Predicting the best neighborhood to open a Friterie in Brussels

1. Introduction

Brussels is the capital and the economic center of Belgium (https://fr.wikipedia.org/wiki/Bruxelles). In 2020, Brussels has more than 185,000 inhabitants with around 5.510,21 habitants/km^2. Being the seat of the French Community and the Flemish Community, as well as the seat of several European Union institutions, Brussels attracts thousands workers and tourists from all over the world every week.

The French fry in Belgium is an institution and can be found in many dishes, from a simple side dish to a main component of the meal (http://www.navefri-unafri.be/fr/la-culture-fritkot/le-fritkot-et-la-culture-belge). For example, the mussels-fries Goscinny, the chicken-fries Roegiers, the tomato-crevette-fries Francotte, the carbonnades-fries Jacobs, the boulets-frites. The French fry is so deeply rooted in Belgian daily life that it became the emblem of the youth during the epic Belgian governmental crisis that lasted 589 days in 2010-2011.

1.2. Business Problem

Brussels being a place to be for investers and french fries being a major dish for the Belgians, a friterie chain would like to open a new restaurant in an economically attractive area of the city. This project thus aims to identify optimal locations to open a Friterie in Brussels, Belgium.

To address this aim, I determined the best neighborhoods to open a friterie based on 3 factors :

- The number of existing friteries in each neighborhood.
- The number of existing restaurants in each neighborhood.
- Distance of neighborhoods of interest from Brussels center.

Together, these information will provide me a clear indication of neighborhoods that meet stakeholders criteria : having ***less than three restaurants*** and ***no friture*** in radius of 500m. Moreover, once these conditions are met, neighborhoods must be as close as possible to Brussels center.

2. Data acquisition

2.1. Data sources

Data from wikipedia were used to determine Brussels boroughs and neighborhoods: https://fr.wikipedia.org/wiki/Mod%C3%A8le:Palette_Quartiers_de_la_ville_de_Bruxelles

Morover, Brussels center and neighborhoods coordinates were optained using the *nominatim* function from geolocator. Finally, the number of fritures and restaurants and their respective location in the neighborhoods were obtained using Foursquare API.

2.2. Starting point

After data collection, they were 4 Boroughs and 28 neighborhoods in our dataset (see blue circle on Figure 1). Moreover, Brussels center coordinates were (50.8465573, 4.351697, see the black circle).

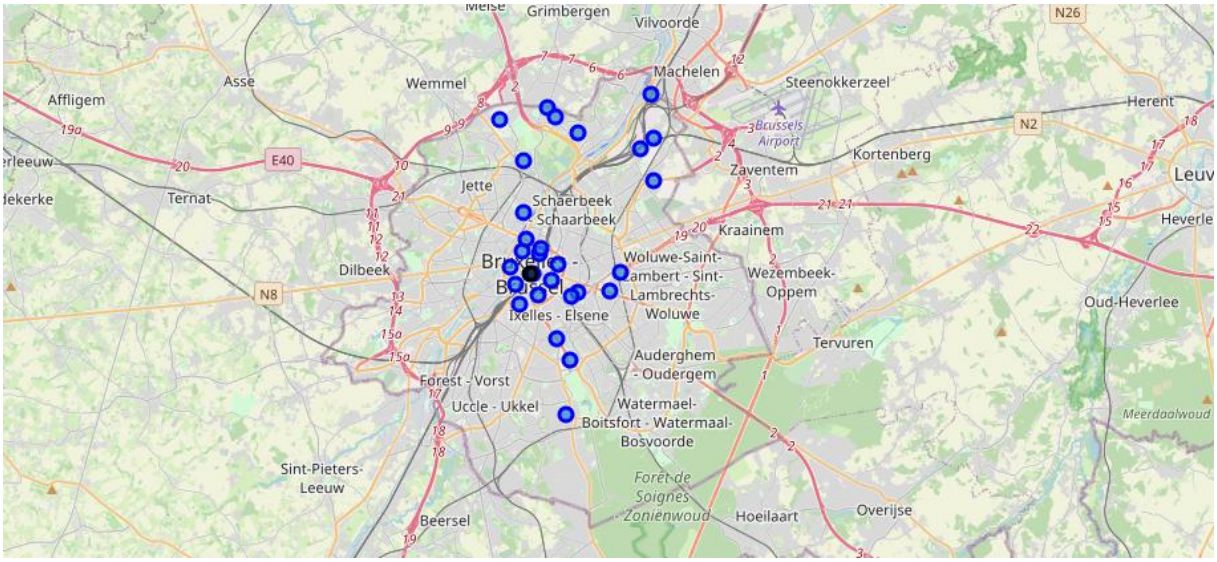

Figure 1. Brussels center and neighborhoods

2.3. Distance between neighborhoods and Brussels center

First, I converted neighborhood and Brussels center coordinates to X/Y coordinates in meters (UTM Cartesian coordinate system). Then, I calculated the distance between each neighborhoods and Brussels center by substacting the X/Y coordinates (see Table 1).

Table 1. Data set with distances between each neighborhood and Brussels center

	Postal Code	Borough	Neighborhood	Latitude	Longitude	Distances to center
0	1000	Center	Centre	50.846718	4.353221	109.525738
1	1000	Center	Marais-Jacqmain	50.853034	4.357105	820.291618
2	1000	Center	des Libertés	50.849882	4.366689	1125.978610
3	1000	Center	Royal	50.844352	4.363050	841.821817
4	1000	Center	Sablon	50.839958	4.356142	803.324866
5	1000	Center	Marolles	50.836740	4.346251	1165.039304
6	1000	Center	Midi-Lemonnier	50.843217	4.344633	625.009706
7	1000	Center	Quartier de la Senne	50.849088	4.341938	747.571882
8	1000	Center	des Quais	50.854210	4.347946	897.202954
9	1020	Nord	Laeken	50.883392	4.348713	4129.701476
10	1000	Nord	Heysel	50.896874	4.335977	5742.870355

3. Data Analysis

3.1. Calculation of the number of friteries in each neighborhood

In first step, I wanted to establish the concentration of fritures and restaurants in the different Brussels'neighborhoods. To this end, I first used the *Foursquare API* to extract information about friteries in a 500 m radius of each neighborhood. Because some Turkish restaurants were also reported as friteries, I cleaned those restaurants. Then, I calculated the number of friteries that could be found in a 500m radius of each neighborhood. As shown in Figure 2, the number of fritures in a 500m radius was surprisingly small in the different neighborhoods (between 0 and 4 friteries). More precisely, I found that neighborhoods in the center of Brussels include the greatest number of fritures, whereas neighborhoods of the north, east and south include much less fritures.

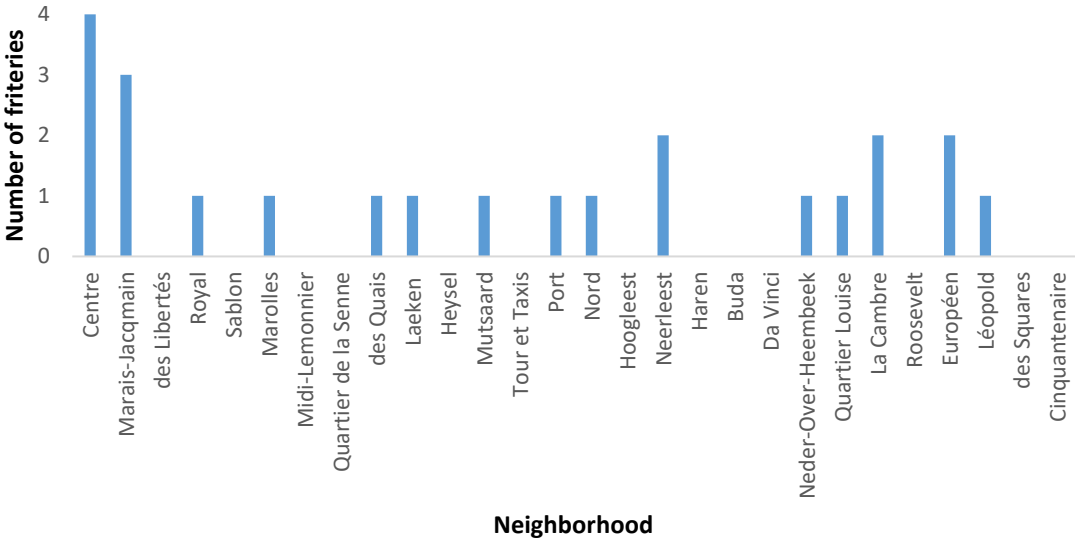

Figure 2. Number of friteries in a 500m radius of each neighborhood

3.2. Calculation of the number of restaurants in each neighborhood.

Second, I used the *Foursquare API* to extract information about restaurants in a 500 m radius of each neighborhood. Then, I calculated the number of restaurants that could be found in a 500m radius of each neighborhood. I found that the number of restaurants was between 0 and 50, with 11 restaurants on average in each neighborhood (see Figure 3). As for friteries, neighborhoods in the center of Brussels includes the greatest number of restaurants, whereas neighborhoods of the north, east and south include much less restaurants.

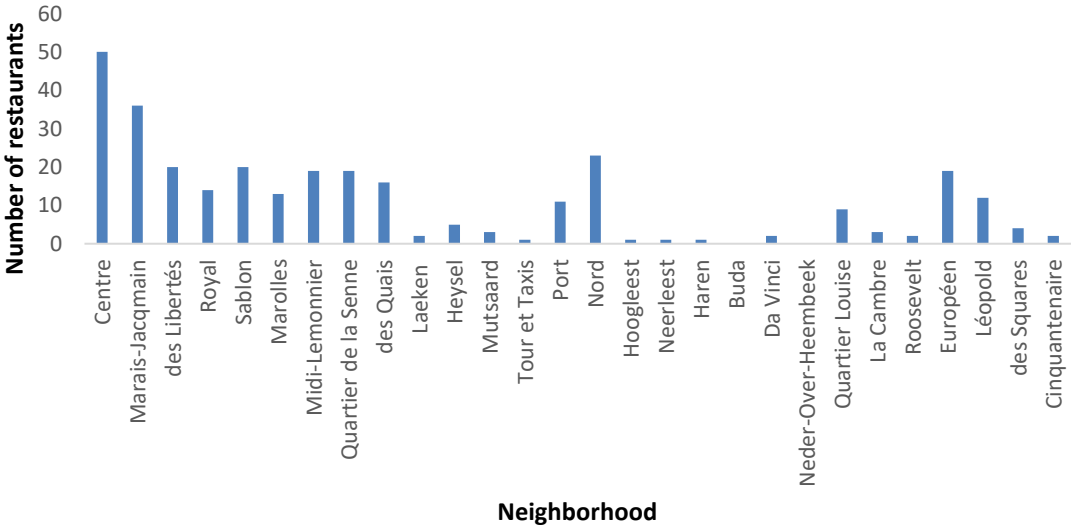

Figure 3. Number of restaurants in a 500m radius of each neighborhood

3.3. Filtering

Having established the number of friteries and restaurants in each neighborhood, I wanted to focus on neighborhoods that meet stakeholders requirements : neighborhoods that involve less than three restaurants an no friture in radius of 500m. I found 10 neighborhoods with no more than two restaurants within 500m and 13 neighborhoods with no friterie within 500m, leaving only 7 neighborhoods that met both criteria (see Table 2).

Table 2. Neighborhoods involving no more than two restaurants and no friteries in radius of 500 meters.

Postal Code	Borough	Neighborhood	Latitude	Longitude	Distances to center	Restaurant in area	Friterie in are
1000	Nord	Tour et Taxis	50.866598	4.348435	2255.826640	1.0	0.
1000	Nord	Hoogleest	50.887500	4.409167	6131.360230	1.0	0.
1000	Nord	Haren	50.890944	4.415755	6730.175989	1.0	0.
1000	Nord	Buda	50.905190	4.414150	7916.250241	0.0	0.
1000	Nord	Da Vinci	50.877144	4.416100	5705.641304	2.0	0.
1050	Sud	Roosevelt	50.800556	4.370833	5326.457160	2.0	0.
1040	Est	Cinquantenaire	50.841037	4.393492	3026.597180	2.0	0.

4. Results

4.1. K-Means Clustering

In order to determine areas of interest to open a new friterie, the candidate neighborhoods were clustered using a k-means clustering model. In this model, we set the number of desired clusters to 3. The resulting clusters and their distance from Brussels center are shown in Figure 2.

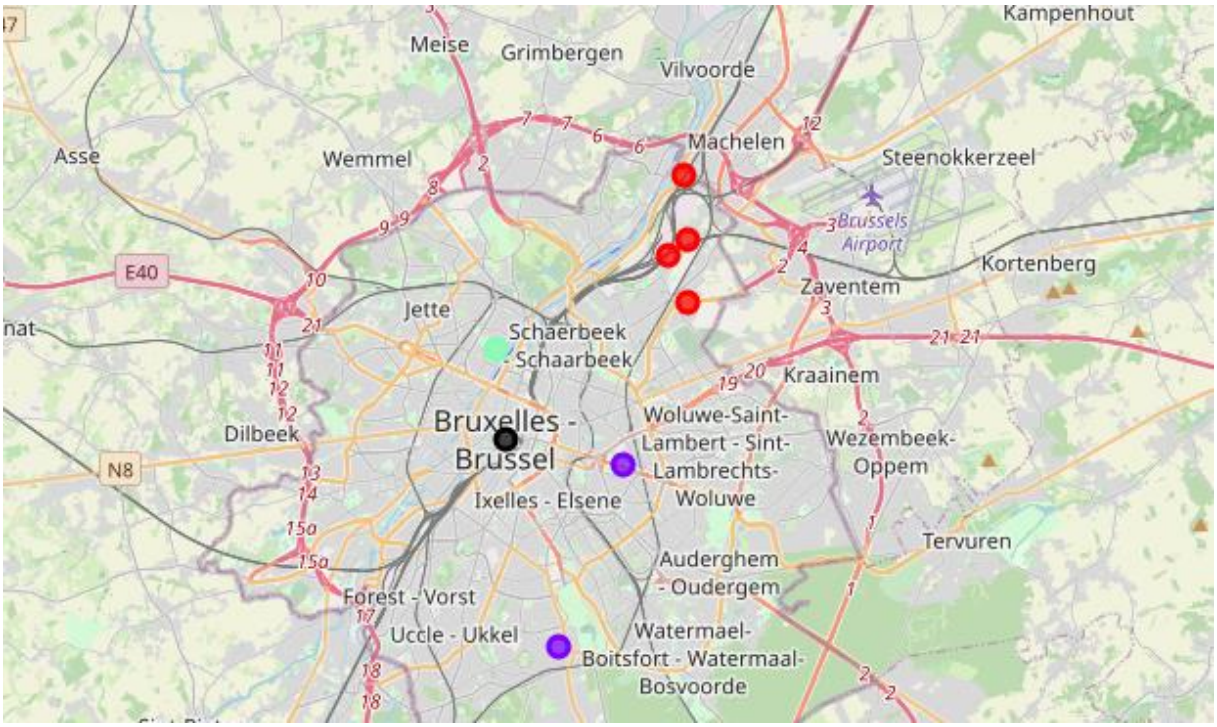

Figure 2. Brussels center and the three areas of interest

4.2. Clusters Review

Cluster 1 : - One to Two restaurant(s) and no friterie in the area (red circles)

Neighborhood	Restaurant in area	Friterie in area
Hoogleest	1.0	0.0
Haren	1.0	0.0
Buda	0.0	0.0
Da Vinci	2.0	0.0

Cluster 2 : - Two restaurants and no friterie in the area (blue circles)

Neighborhood	Restaurant in area	Friterie in area
Roosevelt	2.0	0.0
Cinquantenaire	2.0	0.0

Cluster 1 : - One restaurant and no friterie in the area (turquoise circle)

Neighborhood	Restaurant in area	Friterie in area
Tour et Taxis	1.0	0.0

Because they involve few restaurants than cluster 2, **cluster 1** and **Cluster 3** seem to be the two most interesting clusters.

4.3. Distance between Cluster 1 and Cluster 3 from Brussels center

To identify which is the best area to open a friture, I examined which of Cluster 1 and 3 was closer to the Brussels center. Results showed that the distance between the area and Brussels center is shorter for Cluster 3 (2.2 Km) than Cluster 1 (6.5 Km), making **Cluster 3** the most optimal area to open a friture.

5. Discussion

Overall, our analyses showed that there is a great number of restaurants in Brussels, but the number of fritures is surprisingly small in the different neighborhoods. As expected, we found that neighborhoods in the center of Brussels included the greatest number of restaurants and fritures, whereas neighborhoods of the north, east and south include much less restaurants and fritures. Being established the concentration of fritures and restaurants in the different Brussels'neighborhoods, I focuses my attention on neighborhoods that meet stakeholders requirements : neighborhoods that involve less than three restaurants an no fritures in radius of 500m. Analyses showed that 7 Neighborhoods from the north, east and south correspond to the two criteria. Then, those candidate neighborhoods were clustered in 3 areas of interest in which a friture could be open. A deepen examination of those three and their distance from Brussels center revealed that **Tour et Taxis** emerged as an optimal candidate to open a friture.

It is important to note that these analyses rely on predetermined criteria. They should be taken as a starting point for a deepen investigation and thus do not imply that the three zones of interest, and especially, Tour et Taxis, are actually optimal neighborhoods for a friture.

6. Conclusion

In this project, I wanted to determine in which Brussels' neighborhoods it could be optimal to open a new friterie. To address this question, Stakeholders provided three main criteria: the neighborhoods should involve less than 3 restaurants and no fritures in radius of 500m. Moreover, once these conditions are met, neighborhoods must be as close as possible to Brussels center.

By using Foursquare data to estimate friterie and restaurant concentration in each neighborhood, I identify 7 candidate neighborhoods. A subsequent clustering of those neighborhoods revealed that 3 areas could be interesting to open a new friterie, with Tour et Taxis being the optimal location because of it's proximity from Brussels center.

Taken together, these information could be use by Stakeholders as a starting point for a deepen exploration of neighborhoods in the three recommended areas, based on which the final decision for an optimal friterie location will be taken.