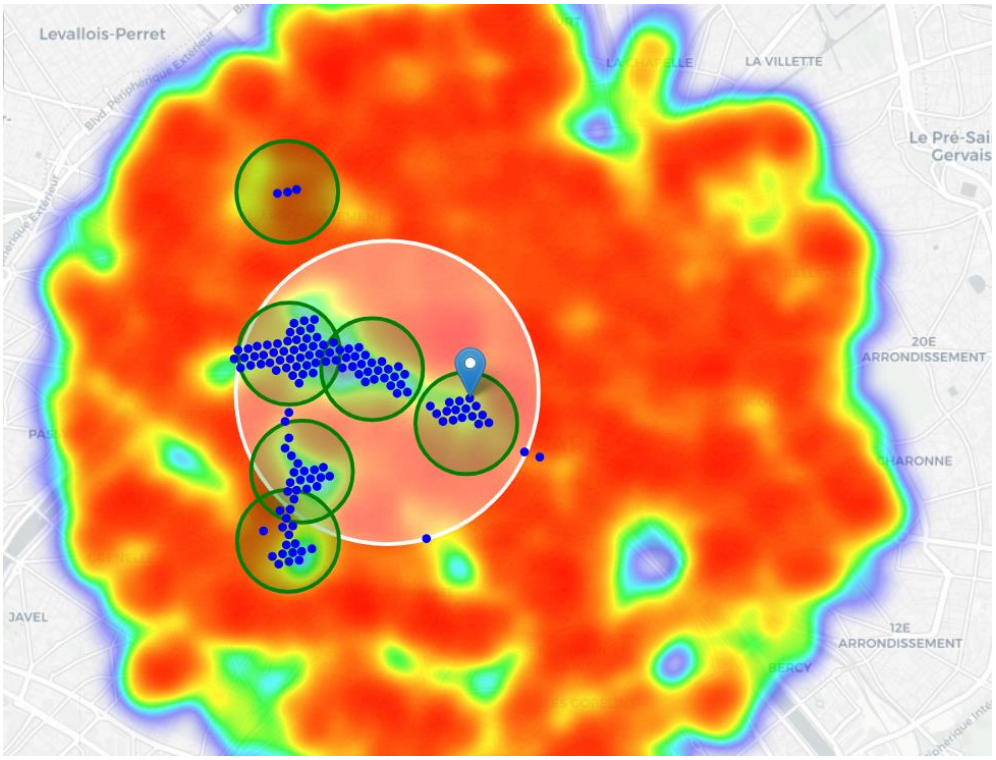
Then I filtered these points according to the following criteria: there should be no more than 2 restaurants within a radius of 200 meters from the point, and there should not be an Italian restaurant within a radius of 300 meters from the point.
I plotted the resulting points on a heatmap:



Then I changed the map a bit, leaving only the resulting areas as a heatmap:



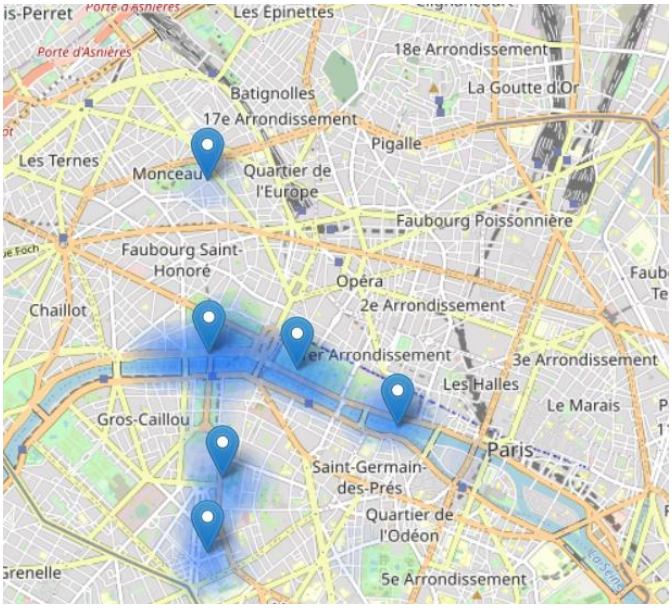
Now it was possible to apply machine learning, namely clustering, to get the centroids of these places:



Then I got the addresses of each centroid with the distance from it to the Louvre:

```
1 Pont Alexandre III, 75008 Paris                => 1.9km from Louvre
8 Boulevard des Invalides, 75007 Paris           => 1.8km from Louvre
Pont des Arts, Pont des Arts, 75006 Paris        => 0.2km from Louvre
18 Quai des Tuileries, 75001 Paris               => 1.0km from Louvre
65 Rue de Monceau, 75008 Paris                   => 2.8km from Louvre
12 Rue du Général Bertrand, 75007 Paris          => 2.3km from Louvre
```

Well, and finally, I put these places on the map, in parallel adding shadows to the places where the final points accumulate:



4. Results and Discussion

My analysis shows that although there is a great number of restaurants in Paris (~3500 in my initial area of interest which was 8x8km around Louvre), there are pockets of low restaurant density fairly close to city center. Highest concentration of restaurants was detected north, east and south from Louvre, so I focused my attention to areas west and south-west, corresponding to boroughs 7E and 8E arroundissements, which offer a combination of popularity among tourists, closeness to city center, strong socio-economic dynamics *and* a number of pockets of low restaurant density.
After directing our attention to this more narrow area of interest (covering approx. 3x3km west from Louvre) I first created a dense grid of location candidates (spaced 100m appart); those locations were then filtered so that those with more than two restaurants in radius of 200m and those with an Italian restaurant closer than 300m were removed.
Those location candidates were then clustered to create zones of interest which contain greatest number of location candidates. Addresses of centers of those zones were also generated using reverse geocoding to be used as markers/starting points for more detailed local analysis based on other factors.
Result of all this is 6 zones containing largest number of potential new restaurant locations based on number of and distance to existing venues - both restaurants in general and Italian restaurants particularly. This, of course, does not imply that those zones are actually optimal locations for a new restaurant(for example, many zones quite strongly capture the Seine, it is much more problematic to locate a restaurant on the water, but, in general, there are nuances everywhere)! Purpose of this analysis was to only provide info on areas close to Paris center but not crowded with existing restaurants (particularly Italian) - it is entirely possible that there is a very good reason for small number of restaurants in any of those areas, reasons which would make them unsuitable for a new restaurant regardless of lack of competition in the area. Recommended zones should therefore be considered only as a starting point for more detailed analysis which could eventually result in location which has not only no nearby competition but also other factors taken into account and all other relevant conditions met.

5. Conclusion

Purpose of this project was to identify Paris areas close to center with low number of restaurants (particularly Italian restaurants) in order to aid stakeholders in narrowing down the search for optimal location for a new Italian restaurant. By calculating restaurant density distribution from Foursquare data we have first identified general boroughs that justify further analysis (7E and 8E arroundissements), and then generated extensive collection of locations which satisfy some basic requirements regarding existing nearby restaurants. Clustering of those locations was then performed in order to create major zones of interest (containing greatest number of potential locations) and addresses of those zone centers were created to be used as starting points for final exploration by stakeholders.

Final decission on optimal restaurant location will be made by stakeholders based on specific characteristics of neighborhoods and locations in every recommended zone, taking into consideration additional factors like attractiveness of each location (proximity to park or water), levels of noise / proximity to major roads, real estate availability, prices, social and economic dynamics of every neighborhood etc.