Restaurant "La ö" goes big !

Market study of Montpellier, France for franchising a high-end sandwicherie

Contents

Abstract/Executive summary

Market study to investigate if "La ö" restaurant could be turned out as franchise business into other Montpellier neighbourhoods.

Introduction/Business problem

Two very good friends of mine, Laura and Denis, are hosting a very good and high-end "fast" food restaurant in Montpellier, France. You can get more detail on the venue and the delicious meals they propose daily (all homemade!) on their facebook account. The restaurant is located in the ArtFx special effects school premises and propose lunch and snacks to students and white-collar people of the surroundings. If you go to this city, feel free to drop yourself there and tell to Laura that you got this address from Elisabeth and Christophe of Zoufftgen. (ask for the Poutine meal...)

https://www.facebook.com/restaurant.la.o/ , https://artfx.school/

In order to pursue their adventure, Laura and Denis would be interesting to see if restaurant "La ö" could be turned out as a franchise restaurant business. Hence, answer to some questions may help them to see if it worth the pain:

- o Where do we find neighbourhoods in Montpellier that are similar to the one where the restaurant "La ö" is currently located? (in term of inhabitants, working customer, business offices and venues)
- o What are the competitors that they may face in that similar neighbourhood?
- o What are the ratings of those competitors compared to the ones of "La ö"?

Methodology

We will use unsupervised Machine Learning (ML) clustering to find Montpellier neighbourhood that are similar to the one of restaurant "la ö". We will display those on a map for a preliminary overview. Then we will focus on the competitors: to identify them, we will do a supervised classifier model. Then we would compare their rating with the ones of "La ö". We will display that with regular graph.

All data and maps displayed into this document are available in the related Jupyter notebook:

Restaurant "La ö" goes big - IBM Watson Studio :
https://dataplatform.cloud.ibm.com/analytics/notebooks/v2/017b7cbd-6c7f-40d8-b58b-2442a9e6af2e/view?access_token=d45e0dca5aefd67d94d6f206d1cd5334484fa1a1f1198b332f283d45850f19c2

Research method

The following stages will be done in cascade:

- Stage 1: Identify the neighbourhood and their socio-economic data
  - Digest socio-eco data of each neighbourhood and sub-neighbourhood :
  - Create a choropleth map
- Stage 2: Cluster (ML) the neighbourhoods to find the most interesting ones for another restaurant installation
  - Clustering of neighbourhoods regarding the activities, services and shops available
- Stage 3: Find competitor venues description from public datasources
  - Select a subset of neighbourhoods and find the venues that are actually competitors using Foursquare
- Stage 4: Compare with competitors
  - Look for the customer ratings of those venues

Some stages may be shorten or bypassed due to the lack of data or technical impediments that would make this Capstone last a few month instead of a few days. ☺

Required Data

- Geographic and demographic data of montpellier neighbourhoods.
- Socio-economic data of montpellier neighbourhoods.
- List of venues in Montpellier including their category and ratings.

Data sources used

- OpenData Monpellier (https://data.montpellier3m.fr/): demographic data, geographic data, socioeconomic data of each neighbourhood
- FourSquare API : venues and rating data
  - Unfortunately Foursquare data source does not include a lot of other venues in Montpellier.

Data cleaning and preparation rationale

Reaching the **open data portal of Montpellier** enables to get the following useful data:

Figure 1 Montpellier open data xlsx

- List of the neighbourhood ("sous-quartier") of Montpellier and their location (lat/log), perimeter and area size. It includes also the geojson to help doing Choropleth maps.
- Socio economic data or each neighbourhood are also available (there is one file per neighbourhood):
  - 'Population in 2009','NumberInhabitantskilometer2'

- o 'TerritorySurface', 'number of Flats', 'Number of house ',
- o 'Income Per Inhanbitant',
- o 'Percentage of Landowners'/'Percentage of Tenants'
- o 'NumberSocialMinimumIncome'
- o 'Percentage Unemployed'
- o 'PercentageRentControlledHousing'
- o Population age split:'0-14years'/'15-29years'/'30-44years'/'45-59years'/'60-74years'/'75+years'
- o Population profession split
- o Population nationality split: French or other
- o Household split : number of persons
- o Family size
- o Tenants with state allocation
- o Working In Montpellier/ Outside Montpellier
- **Economic activity data**
  - o Number and type of shops
  - o Number and type of private services (gaz station, shops….)
  - o Number and type of state services(Police station …)
  - o Number and type of industries

All those data are cleaned-up and prepared as xlsx files. I used Google Map, 'Search Nearby' option to get the centre coordinates of the each neighbourhoud.

Since 2001, Montpellier has been divided into seven official neighbourhoods, themselves divided into sub-neighbourhoods. For our analysis we used the granularity "sous-quartier" that we will call neighbourhood. There are 31 of them, namely:

- Aiguelongue
- Aiguerelles
- Alco
- Antigone
- Boutonnet
- Celleneuve
- Centre Historique
- Comédie
- Croix d'Argent
- Estanove
- Figuerolles
- Gambetta

- Gares
- Grammont
- Hopitaux-Facultés
- La Chamberte
- La Martelle
- La Pompignane
- Lemasson
- Les Arceaux
- Les Aubes
- Les Beaux - Arts
- Les Cevennes

- Les Hauts de Massane
- Millénaire
- Mosson
- Pas du Loup
- Plan des 4 Seigneurs
- Port Marianne
- Près d'Arènes
- Saint Martin

*Figure 2 Neighbourhood of Montpellier, France*

Using the Foursquare API, we are able to get the venues list and category of each neighbourhood using a central longitude/latitude point for the neighbourhood area and a radius of 2 km as lookup surface. Only categories related to "restaurant" were selected.

Results

Descriptive statistics of Montpellier for population and social

The restaurant "La ö" is located in the neighbourhood "Hopitaux-Facultés" which is the largest of Montpellier after "Port Marianne" and just before "Aiguelongue".

Let's compare this neighbourhood with the others. "Hopitaux-Facultés" population is the largest by far. Its population is mostly young and between 15-29 years old. The segment 30-44years is also large. So we can assume that its 27,726 inhabitants are mostly active.
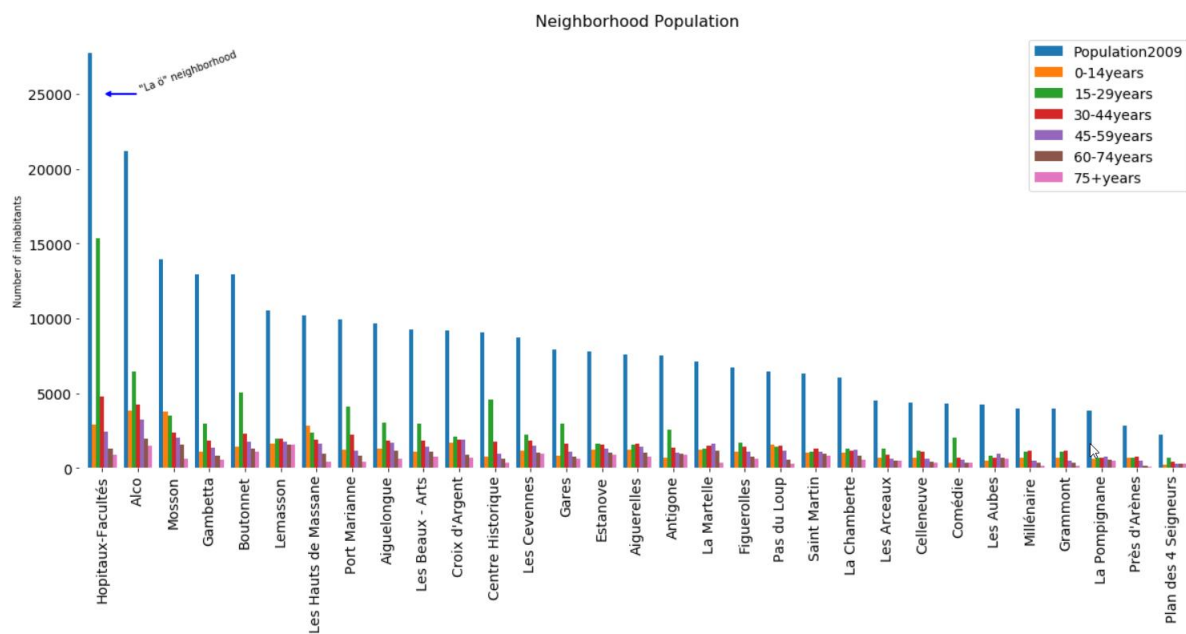
No other neighbourhood have such a high rate of young population. This might be due to the fact that many students may be living nearby universities and schools.
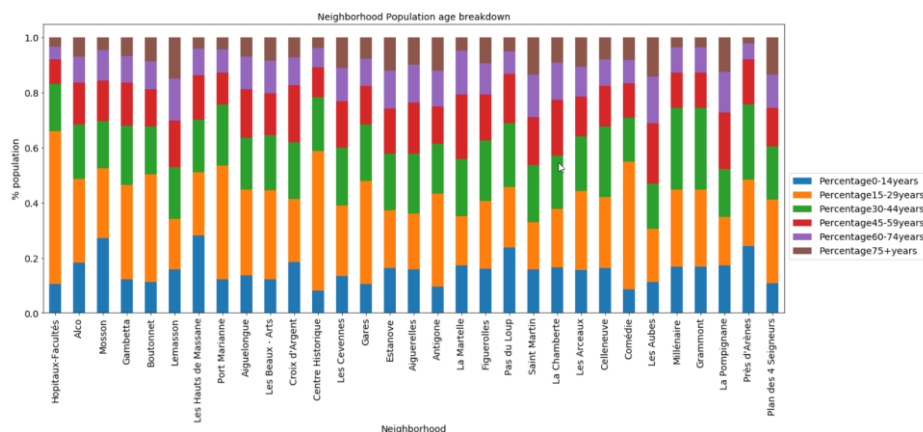
When looking at the profession of inhabitants in each neighbourhood we see that "Hopitaux-Facultés", "Alco" and "Boutonnet" have the highest rate of "autres" aka "other". This category includes the "student" category. This can be explained by the fact that all student take accommodation nearby the area where universities and schools is located.

Occupation of active inhabitants
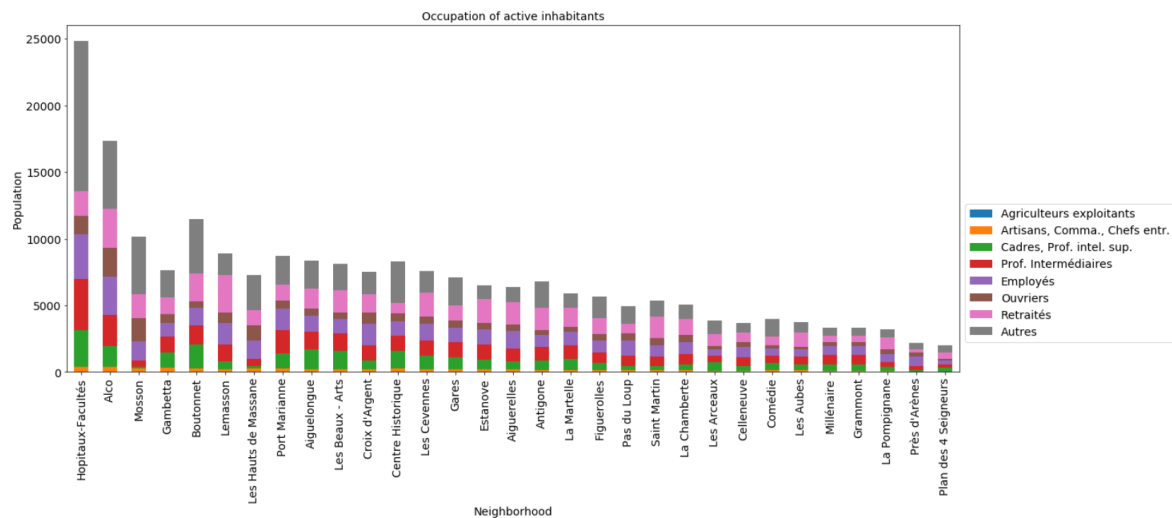
Regarding the social care, we see that in neighborhood "Hopitaux-Facultés" almost 12,000 out of 25,000 which is large receive a state housing allowance. You have to know that in France, students or people with low income or jobless receive money from the state to help paying accommodation. Here we see that almost 50% receive an allowance. This is a marker that many people are students as usually students receive an accommodation allowance during their study.

inhabitants with allocation
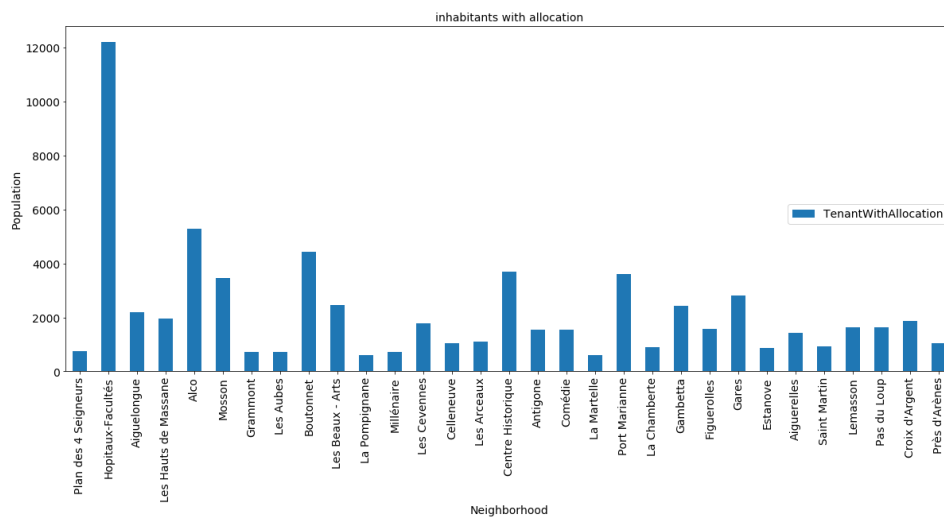
Income per inhabitant of each neighbourhood would help to identify what is the wealth population hence the probability that they go out to have diner or lunch and which kind of restaurant they can afford. I used python folium library to visualize geographic.
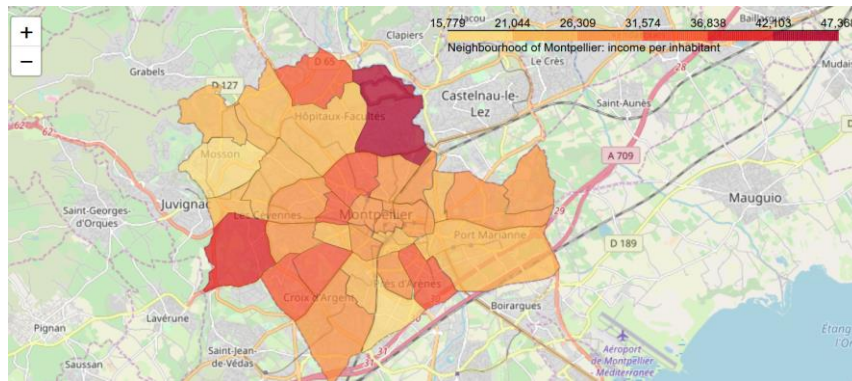
Figure 3 Income per inhabitant

We see clearly that the income per inhabitant of the neighbourhood "Hopitaux-Faculté" is one of the lowest of Montpellier. It could be that inhabitants are students or lower/mid-class workers whose jobs are into public institutions such as hospital/public university or into private service companies.

LIBSQUART	IncomePerInhanbitant	Population2009
Mosson	16089.0	13920.0
Près d'Arènes	19686.0	2864.0
Hopitaux-Facultés	21710.0	27726.0
Les Hauts de Massane	21723.0	10173.0
Alco	22589.0	21167.0
Celleneuve	23404.0	4387.0
Figuerolles	24289.0	6725.0
Gares	24781.0	7946.0
Port Marianne	24823.0	9951.0
Lemasson	26252.0	10564.0

Figure 4 Lowest 10 income per capita

Neverleless the neighborhood is located nearby the richest one "Aiguelongue". This is most probably, where high-level white collars live. They could commute to work every day and have their home in a nice environment.

Regarding the business activities, we can see the "Hopitaux-Facultés" is among the ones with the largest number of "enseignement" (aka teaching) institution. But there are unfortunate bias here as elementary schools and college are accounted. Same regarding the "scientific activities" as they are into the same category as "administrative service". The history centre certainly includes many "local" administrative services such as city hall etc.

LIBSQUART	Administration publique, enseignement, santé humaine et action sociale	Activités scientifiques et techniques ; services administratifs et de soutien
Grammont	396.0	74.0
Millénaire	396.0	74.0
Boutonnet	309.0	179.0
Hopitaux-Facultés	243.0	229.0
Centre Historique	228.0	446.0
Les Cevennes	224.0	104.0
Antigone	195.0	191.0
Mosson	176.0	222.0
Gares	167.0	270.0
Port Marianne	165.0	186.0

Figure 5 Number of institution by domain

Regarding the venues in Montpellier, there are a lot of them spread all around and into the city with no specific location pattern that we can identify.
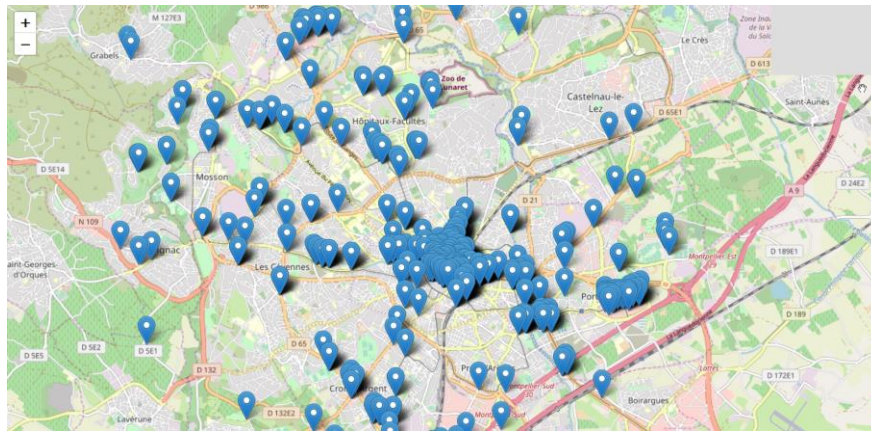

Figure 6 Venues in Montpellier as provided by Foursquare

Conclusion

Because «Restaurant La ö» is a fast food (even high end) it is more relevant to settle its business into a middle class or working-class neighbourhood. Based on the above statistics on population and social indicators, we would elect the following neighbourhoods:

- Alco, Mosson, Gambetta : because of the age and profession of inhabitant (including students)
- Mosson, Alco, Près d'Arène, Les haut de Massane, Celleneuve : because of the income per capita

Clustering for similar neighbourhood for service, shops and industries

We can also cluster the neighbourhoods based on key indicators so that we can identify which other neighbourhoods have similar "business" as the one were restaurant "La ö" is located. We use a KMeans algorithm as it is lean and simple to implement and is one of the most common cluster method of unsupervised learning.

The following key indicators are used to feed the clustering Machine Learning algorithm. It counts the number of industries, shops or services among different categories.

Industries:	Shops :	Services :
'Industries extractives, énergie, eau, gestion des déchets et dépollution', 'Fabrication de denrées alimentaires, de boissons et de produits à base de tabac', 'Fabrication équipements électriques, électroniques, informatiques ; fabrication de machines', 'Fabrication de matériels de transport', 'Fabrication autres produits industriels', 'Construction', 'Commerce ; réparation dautomobiles et de motocycles', 'Transports et entreposage', 'Hébergement et restauration', 'Information et communication', 'Activités financières et dassurance:', 'Activités immobilières', 'Activités scientifiques et techniques ; services administratifs et de soutien', 'Administration publique, enseignement, santé humaine et action sociale', 'Autres activités de services', 'Établissements sans salariés', 'Établissement de 1 à 49 salariés', 'Établissements de 50 salariés et +',	'Hypermarché', 'Supermarché', 'Grande surface de bricolage', 'Supérette', 'Epicerie', 'Boulangerie', 'Boucherie charcuterie', 'Produits surgelés', 'Poissonnerie', 'Librairie papeterie journaux', 'Magasin de vêtements', 'Magasin déquipements du foyer', 'Magasin de chaussures', 'Magasin délectroménager et de mat. audio-vidéo', 'Magasin de meubles', 'Magasin darticles de sports et de loisirs', 'Magasin de revêtements murs et sols', 'Droguerie quincaillerie bricolage', 'Parfumerie', 'Horlogerie Bijouterie', 'Fleuriste', 'Magasin doptique', 'Station service',	'Police', 'Trésorerie', 'Gendarmerie', 'Cour dappel', 'Tribunal de grande instance', 'Tribunal dinstance', 'Conseil de prud'hommes', 'Tribunal de commerce', 'Agence de proximité', 'Relais pôle emploi', 'Permanence pôle emploi', 'Agence de services spécialisés', 'Agence thématique', 'Banque, Caisse dépargne', 'Pompes funèbres', 'Bureau de poste', 'Relais poste commerçant', 'Agence postale communale', 'Réparation auto et de matériel agricole', 'Contrôle technique automobile', 'Location auto-utilitaires légers', 'École de conduite', 'Maçon', 'Plâtrier peintre', 'Menuisier, charpentier, serrurier',

		'Plombier, couvreur, chauffagiste', 'Électricien', 'Entreprise générale du bâtiment', 'Coiffure', 'Vétérinaire', 'Agence de travail temporaire', 'Restaurant', 'Agence immobilière', 'Blanchisserie-Teinturerie'

Example of key indicator

Industries extractives, énergie, eau, gestion des déchets et dépollution	Fabrication de denrées alimentaires, de boissons et de produits à base de tabac	Fabrication équipements électriques, électroniques, informatiques ; fabrication de machines	Fabrication de matériels de transport	Fabrication autres produits industriels	Construction	Commerce ; réparation d'automobiles et de motocycles	Transports et entreposage	Hébergement et restauration	Information et communication	Activités financières et d'assurance:	Activités immobilières	Activités scientifiques et techniques ; services administratifs et de soutien	Administration publique, enseignement, santé humaine et action sociale
1.0	2.0	0.0	0.0	3.0	11.0	13.0	0.0	2.0	7.0	1.0	5.0	15.0	12.0
4.0	4.0	5.0	0.0	20.0	80.0	147.0	28.0	57.0	76.0	53.0	50.0	229.0	243.0
2.0	6.0	1.0	0.0	3.0	30.0	62.0	4.0	15.0	25.0	16.0	35.0	105.0	114.0
9.0	5.0	1.0	0.0	11.0	119.0	82.0	19.0	17.0	13.0	9.0	15.0	49.0	41.0
4.0	12.0	2.0	1.0	8.0	166.0	134.0	9.0	26.0	31.0	19.0	39.0	125.0	164.0
5.0	10.0	3.0	0.0	15.0	432.0	206.0	18.0	27.0	30.0	21.0	29.0	222.0	176.0

Figure 7 Key indicators for clustering

The selection of the number of clusters was made according to the best inertia as shown below

```
#
# plot the inertia with the different k to find the better balance
#
plt.plot(range(1,Ks),inertias,'g')
plt.ylabel('Inertia ')
plt.xlabel('Number of centers/clusters (K)')
plt.tight_layout()
plt.show()
```


The result of the clustering with 4 centers is displayed in map below.

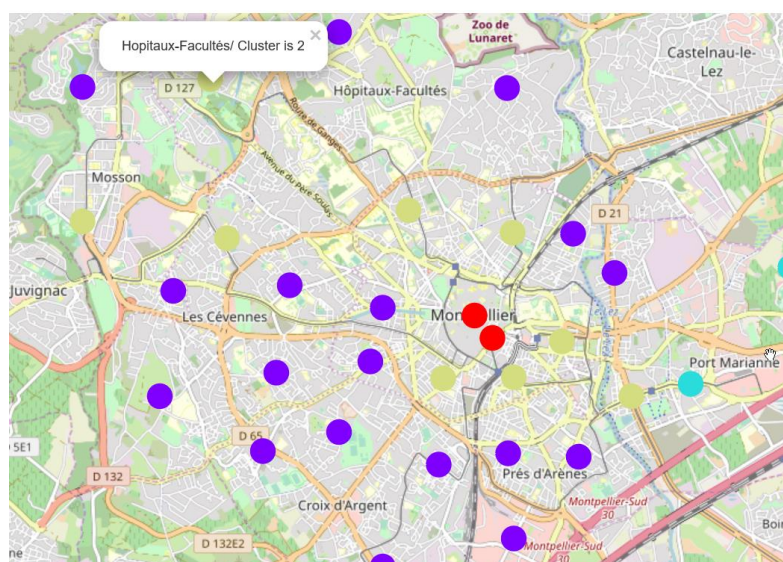*Figure 8 Neighbourhood clustering map*

The content of the 4 clusters is given below.

Cluster	Number of neighbourhoods	Neighbourhoods
0	18	Plan des 4 Seigneurs, Aiguelongue, Les Hauts de Massane, Les Aubes, La Pompignane, Les Cevennes, Celleneuve, Les Arceaux, La Martelle, La Chamberte, Figuerolles, Estanove, Aiguerelles, Saint Martin, Lemasson, Pas du Loup, Croix d'Argent, Près d'Arènes
2	9	**Hopitaux-Facultés**, **Alco, Mosson, Boutonnet, Les Beaux - Arts, Antigone, Port Marianne, Gambetta, Gares**
3	2	Centre Historique, Comédie
1	2	Grammont, Millénaire

Conclusion

We can conclude that based on the available services, shops and industries, 8 neighbourhoods offer the same environment as Hopitaux-Facultés : Alco, Mosson, Boutonnet, Les Beaux - Arts, Antigone, Port Marianne, Gambetta, Gares.

Analysis of competitor restaurants with Foursquare

Foursquare provides some useful information about restaurant "la ö".
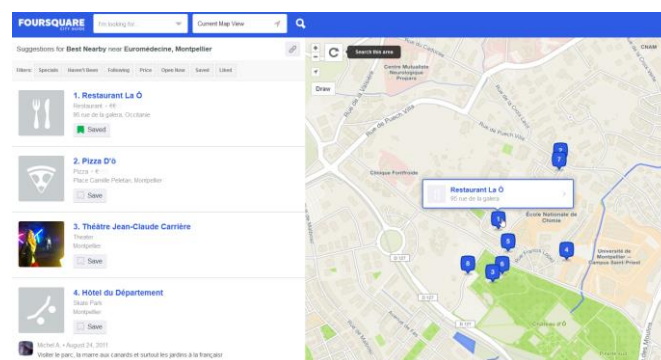(https://foursquare.com/v/restaurant-la-%C3%B4/5e18de2aa97b28000874c350)

Figure 9 Restaurant "La ö" as displayed by Foursquare website

But what about the competitors that may be already present into the target neighbourhoods? In order to scope our search we will focus on the neighbourhoods that match both the descriptive analytics on population/social and the machine learning clustering that we did in the above chapters: **Alco, Mosson and Gambetta**.

There are 27 restaurants or food related venues in those 3 neighbourhoods:

Neighborhood	Neighborhood Latitude	Neighborhood Longitude	Venue	Id	Venue Latitude	Venue Longitude	Venue Category
CVA_Alco	43.619652	3.839013	Cafet' de Sup de Co	4d64f852cf2bb60c8d52a1bc	43.621413	3.833217	Restaurant
CVA_Alco	43.619652	3.839013	Le Sens Six	4f02f6820e01089c58869be6	43.610737	3.849742	Diner
CVA_Alco	43.619652	3.839013	Scholler	4c02287dcbd876b0cbf7f043	43.610881	3.848207	Dessert Shop
CVA_Alco	43.619652	3.839013	Pierrot & Fils	4dade8316a23e6c9347f1dfd	43.618583	3.863589	Pizza Place
PAI_Mosson	43.621561	3.816940	Cafet' de Sup de Co	4d64f852cf2bb60c8d52a1bc	43.621413	3.833217	Restaurant
PAI_Mosson	43.621561	3.816940	McDonald's	4e46686952b1bac0d9754cb2	43.613970	3.800143	Fast Food Restaurant
MCG_Gambetta	43.604150	3.872250	Chez Ouam	4e0639b214959022c88f0059	43.608506	3.873728	French Restaurant
MCG_Gambetta	43.604150	3.872250	bonobo	59fedc1c6f0aa26647297cb3	43.608827	3.874160	Coffee Shop
MCG_Gambetta	43.604150	3.872250	Coffee Club	524affb4498ef4827a0ffb73	43.610002	3.876010	Coffee Shop
MCG_Gambetta	43.604150	3.872250	Thym et Romarin	4d9a1f2433c760fcc0ba6a6e	43.608376	3.874218	French Restaurant
MCG_Gambetta	43.604150	3.872250	l'endroit	4ff5728de4b01d081f9240af	43.608414	3.875361	Restaurant
MCG_Gambetta	43.604150	3.872250	il pizzaiolo	50c384f8e4b0e77d29f91c87	43.607838	3.881230	Pizza Place
MCG_Gambetta	43.604150	3.872250	ÜFish	573d8b08498ea35370028338	43.609573	3.877077	Fish & Chips Shop
MCG_Gambetta	43.604150	3.872250	L'Artichaut	4c86261c47cc224b1c96a69f	43.610338	3.875610	French Restaurant
MCG_Gambetta	43.604150	3.872250	Big Fernand	5782a71a498e75caea337518	43.609800	3.877980	Burger Joint

Figure 10 Restaurants in selected neighbourhoods
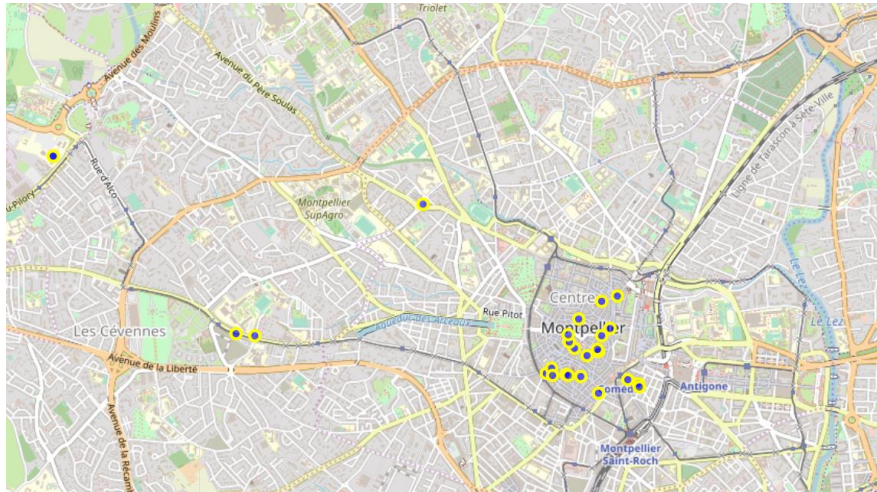
Here is their localisation

Figure 11 Restaurant location in Alco, Gambetta and Mosson

We see that there are a lot of restaurant in Gambetta. It is not a good idea to go in place where there are already many competitors. So let's see the rating of the restaurants in the 2 others neighbourhood:

```
Neighbourhood CVA_Alco: Rating for "Cafet' de Sup de Co": This venue has not been rated yet.
Neighbourhood CVA_Alco: Rating for "Le Sens Six" is 5.8
Neighbourhood CVA_Alco: Rating for "Scholler": This venue has not been rated yet.
Neighbourhood CVA_Alco: Rating for "Pierrot & Fils": This venue has not been rated yet.
Neighbourhood PAI_Mosson: Rating for "Cafet' de Sup de Co": This venue has not been rated yet.
Neighbourhood PAI_Mosson: Rating for "McDonald's" is 5.2
```

Conclusion

It is hard to make a decision based on the data from Foursquare. Especially as it is crowd sourced data. Nevertheless, Alco and Mosson neighbourhoods seem to be a good place as there are few restaurants there whose ratings are not that good.

Discussion

The analysis allows us to identify 2 neighbourhoods where another "La ö" restaurant could be installed. But we faced several impediments to provide a better analysis:

- Foursquare does not populate much of the venues of Montpellier. Some neighbourhood are clearly missing a lot of venues. I tried to reach the Facebook API instead but unfortunately, it seems that we cannot do a search based on latitude and longitude with a radius. Other website such as yelp (https://www.yelp.fr/montpellier) may be used as they seem to provide more up-to-date information.
- Population data are rather old (2009)
- Montpellier Open data are very useful indeed but the categories are too high level. For instance, elementary schools and universities are accounted in the same bin.

More over neighbourhood boundaries are purely "geographic" which helps doing statistics but does not reflect the real habits of people and the area they live in.

Overall conclusion

I would advise my friends, Laura and Denis, to find a location in the neighbourhood "Alco". It seems a good place as the population and activities are the same as "Hopitaux-Facultés" where their restaurant is currently located. Moreover they will face very few competitors there and there are also a lot of students that may become regular clients. The drawback is that is that this neighbourhood is close to the current one. The bulk of customers may be too small to accommodate two restaurants.

The same analysis would be more useful if done with the neighbourhoods of other cities in France. But this is another story....

References

- Géolocalisation details (https://perso.esiee.fr/~courivad/Python1/15-geo.html)
 - https://data.montpellier3m.fr/
 - https://www.insee.fr
 - https://www.insee.fr/fr/statistiques/1405599?geo=EPCI-243400017
 - https://inhesj.fr/ondrp
 - https://www.data.gouv.fr
 - https://france-decouverte.geoclip.fr
- https://sig.ville.gouv.fr/
- https://wiki.openstreetmap.org/wiki/Montpellier
- https://fr.wikipedia.org/wiki/Montpellier_M%C3%A9diterran%C3%A9e_M%C3%A9tropole

Acknowledgement

Appendix

Montpellier open data files

Montpellier_latlong_sous_quartiers.xlsx
Sous-quartier_02_Aiguelongue.xlsx
Sous-quartier_17_Pres dArenes.xlsx
Sous-quartier_13_Croix dArgent.xlsx
Sous-quartier_14_Pas du Loup.xlsx
Sous-quartier_12_Lemasson.xlsx
Sous-quartier_15_Saint Martin.xlsx
Sous-quartier_16_Aiguerelles.xlsx
Sous-quartier_11_Estanove.xlsx
Sous-quartier_20_Gares.xlsx
Sous-quartier_28_Figuerolles.xlsx
Sous-quartier_26_Gambetta.xlsx
Sous-quartier_10_Chamberte.xlsx
Sous-quartier_18_Port Marianne.xlsx
Sous-quartier_09_Martelle.xlsx
Sous-quartier_30_Comédie.xlsx
Sous-quartier_27_Antigone.xlsx
Sous-quartier_01_Hôpitaux-Facultés.xlsx
Sous-quartier_25_Centre Historique.xlsx
Sous-quartier_29_Arceaux.xlsx
Sous-quartier_06_Celleneuve.xlsx
Sous-quartier_08_Cévennes.xlsx
Sous-quartier_21_Pompignane.xlsx
Sous-quartier_24_Beaux Arts.xlsx
Sous-quartier_23_Boutonnet.xlsx
Sous-quartier_22_Aubes.xlsx
Sous-quartier_19_Millénaire-Grammont.xlsx
Sous-quartier_04_Paillade.xlsx
Sous-quartier_07_Alco.xlsx
Sous-quartier_05_Hauts de Massane.xlsx
Sous-quartier_03_Plan des 4 seigneurs.xlsx
Ville_Montpellier.xlsx
Quartier_Près d'Arènes.xlsx
Quartier_Port Marianne.xlsx

Quartier_Mosson.xlsx
Quartier_Hôpitaux-Facultés.xlsx
Quartier_Croix d'Argent.xlsx
Quartier_Cévennes.xlsx
Quartier_Centre.xlsx