Searching for the best place in Paris to have a restaurant

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I.   Introduction/Business Problem

a. Background

Paul is a chef who works in a great Paris restaurant called Fouquet's. He worked in this restaurant for 15 years and has always done a good job. Today, Paul's ambition is to open his restaurant in Paris and have his own employees. It will be a French restaurant. Paul asks himself a single question: what is the best place to open his restaurant? He would like to open it in a place frequented by many people to maximize his income. So, let's get try to help Paul finding the BEST place!

b. Target audience

We want to help Paul. But this problem can be applied to all contractors, especially contractors in the commercial sector who want to make the most benefit of their business.
We all know that it is more interesting to develop a business in popular sectors especially if the business is directly aimed at consumers. For an electricity supplier company for example, it is not mandatory for it to be in a popular area because generally the subscription to an electricity contract is generally done by phone or internet. Nobody moves to the company for that. On the other side, people often go on site when having lunch or dinner, in a well-attended restaurant allocated in a pleasant area. So, it's more interesting to place a restaurant near popular places.

II.   Data

I will select the popular places where people like to go. Because these places are very frequented by people and so after good hours of shopping or cinema, they are probably hungry.

To do that, I will use Foursquare location data to select the most popular places in Paris. I will first use a geolocator to get the longitude and latitude of Paris and then I will pass it on the url calling Foursquare API. I will use the exploring mode while calling at Foursquare. This will return several data about popular places such as name, id, categories, longitude, latitude, address …

III. Methodology

Foursquare is a technology platform that powers leading business solutions and consumer products through a deep understanding of location. Foursquare's location platform makes several tools and data available to leading brands and companies, helping them to locate, engage with, message and measure consumers. It helps to build the most trusted, independent location platform for understanding how people move through the real world.

From Foursquare location data, I used to explore popular venues in Paris. This returns a list of recommended venues near the current location (Paris). It is represented into a data frame with the following columns:

- name
- categories
- address
- cc
- city
- country
- crossStreet
- distance
- formattedAddress
- labeledLatLngs
- lat (latitude of the place)
- lng (longitude of place)
- postalCode
- state
- id

	name	categories	address	cc	city	country	crossStreet	distance	formattedAddress	labeledLatLngs	lat	lng	postalCode	state	id
0	Place de l'Hôtel de Ville – Esplanade de la Li...	Plaza	Place de l'Hôtel de Ville	FR	Paris	France	NaN	60	[Place de l'Hôtel de Ville, 75004 Paris, France]	NaN	48.857138	2.351693	75004	Île-de-France	4bf41231e5eba59334341f90
1	Häagen-Dazs	Ice Cream Shop	1 rue d'Arcole	FR	Paris	France	NaN	218	[1 rue d'Arcole, 75004 Paris, France]	[{'label': 'display', 'lat': 48.85487262126511...	48.854873	2.350125	75004	Île-de-France	4cb2fc20db32f04d6da9d34d
2	LUSH	Cosmetics Shop	3 rue du Renard	FR	Paris	France	NaN	131	[3 rue du Renard, 75004 Paris, France]	[{'label': 'display', 'lat': 48.85779127633849...	48.857791	2.351622	75004	Île-de-France	4d628e33e4fe548152b8979e
3	L'Alsacien	Alsatian Restaurant	6 rue Saint-Bon	FR	Paris	France	NaN	202	[6 rue Saint-Bon, 75004 Paris, France]	[{'label': 'display', 'lat': 48.85827502747949...	48.858275	2.350381	75004	Île-de-France	54351b59498e123ee4afc7ff
4	BHV Marais	Department Store	52 rue de Rivoli	FR	Paris	France	Rue de Rivoli	171	[52 rue de Rivoli (Rue de Rivoli), 75004 Paris...	[{'label': 'display', 'lat': 48.85721020405602...	48.857210	2.353651	75004	Île-de-France	4b4b6a3df964a520b89a26e3
5	Maison Aleph	Pastry Shop	20 rue de la Verrerie	FR	Paris	France	NaN	260	[20 rue de la Verrerie, 75004 Paris, France]	[{'label': 'display', 'lat': 48.857348, 'lng':...	48.857348	2.354873	75004	Île-de-France	59247f4e0d2be70573edd834

Figure 1 – Five first rows the extracted data frame

I plotted each row of the data frame based on the latitude and longitude information in a Map by using **folium**.

folium is a library that builds on the data wrangling strengths of the Python ecosystem and the mapping strengths of the leaflet.js library. It is possible to manipulate data in Python, then visualize it in on a Leaflet map via folium. folium makes it easy to visualize data that's been manipulated in Python on an interactive leaflet map. It enables both the binding of data to a map for choropleth visualizations as well as passing rich vector/raster/HTML visualizations as markers on the map.

To have a better vision of boroughs in Paris, I have also added in the Map the longitude and latitude information of each borough in Paris (75001, 75002, 75003, 75004, 75005, …, 75020). This allowed me to locate the borough where there is the greatest number of popular venues.

Afterwards, I used a clustering method called **K-Means clustering** to help Paul finding popular places that are near to the **center** of the chosen borough. I chose to interest myself in the center of the borough because generally, in the center of the boroughs in Paris, there is a lot of subway stations. Buses and other means of transportation (like "vélo Lib" for example) are also mainly located in the center of boroughs. As Parisians travel mainly by public transport, they like to be able to have access to transportation in a few minutes particularly subways and buses which run until late hours. So, having the opportunity to place a restaurant near main transportation will further promote the increase of customer base.

To do that, I did not take values of column "distance" in the Data Frame because I did not know what there are related to. I opted for computing the real distance between each datapoint and the center of the chosen borough. This was done with a function named **Great-circle distance**.

Theoretically, the Great-circle distance or orthodromic distance is the shortest distance between two points on the surface of a sphere, measured along the surface of the sphere (as opposed to a straight line through the sphere's interior). The distance between two points in Euclidean space is the length of a straight line between them, but on the sphere, there are no straight lines. In spaces with curvature, straight lines are replaced by geodesics. Geodesics on the sphere are circles on the sphere whose centers coincide with the center of the sphere and are called great circles.
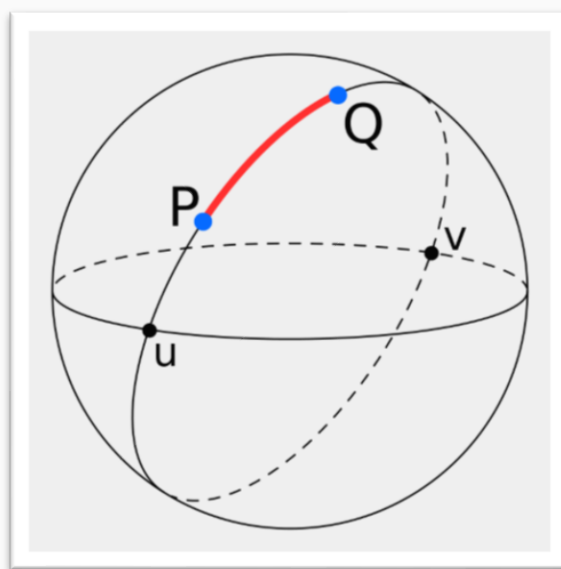

Figure 2 – *Illustration of a great-circle distance (drawn in red) between two points on a sphere, P and Q. Two antipodal points, u and v, are also shown.*

Great-circle distance is a function available in Python on the library **geopy**.
geopy is a Python 2 and 3 client for several popular geocoding web services. geopy makes it easy for Python developers to locate the coordinates of addresses, cities, countries, and landmarks across the globe using third-party geocoders and other data sources. Geopy can calculate geodesic distance between two points using the great-circle distance.

The clustering method I used, is based on distance calculated and then return two clusters of data points: a first cluster with the nearest points of the center of the borough and a second cluster with the farthest points of the center.

IV.   Results

a. Data visualization with Map

As said above, I have plotted a Map which represents popular places (blue circles) and boroughs of Paris (red circles) based on data frame extracted on Foursquare.
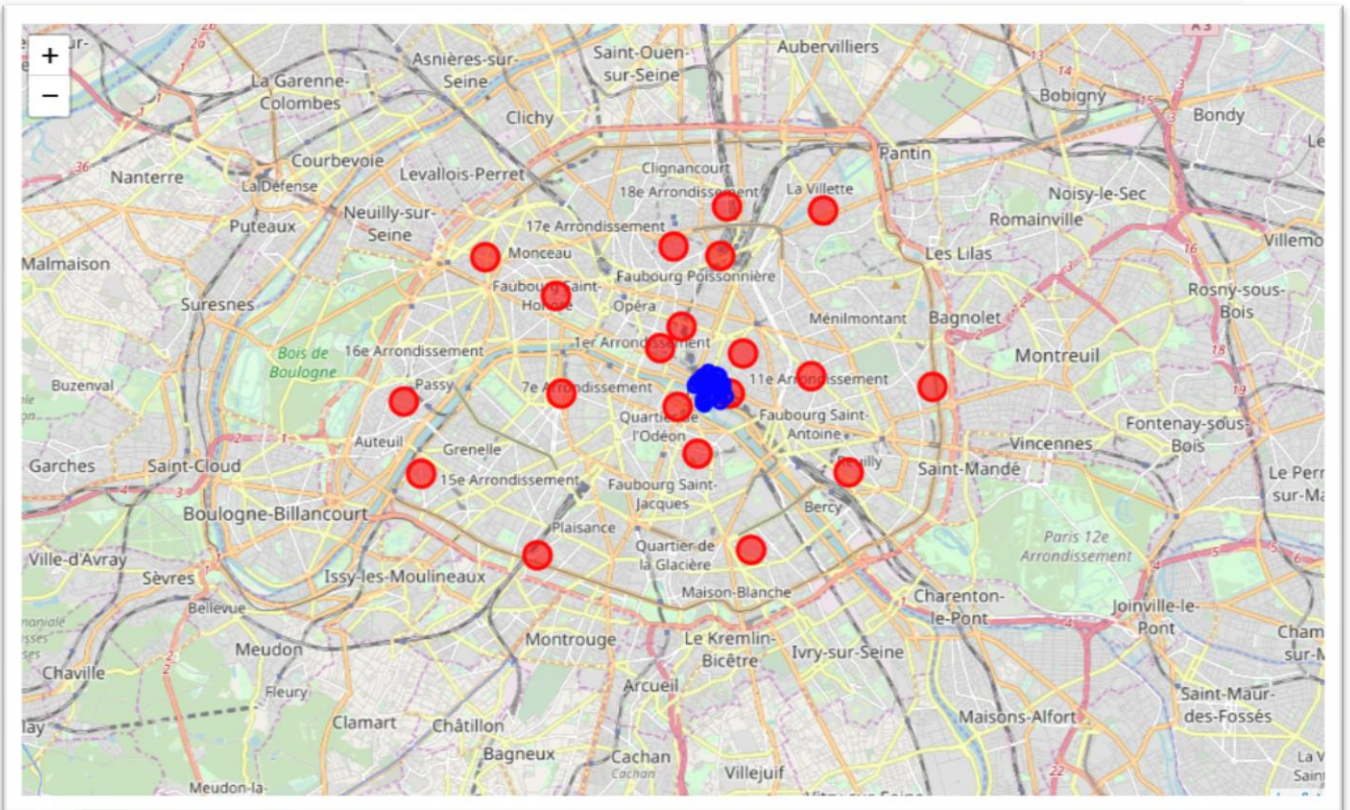
Let's visualize the result map of this operation below:

Figure 3 – Map plot of data

When I make a zoom, I can see that popular venues are more around the borough **75004**:
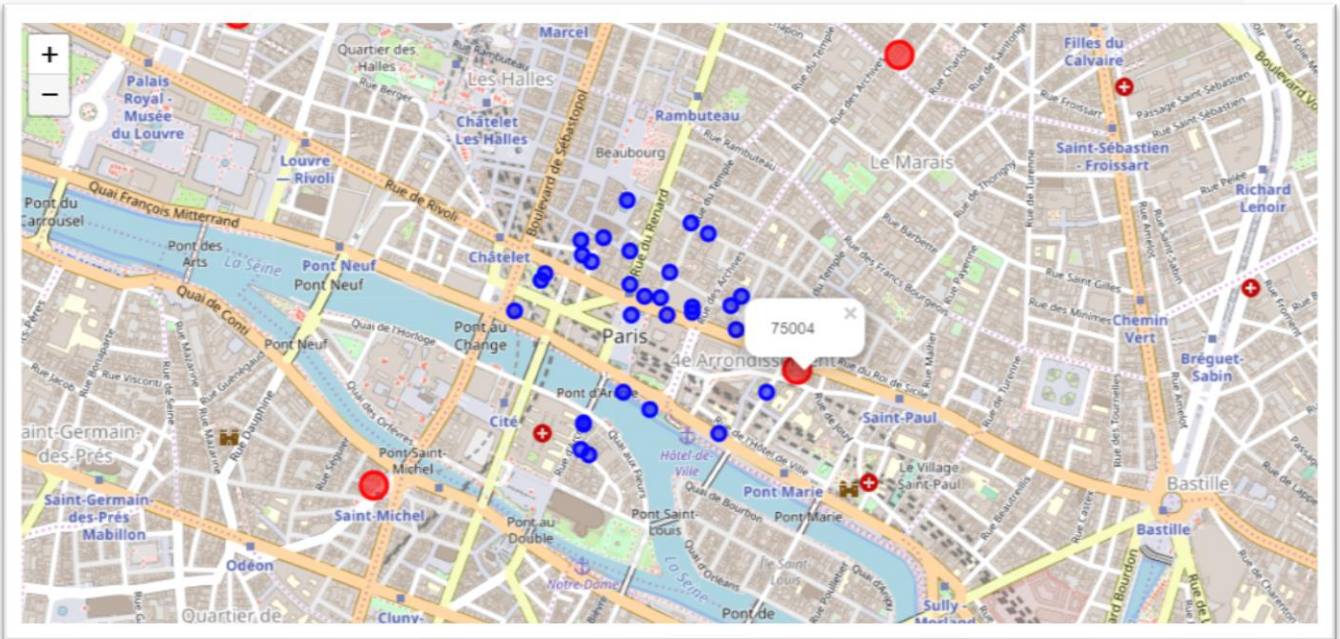

Figure 4 – Map with zoom of 75004 borough

Based on data extracted on Foursquare, we can say that the borough named 75004 have the highest number of popular places (like restaurants, parks, shops, historic sites and so on).

b. Clustering

In this section, I will use the K-means clustering method to find places which are near to the center of 75004 borough.

K-Means is applied in the processed data frame with the real distance between each point from the center of 75004 borough.
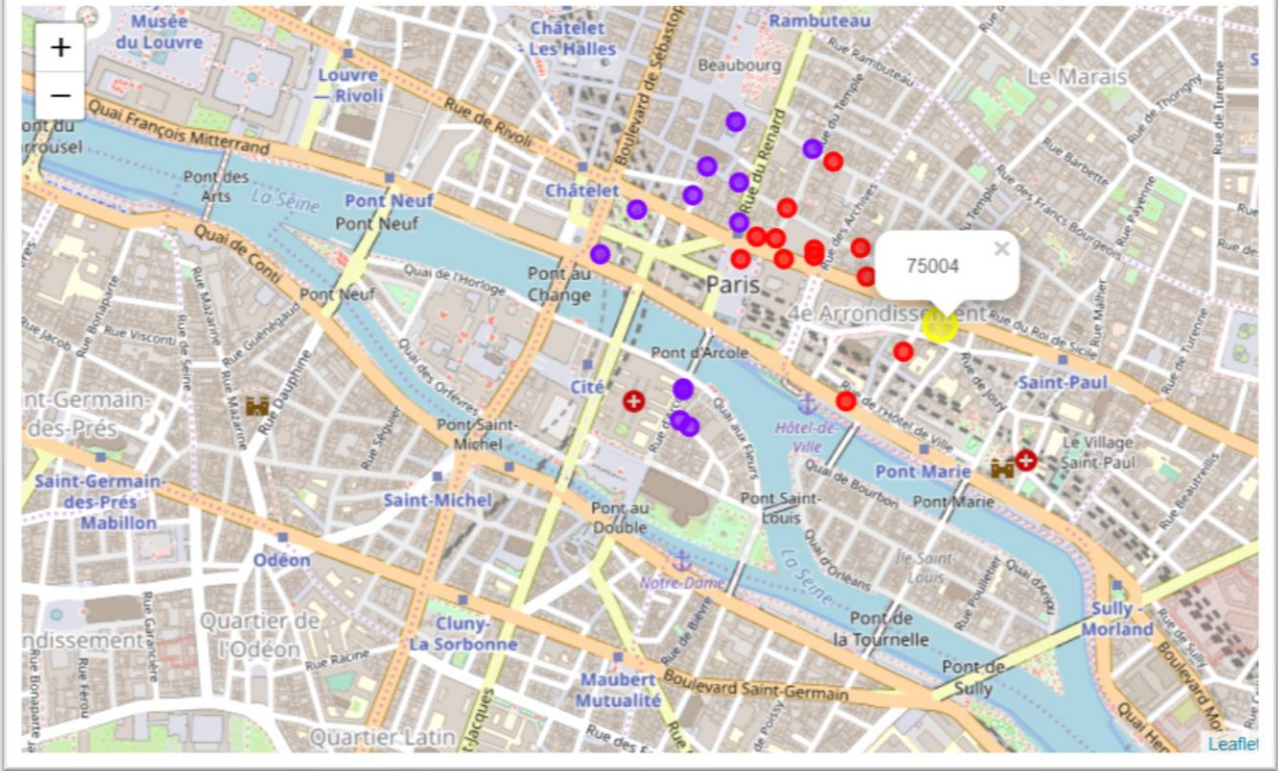
Figure 5 *– Map after clustering*

V.   Discussion

The final map shows nearest popular venues from the center of 75004 borough. So, for Paul it is better to have his restaurant in the sector where are located the nearest popular venues from the center of 75004.
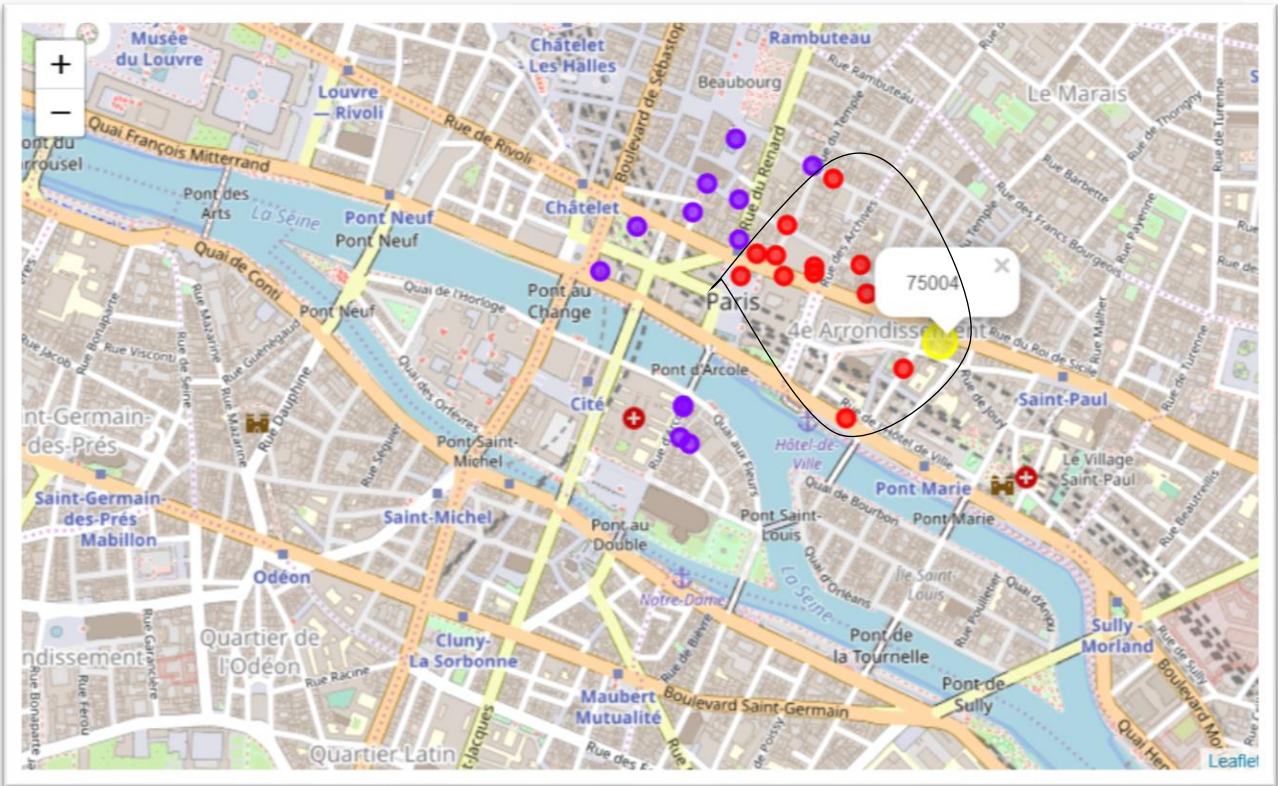
Figure 6 – The best location

Below I show more information about the nearest places :

Cluster Labels		name	categories	address	cc	city	country	crossStreet	distance	formattedAddress	labeledLatLngs	lat	lng	postalCode	state	id
0	0	Place de l'Hôtel de Ville – Esplanade de la Li...	Plaza	Place de l'Hôtel de Ville	FR	Paris	France	NaN	410.770942	[Place de l'Hôtel de Ville, 75004 Paris, France]	NaN	48.857138	2.351693	75004	Île-de-France	4bf41231e5eba59334341f90
4	0	BHV Marais	Department Store	52 rue de Rivoli	FR	Paris	France	Rue de Rivoli	281.910672	[52 rue de Rivoli (Rue de Rivoli), 75004 Paris...	[{'label': 'display', 'lng': 2.353650749944106...	48.857210	2.353651	75004	Île-de-France	4b4b6a3df964a520b89a26e3
5	0	Maison Aleph	Pastry Shop	20 rue de la Verrerie	FR	Paris	France	NaN	218.216254	[20 rue de la Verrerie, 75004 Paris, France]	[{'label': 'display', 'lng': 2.354873, 'lat'...	48.857348	2.354873	75004	Île-de-France	592477f4e0d2be70573edd834
7	0	Paris Rendez-Vous	Souvenir Shop	29 rue de Rivoli	FR	Paris	France	Rue Lobau	332.423414	[29 rue de Rivoli (Rue Lobau), 75004 Paris, Fr...	[{'label': 'display', 'lng': 2.352841377331694...	48.857150	2.352841	75004	Île-de-France	5361075a498ea34171cb06ca
8	0	Hotel Duo Paris	Hotel	11 rue du Temple	FR	Paris	France	Rue de la Verrerie	377.893642	[11 rue du Temple (Rue de la Verrerie), 75004 ...	[{'label': 'display', 'lng': 2.352966996940952...	48.858065	2.352937	75004	Île-de-France	4e84bdeb2fb6611bdfd704ea
10	0	Fleux'	Furniture / Home Store	39 et 52 rue Sainte-Croix de la Bretonnerie	FR	Paris	France	NaN	383.704403	[39 et 52 rue Sainte-Croix de la Bretonnerie, ...	[{'label': 'display', 'lng': 2.354148718454883...	48.858876	2.354149	75004	Île-de-France	4b533b45f964a520509327e3
11	0	BHV Marais – L'Homme	Men's Store	36 rue de la Verrerie	FR	Paris	France	NaN	287.842409	[36 rue de la Verrerie, 75004 Paris, France]	[{'label': 'display', 'lng': 2.353649716361926...	48.857317	2.353650	75004	Île-de-France	4be150de0065c9b6bc4cb338
12	0	Yummy and Guiltfree	Gluten-free Restaurant	3 rue du Temple	FR	Paris	France	NaN	365.441743	[3 rue du Temple, 75004 Paris, France]	[{'label': 'display', 'lng': 2.352604759342985...	48.857516	2.352605	75004	Île-de-France	5901dcce5d891b426af3e948
13	0	Les Mauvais Garçons	Lyonese Bouchon	4 rue des Mauvais Garçons	FR	Paris	France	NaN	170.060191	[4 rue des Mauvais Garçons, 75004 Paris, ...	[{'label': 'display', 'lng': 2.35508376610984...	48.856829	2.355084	75004	Île-de-France	4bc9d039937ca5937f57a692
17	0	The Body Shop	Cosmetics Shop	68 rue de Rivoli	FR	Paris	France	NaN	398.860220	[68 rue de Rivoli, 75004 Paris, France]	[{'label': 'display', 'lng': 2.35210557, 'lat'...	48.857530	2.352106	75004	Île-de-France	4d99bbbadaec224bd286653e
18	0	Bel Canto	French Restaurant	72 quai de l'Hôtel de Ville	FR	Paris	France	NaN	239.598084	[72 quai de l'Hôtel de Ville, 75004 Paris, Fla...	[{'label': 'display', 'lng': 2.354493253281162...	48.854632	2.354493	75004	Île-de-France	4adcda12f964a520513621e1
22	0	Le Peloton Café	Coffee Shop	17 rue du Pont Louis-Philippe	FR	Paris	France	NaN	90.944561	[17 rue du Pont Louis-Philippe, 75004 Paris, F...	[{'label': 'display', 'lng': 2.356033716335545...	48.855505	2.356034	75004	Île-de-France	5618ca93498e8d9df7d0b582

VI. Conclusion

In this study, I analyzed data extracted from Foursquare location data to determine the best place to have a restaurant in Paris based on popular places. I used several Python functions to process the data, compute new data and plot datapoints.

Thank you for your support!

VII. Notebook link

IBM Watson Studio Link

https://dataplatform.cloud.ibm.com/analytics/notebooks/v2/b3bfc8c3-823d-41fb-a182-360685ab4d18/view?access_token=f9a254bbd19b3565b7161276498c9a366fa919cea20597a02d345aec7950eb07

GitHub link

https://github.com/MameFatouMb/Capstone-project/blob/master/Final%20Capstone%20project.ipynb

VIII. Presentation

I made a presentation.

Capstone project - Presentation.pdf