Best location for a car rental agency in Paris

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1. Introduction

a. Description of the problem and a discussion of the background

Paris is the most densely populated capital city in Europe and the fourth in the world (21,498/km² - 53,000/sq mi). As a consequence the real estate prices are amongst the highest in the world (8th in the world with 14,017.63 $ per square meter).

Paris being a city where relatively few people possess a car (due to excessive taxes and parking fees). So a car rental agency can be a juicy business because a lot of residents may need occasionally a car

For this project let's put ourselves in the shoes of an entrepreneur looking to open a car rental agency. So for the location we have to find a balance between the real estate prices and the presence of competitors.

2. Data description

To solve this problem we will use the following data :

- An excel file (Arrondissements_Paris.xlsx) downloaded from "Open platform for French public data" containing the list of all the Paris districts with their coordinates. [1]
- Foursquare API to get the car rental agencies for each district [2]
- The real estate prices for all Paris districts [3]

3. Methodology

a. Loading and exploring dataset

I gathered for all the districts the coordinates and the housing prices in one file "Arrondissements_Paris.xlsx" :

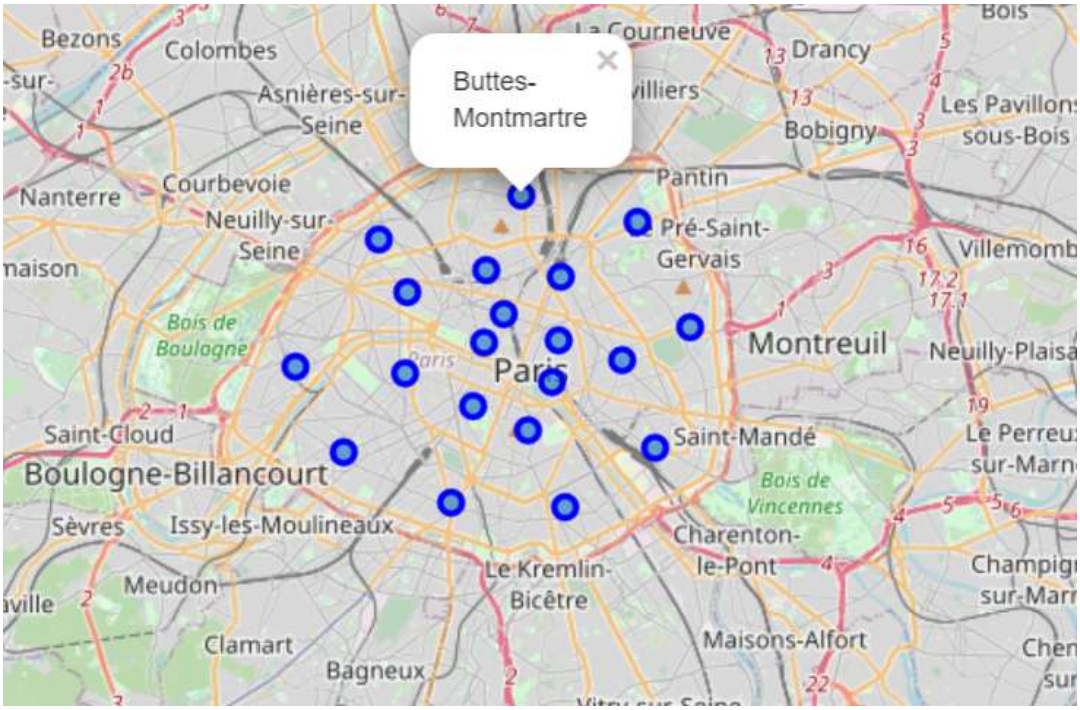
strict_Number	Numéro d'arrondissement INSEE	Nom de l'arrondissement	District_Name	N_SQ_CO	Surface	Périmètre	Latitude	Longitude	average housing price
17	75117	17ème Ardt	Batignolles-Monceau	750001537	5.668835e+06	10775.579516	48.883669	2.303638	10210
20	75120	20ème Ardt	Ménilmontant	750001537	5.983446e+06	10704.940486	48.865439	2.400913	8560
9	75109	9ème Ardt	Opéra	750001537	2.178303e+06	6471.588290	48.877164	2.337458	10730
18	75118	18ème Ardt	Buttes-Montmartre	750001537	5.996051e+06	9916.464176	48.892569	2.348161	9360
3	75103	3ème Ardt	Temple	750001537	1.170883e+06	4519.263648	48.862872	2.360001	12260

We kept only the following columns : PostalCode,District_Number,District_Name and the coordinates :

	PostalCode	District_Number	District_Name	Latitude	Longitude	average housing price
0	75017	17	Batignolles-Monceau	48.883669	2.303638	10210
1	75020	20	Ménilmontant	48.865439	2.400913	8560
2	75009	9	Opéra	48.877164	2.337458	10730
3	75018	18	Buttes-Montmartre	48.892569	2.348161	9360
4	75003	3	Temple	48.862872	2.360001	12260

b. Paris districts visualization

Visualization of the Paris 20 districts using a folium map :



c. Retrieving car rental agencies coordinates using the Foursquare API :

After getting all the needed data from Foursquare we created a data frame with the number of car rental agencies per district :

	Postal_code	Number_of_car_agencies
0	75001	17
1	75002	11
2	75003	11
3	75004	13
4	75005	12

Then we merge it with the data frame containing all the districts coordinates and the housing prices :

PostalCode	District_Number	District_Name	Latitude	Longitude	average housing price	Car_rental_agencies
75001	1	Louvre	48.862563	2.336443	12840	17
75002	2	Bourse	48.868279	2.342803	11250	11
75003	3	Temple	48.862872	2.360001	12260	11
75004	4	Hôtel-de-Ville	48.854341	2.357630	12790	13
75005	5	Panthéon	48.844443	2.350715	12140	12
75006	6	Luxembourg	48.849130	2.332898	14180	13
75007	7	Palais-Bourbon	48.856174	2.312188	13230	10
75008	8	Élysée	48.872721	2.312554	11240	14

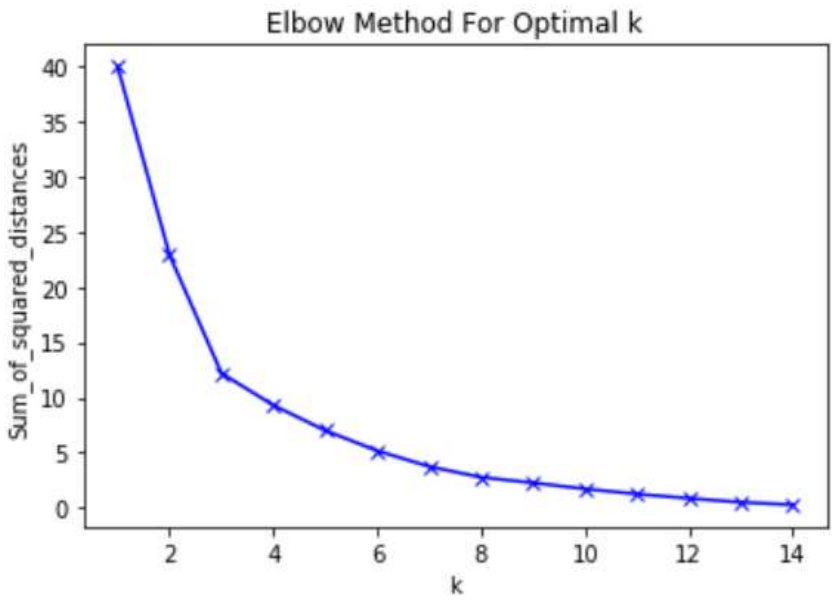
The total number of car agencies in Paris is 229.

d. Clustering districts with Kmeans method

First we extracted the relevant data (the column "Car_rental_agencies" which contains the number of car rental agencies for each district and the column “average housing price”).

After we normalized the data, we used unsupervised learning K-means algorithm to cluster the districts because the data is unlabeled.

We determined the optimal k using the elbow method :

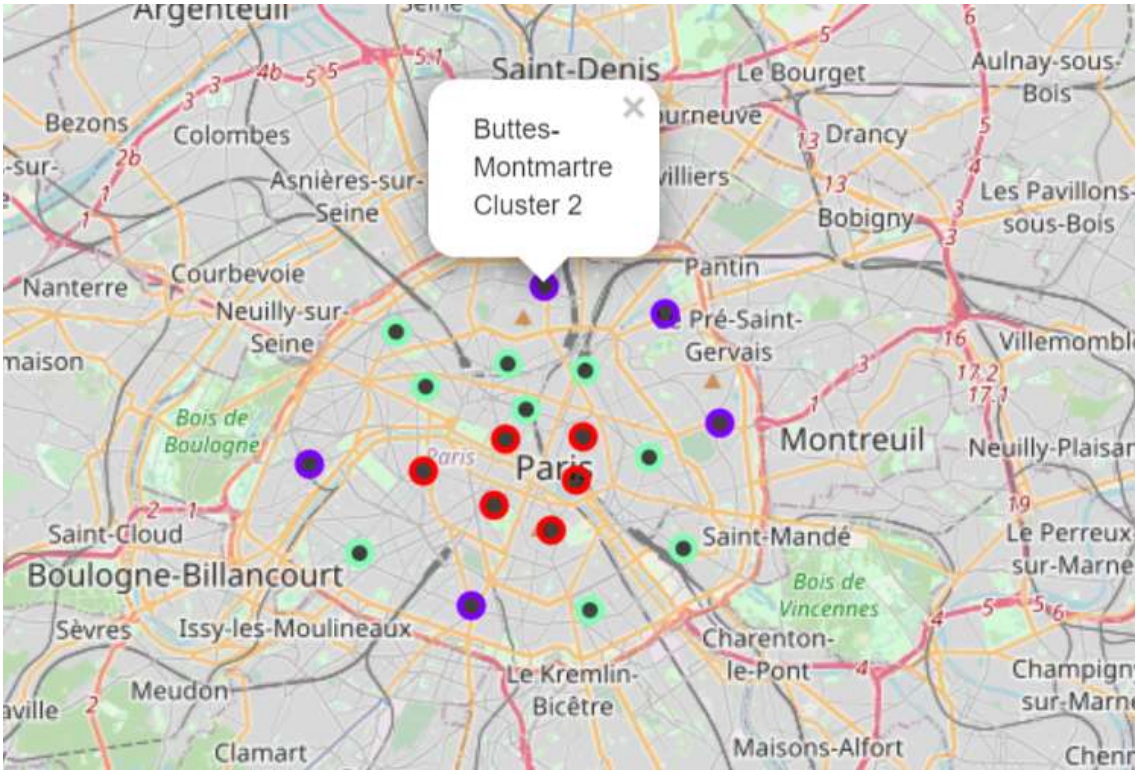


In the plot above the elbow is at k=3 indicating the optimal k for this dataset is 3

4. Results

a. Visualization of the resulting clusters

To visualize the clusters we used a Folium map :

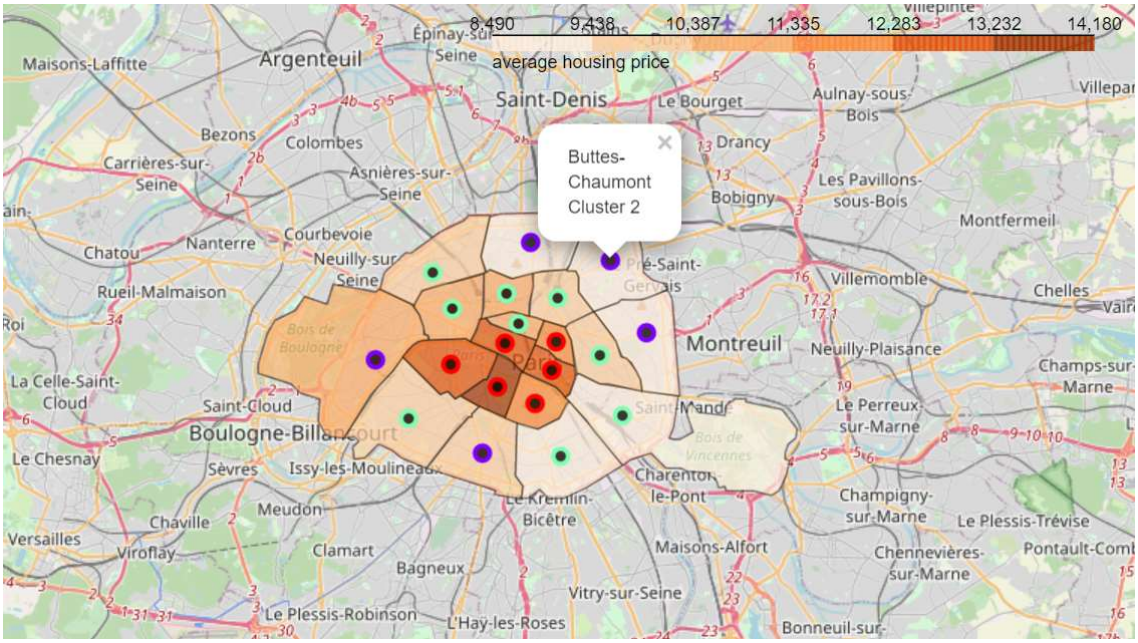


We can label the clusters as follows :

- Cluster 0 (green markers) : High number of car rental agencies and low housing prices
- Cluster 1(red markers) : High number of car rental agencies and high housing prices
- Cluster 2(purple markers) : low number of car rental agencies and low housing prices

From a json file file 'arrondissements.geojson' with the paris district coordinates we created a choropleth map containing :

- The district name
- The cluster name
- The average housing price



5. Discussion

Our results show that there are relatively few car rental agencies in Paris (229) so our first intuition that Paris has relatively few car rental agencies has been confirmed.

It seems wise to choose a district from the cluster 2 with low density of car rental agencies and low housing prices such as "Buttes-Montmartre","Buttes-Chaumont","Ménilmontant","Passy" or "Observatoire" (The purple markers in the above map).

Among these districts "Passy" and "Observatoire" would be a better choice since they draw an important business clientele.

These recommendations have to be considered only as a starting point, others factors have to be taken into account such as the road traffic and the availability of building lands in the concerned districts

6. Conclusion

The aim of this project was to identify the best location to open a car rental agency , a district with few car rental agencies and low housing prices.

By using KMeans clustering method with data coming from Foursquare API we clustered Paris districts into 3 clusters:

- Cluster 0 : High number of car rental agencies and low housing prices
- Cluster 1 : High number of car rental agencies and high housing prices
- Cluster 2 : low number of car rental agencies and low housing prices

We highlighted that the cluster 2 was the better choice.

This cluster contains the following district : "Buttes-Montmartre","Buttes-Chaumont","Ménilmontant","Passy" or "Observatoire"

Besides of this recommendation the final decision must take into account some more factors such as the road traffic and the availability of building lands.

7. References

- [1] Paris districts coordinates
- [2] Foursquare API
- [3] Average housing prices in Paris