# Opening a fine dining restaurant in Paris

## Jonas Célia

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1. Introduction

In this project we will try to find an optimal location for a restaurant. Specifically, this report will be targeted to stakeholders interested in opening a **fine dining restaurant** in **Paris**, France.

We will try to detect **locations that are not already crowded with restaurants**. We are also particularly interested in **areas with high annual income**. We would also prefer locations **with no fine dining restaurants in vicinity**, assuming that first two conditions are met.

We will use our data science powers to generate a few most promissing neighborhoods based on this criteria. Advantages of each area will then be clearly expressed so that best possible final location can be chosen by stakeholders.

Based on definition of our problem, factors that will influence our decision are:

* level of median annual income in the neighborhood
* number of existing restaurants in the neighborhood (any type of restaurant)
* number of fine dining restaurants in the neighborhood, if any

1. Data acquisition and cleaning
   1. Data sources

* Districts of Paris (geojson file) : [**www.data.gouv.fr**](http://www.data.gouv.fr)
* Boroughs of Paris (geojson file) :  [www.**opendata.paris.fr**](http://www.opendata.paris.fr)
* Annual income median from districts (csv file) : [**www.insee.fr**](http://www.insee.fr)
* Centers of candidate areas will be generated algorithmically and approximate addresses of centers of those areas : **Google Maps API reverse geocoding**
* Number of restaurants and their location in every neighborhood : **Foursquare API**
* Price range of restaurants : **Zomato API** and **Yelp API**
* Coordinate of Paris center : **Google Maps API geocoding** of Notre-Dame de Paris.
  1. Data cleaning

We selected 4 districts in Paris with the highest median annual income : districts 6, 7, 8 and 16. A part of district 16 is a giant park named Bois de Boulogne, which has a bad reputation and was excluded from data.

We dropped addresses that were not in the districts selected. We collected a total of 1276 restaurants in 4 districts.

Fine-dining restaurants were defined by a score of 4 in Yelp and Zomato API.

1. Exploratory Data Analysis

We found on average 22.32 restaurants in every area with radius=300m. We also found that, **on average fine dining restaurant can be found within ~240m** from every area center candidate.

Une image contenant texte, carte, vert, papier

Description générée automatiquement

Figure 1. Heatmap of restaurants in our 4 districts.

Black borders : districts

Green borders : boroughs

Une image contenant carte, intérieur, table, ordinateur

Description générée automatiquement

Figure 2. Heatmap of fine dining restaurants in our 4 districts.

Black borders : districts

Green borders : boroughs

We created smaller neighborhoods, using the same center for each district, since there is no clear area without fine dining restaurants, except west of 16th district, which is a park.

We found followings statistics :

* Locations with no more than two restaurants nearby: 287
* Locations with no fine dining restaurants within 400m: 263
* Locations with both conditions met: 127

Une image contenant texte, carte, intérieur, table

Description générée automatiquement

Figure 3. Heatmap of restaurants with locations with good conditions in blue

Black borders : districts

Green borders : boroughs

Une image contenant texte, carte

Description générée automatiquement

Figure 4. Heatmap of good location for a new fine dining restaurant

Blue borders : boroughs

1. Model

We clustered those location using k-means, to create centers of zones containing good locations.

Une image contenant texte, carte

Description générée automatiquement

Figure 5. Clusters of good location for a new fine dining restaurant

Blue borders : boroughs

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Addresses of centers of areas recommended for further analysis

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Marbeau, 75116 Paris => 2.8km from Pont Alexandre III

Unnamed Road, 75016 Paris => 4.0km from Pont Alexandre III

9 Avenue Emile Acollas, 75007 Paris => 1.6km from Pont Alexandre III

24 Rue du Commandant Guilbaud, 75016 Boulogne-Billancourt => 5.2km from Pont Alexandre III

Stade de Roland-Garros, 2 Avenue Gordon Bennett, 75016 Paris => 5.2km from Pont Alexandre III

Unnamed Road, 75006 Paris => 2.7km from Pont Alexandre III

92 Avenue du Président Kennedy, 75016 Paris => 2.6km from Pont Alexandre III

20 Rue du Général Malleterre, 75016 Paris => 5.0km from Pont Alexandre III

151 Rue de Longchamp, 75116 Paris => 3.0km from Pont Alexandre III

6 Avenue Raphaël, 75016 Paris => 3.4km from Pont Alexandre III

34 Square du Trocadéro, 75116 Paris => 2.3km from Pont Alexandre III

1. Conclusions

Purpose of this project was to identify Paris areas with high median annual income and with low number of restaurants (particularly fine dining restaurants) in order to aid stakeholders in narrowing down the search for optimal location for a new fine dining restaurant. By calculating restaurant density distribution from Foursquare data we have first identified number of restaurants, 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 decision 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.