To open a restaurant in Copenhagen (DK)

Market Analysis and Strategy to implement a successful business model

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Introduction

Background

Copenhagen is the capital and most populous city of Denmark. As of July 2018, the city has a population of 777,218 (616,098 in Copenhagen Municipality, 103,914 in Frederiksberg Municipality, 43,005 in Tårnby Municipality, and 14,201 in Dragør Municipality).
It forms the core of the wider Urban Area of Copenhagen (population 1,627,705) and the Copenhagen Metropolitan area (population 2,057,737). Copenhagen is situated on the eastern coast of the island of Zealand; another small portion of the city is located on Amager, and is separated from Malmö (population of 312,012 inhabitants in 2017 out of a municipal total of 338,230), Sweden, by the strait of Øresund. The Øresund Bridge connects he two cities by rail and road, and the whole Øresund area is home to around 4 million people.
Importantly for the purpose of this document, the city boasts a very lively and competitive culinary scene: as of 2014, Copenhagen has 15 Michelin-starred restaurants, the most of any Scandinavian city[1].

Problem and Interest

Our client wants to open a restaurant in the Copenhagen Urban Area. However, he/she does not know the city at all therefore, before investing, he/she would like us to conduct an analysis of the restaurant market: types of competitors, number of competitors and their area distribution are some of the advices he/she is seeking. At the end of the report we are supposed to provide him with a strategy, including alternative strategies of investment.

Data acquisition and cleaning

Data Source

1. In the first place, we got information on all the boroughs of Copenhagen and their relative postalcodes. These data were easy to access on the PostNord website[2]
2. Secondly, we got the latitude and longitude coordinates for each and every borough of interest, which are accessible from Google Maps.
3. With the postalcodes and the coordinates in our hands, we leveraged the Foursquare API database to get all the venues within a given radius (1 km) from the center of every borough.
4. Furthermore, we exploited the Bolig Portal website to get the housing prices for a room in Copenhagen, which was multiplied by a factor of 3 to get a price which is at least in the ballpark of the renting price for a restaurant.
5. Last but no least, we scraped the geojson data for the Choropleth map from the Copenhagen Data website[3].

Data Cleaning

Data downloaded or scraped from both Google Maps and PostNord website were combined in a single table. Data downloaded from the PostNord website were filtered to remove all entries which were not relevant (i.e., not belonging to the Copenhagen Urban Area) and integrated with data from Google Maps (see table 1); all this was done with the purpose of leveraging the Foursquare database.

	Borough	Postalcode	Latitude	Longitude
0	Albertslund	2620	55.680222	12.344944
1	Bagsværd	2880	55.760240	12.449665
2	Ballerup	2750	55.733414	12.357824
3	Brøndby	2605	55.645991	12.415682
4	Brøndby Strand	2660	55.622972	12.420225
5	Brønshøj	2700	55.703435	12.497005
6	Charlottenlund	2920	55.759298	12.575239
7	Dragør	2791	55.589891	12.644038
8	Dyssegård	2870	55.733663	12.527227
9	Frederiksberg	2000	55.678974	12.515761
10	Frederiksberg C	1805, 1810, 1927, 1867, 1857, 1908, 1870, 1917...	55.679026	12.544811
11	Gentofte	2820	55.751258	12.543335
12	Glostrup	2600	55.676961	12.402743
13	Greve	2670	55.598277	12.243247
14	Hedehusene	2640	55.654361	12.199693
15	Hellerup	2900	55.735471	12.567897

Table 1: Copenhagen boroughs vs postalcodes and coordinates from Google Maps

Leveraging the Foursquare API data provided a plethora of venues entries, among which over one hundred restaurant venues entries (see for example table 2 below).

	Borough	Borough Latitude	Borough Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
0	Albertslund	55.680222	12.344944	Badesøen	55.675682	12.334593	Water Park
1	Albertslund	55.680222	12.344944	Galgebakken Torv	55.679553	12.347632	Plaza
2	Albertslund	55.680222	12.344944	Fakta	55.675374	12.354690	Grocery Store
3	Albertslund	55.680222	12.344944	Albertslund Hallerne	55.676495	12.333289	Volleyball Court
4	Bagsværd	55.760240	12.449665	Bibliografen	55.760622	12.456612	Multiplex
5	Bagsværd	55.760240	12.449665	Irma Bagsværd Torv	55.760413	12.454644	Grocery Store
6	Bagsværd	55.760240	12.449665	Aldershvile Planteskole	55.765009	12.457966	Flower Shop
7	Bagsværd	55.760240	12.449665	Meny	55.760992	12.454781	Supermarket
8	Bagsværd	55.760240	12.449665	Netto	55.761198	12.450222	Grocery Store
9	Bagsværd	55.760240	12.449665	GuldBageren	55.761049	12.452373	Bakery
10	Bagsværd	55.760240	12.449665	Fakta	55.760137	12.451824	Convenience Store
11	Bagsværd	55.760240	12.449665	Bagsværd Kirke	55.761645	12.444028	Church
12	Bagsværd	55.760240	12.449665	Bagsværd Sø	55.764162	12.448976	Lake
13	Bagsværd	55.760240	12.449665	Bagsværd Stadion	55.759773	12.459336	Track Stadium
14	Bagsværd	55.760240	12.449665	Søndergaard Park Pizza & Grill	55.757261	12.460361	Pizza Place
15	Bagsværd	55.760240	12.449665	Novo Nordisk 9a	55.754581	12.456358	Cafeteria

Table 2: Copenhagen boroughs vs venues, venues coordinates and venues category from Foursquare

All these data will be used to get as much information as we can to map out the most common venues per borough, as well as the restaurant types and location.
Finally, we also plan on creating a Choropleth map with the rent prices: To do so, we scaled our area of interest down to Copenhagen City Proper Area, as the relevant geojson files could only be retrieved for this area. However, this was not a big problem, as KBH City Proper is the area with the highest contration of restaurants in the Copenhagen Urban Area. This also entailed some minor borough name change, as the postalcodes area subdivision does not always correspond to the Copenhagen area subdivision made by the Copenhagen Commune.

Methodology

Exploratory Analysis of the competitors' scenario

With the help of the Python **folium** library and the coordinates acquired from Google Maps, we were able to visualize the geographic details of Copenhagen on a map of Copenhagen with superimposed borough centers. We present the result in Figure 1, where each and every dot represents the center of a different borough.With these data in our hands, we utilized the Foursquare API to explore the boroughs for venues, with a keen eye for restaurants. The limit was set at **100 venues** and the radius at **1000 meter** for each borough from their given latitude and longitude coordinates.

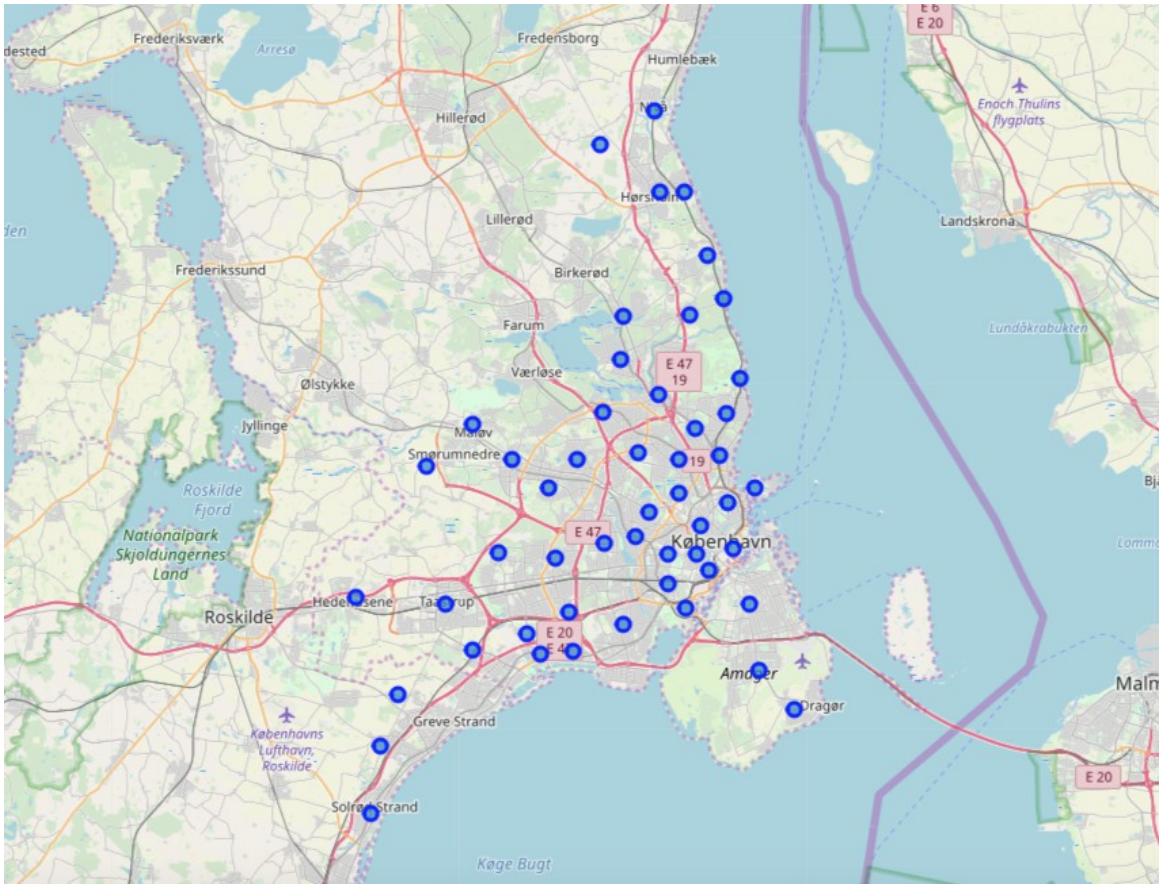

Figure 1: Copenhagen boroughs on the map.

Here is a head of the list, which contains Borough name, latitude and longitude, as well as Venues name, category, latitude and longitude informations from Forsquare API. The list contains over 1300 different venues.

From this list, containing all possible venue categories, we selected the ones which are categorized as “Restaurants” (for simplicity, we ignore the pizzerias and all fast foods which are not labeled as “Restaurants” by the Fousquare API). We present the result in Table 3.

	Borough	Borough Latitude	Borough Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
0	Brønshøj	55.703435	12.497005	Ya Ya Sushi	55.705431	12.492150	Sushi Restaurant
1	Brønshøj	55.703435	12.497005	Chicken & Bagels	55.704943	12.495769	Generic Restaurant
2	Charlottenlund	55.759298	12.575239	Izumi	55.754712	12.568735	Sushi Restaurant
3	Charlottenlund	55.759298	12.575239	Café A	55.763690	12.579119	Generic Restaurant
4	Charlottenlund	55.759298	12.575239	Letz Sushi	55.753681	12.572732	Sushi Restaurant
5	Charlottenlund	55.759298	12.575239	Emils Kebab	55.752255	12.571679	Kebab Restaurant
6	Dyssegård	55.733663	12.527227	Madhus 24	55.730362	12.521682	Generic Restaurant
7	Dyssegård	55.733663	12.527227	Pizza Perfecto	55.730317	12.521448	Fast Food Restaurant
8	Dyssegård	55.733663	12.527227	King Chicken	55.728764	12.524049	Fast Food Restaurant
9	Dyssegård	55.733663	12.527227	Itzi Pitzi	55.737161	12.539897	Italian Restaurant

Table 3: Head of the Copenhagen Restaurant venues list.

This segmentation returned 32 different restaurant categories, the frequency of which we counted and reported in the histogram in Figure 2. As one might expect, Scandinavian restaurants are the most important entry, together with the "Generic Restaurant" category (this name only means they serve unspecialized menus, and should not be considered as a quality indicator), Sushi, Italian and Thai restaurants.

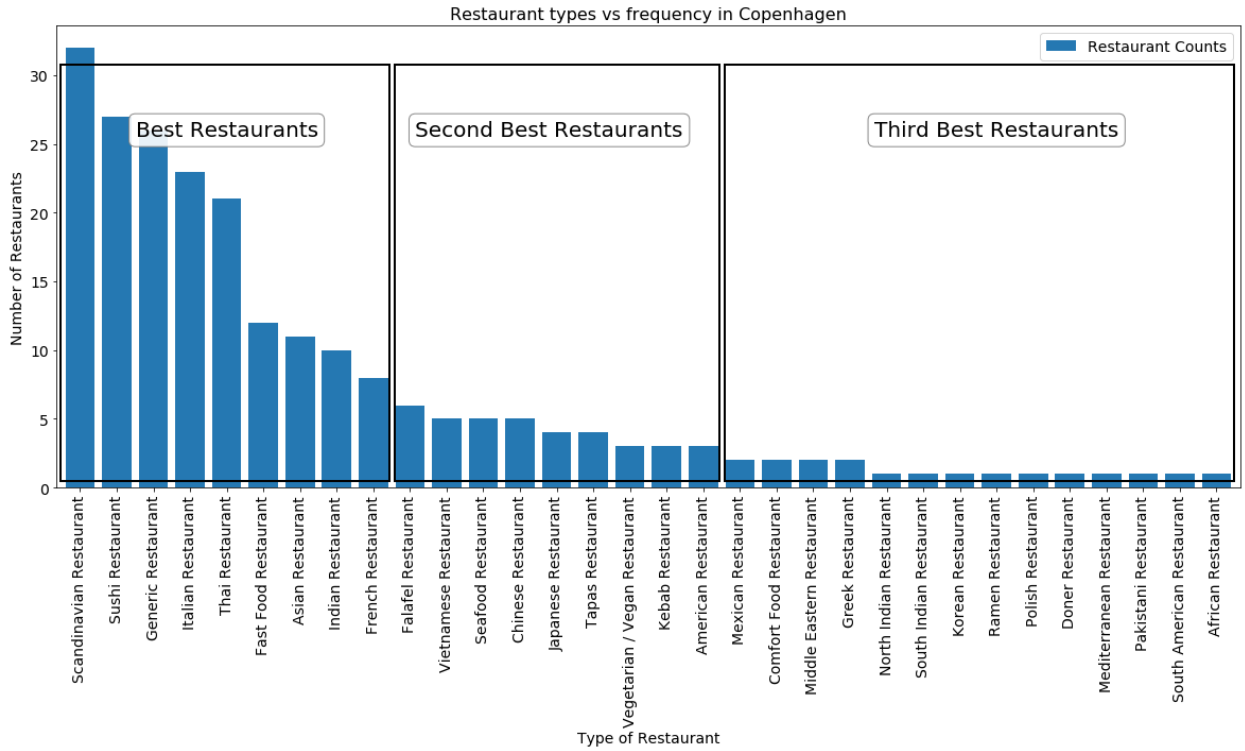

Figure 2: Copenhagen restaurants type histogram. The restaurants are divided into three categories, depending on their abundance.

We want to play with our dataset, and segment the data by selecting the best 10 Restaurant venue for each borough. We present the head of the list in Table 4.

	Borough	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
0	Brønshøj	Sushi Restaurant	Generic Restaurant	Vietnamese Restaurant	Korean Restaurant	American Restaurant	Asian Restaurant	Chinese Restaurant	Comfort Food Restaurant	Falafel Restaurant	Fast Food Restaurant
1	Charlottenlund	Sushi Restaurant	Generic Restaurant	Kebab Restaurant	Vietnamese Restaurant	Korean Restaurant	American Restaurant	Asian Restaurant	Chinese Restaurant	Comfort Food Restaurant	Falafel Restaurant
2	Dyssegård	Fast Food Restaurant	Generic Restaurant	Italian Restaurant	Vietnamese Restaurant	Korean Restaurant	American Restaurant	Asian Restaurant	Chinese Restaurant	Comfort Food Restaurant	Falafel Restaurant
3	Frederiksberg	African Restaurant	Sushi Restaurant	French Restaurant	Polish Restaurant	Italian Restaurant	Kebab Restaurant	American Restaurant	Asian Restaurant	Chinese Restaurant	Comfort Food Restaurant
4	Frederiksberg C	Scandinavian Restaurant	Italian Restaurant	Thai Restaurant	Asian Restaurant	Generic Restaurant	French Restaurant	Greek Restaurant	Indian Restaurant	Tapas Restaurant	Sushi Restaurant
5	Gentofte	Italian Restaurant	Vietnamese Restaurant	Korean Restaurant	American Restaurant	Asian Restaurant	Chinese Restaurant	Comfort Food Restaurant	Falafel Restaurant	Fast Food Restaurant	French Restaurant
6	Hedehusene	Italian Restaurant	Asian Restaurant	Fast Food Restaurant	Vietnamese Restaurant	Korean Restaurant	American Restaurant	Chinese Restaurant	Comfort Food Restaurant	Falafel Restaurant	French Restaurant
7	Hellerup	Scandinavian Restaurant	Thai Restaurant	Sushi Restaurant	Asian Restaurant	Comfort Food Restaurant	Generic Restaurant	Fast Food Restaurant	French Restaurant	Italian Restaurant	Indian Restaurant
8	Holte	Chinese Restaurant	Italian Restaurant	Vietnamese Restaurant	Korean Restaurant	American Restaurant	Asian Restaurant	Comfort Food Restaurant	Falafel Restaurant	Fast Food Restaurant	French Restaurant
9	Ishøj	Fast Food Restaurant	Vietnamese Restaurant	Korean Restaurant	American Restaurant	Asian Restaurant	Chinese Restaurant	Comfort Food Restaurant	Falafel Restaurant	French Restaurant	Generic Restaurant

Table 4: Head of the Copenhagen Best 10 Restaurant venues per Borough list.

We can also divide our dataframe into clusters with the K-means algorithm and plot the position of each and every restaurant on the Copenhagen map, in a different color, depending on the cluster label. The result is presented in Figure 3 below.

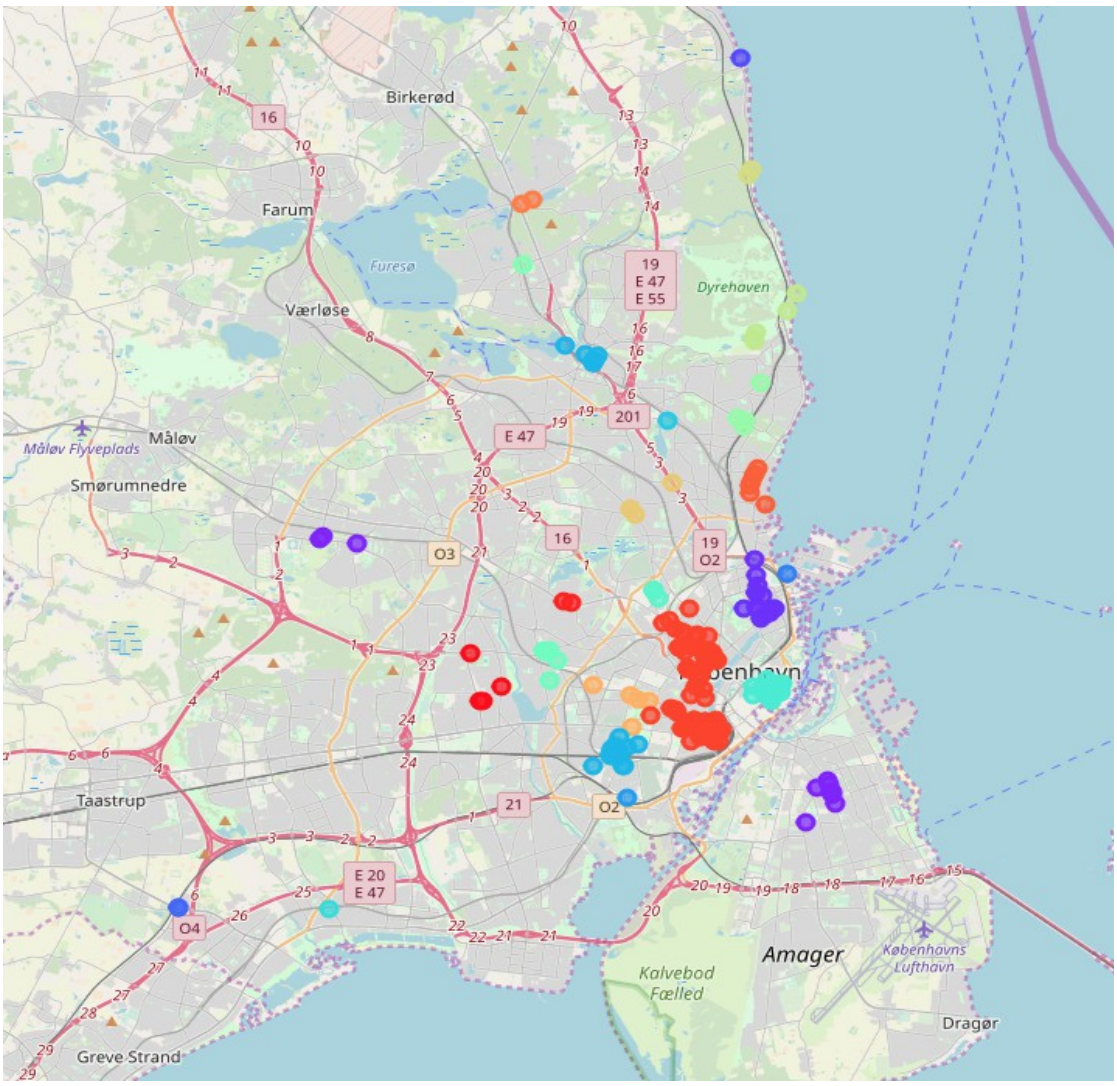

Figure 3: K-means clustering (25 clusters) of all restaurants of our Copenhagen Restaurants database.

We can see that the simple, untrained K-means clustering algorithm divided our Restaurants database in 25 clusters.

The city center and the adjacent neighborhoods count a large amount of datapoints, each neighborhood's restaurants grouped in one cluster, while there are a number of scattered clusters containing the datapoints of the restaurants located in the suburban boroughs.

The clustering algorithm counts so many different items because the map is quite large and the scattering is significant, so that to minimize the summed square error of the K-means algorithm one has to increase the number of clusters, as there is no pronounced elbow in the SSE vs Number of Clusters plot (see Figure 4 for more details).

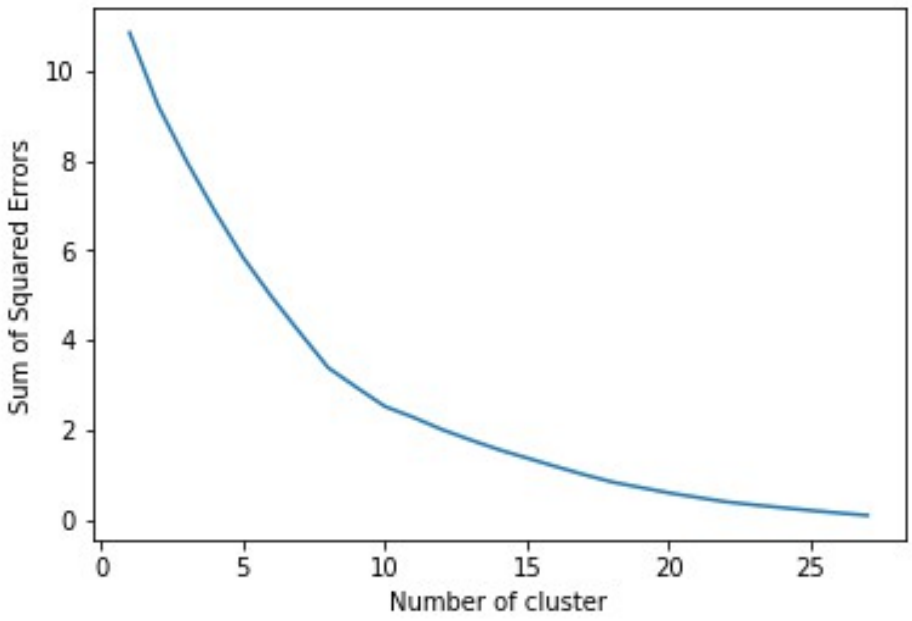

Figure 4: Sum of square errors vs number of clusters: No elbow is clearly visible in the curve.

However, this is perhaps not the most convenient way to visualize the results. Therefore, we decided to refine our strategy to make a more accurate decision. For this purpose, a direct visualization of the restaurants' position on the map could be very handy, combined with some comment on the “what is where”.

We decided to plot the first nine most frequent types of restaurants (over 7 counts), in case our client decided to get into the most competitive branch of the business (see Figure 5); secondly, we plotted the nine restaurants in the second most competitive branch (from 3 to 6 counts) in a separate map (see Figure 6). We skipped the least competitive branch of restaurants because it is probably the least lucrative branch of all and we doubt one wants to invest there.

Results and Discussion

In Figure 5 we can see the distribution of the first nine types of restaurants, superimposed on top of Copenhagen map. Each color marks a different type of restaurant.

We can see that most of the restaurant are clustered in the city center (Indre By or Copenhagen K), or in the boroughs of Østerbro, Nørrebro, Vesterbro, Fredericksberg and Valby. Some minor clustering occurs at Hellerup, Klampenborg, Brønshøj, Vanløse and Charlottenlund.

Even more relevant is the clustering of some restaurants' type in some specific boroughs: Thai restaurants are more abundant between Vesterbro and Fredericksberg, and also in Østerbro, Nørrebro they are heavily clustered.

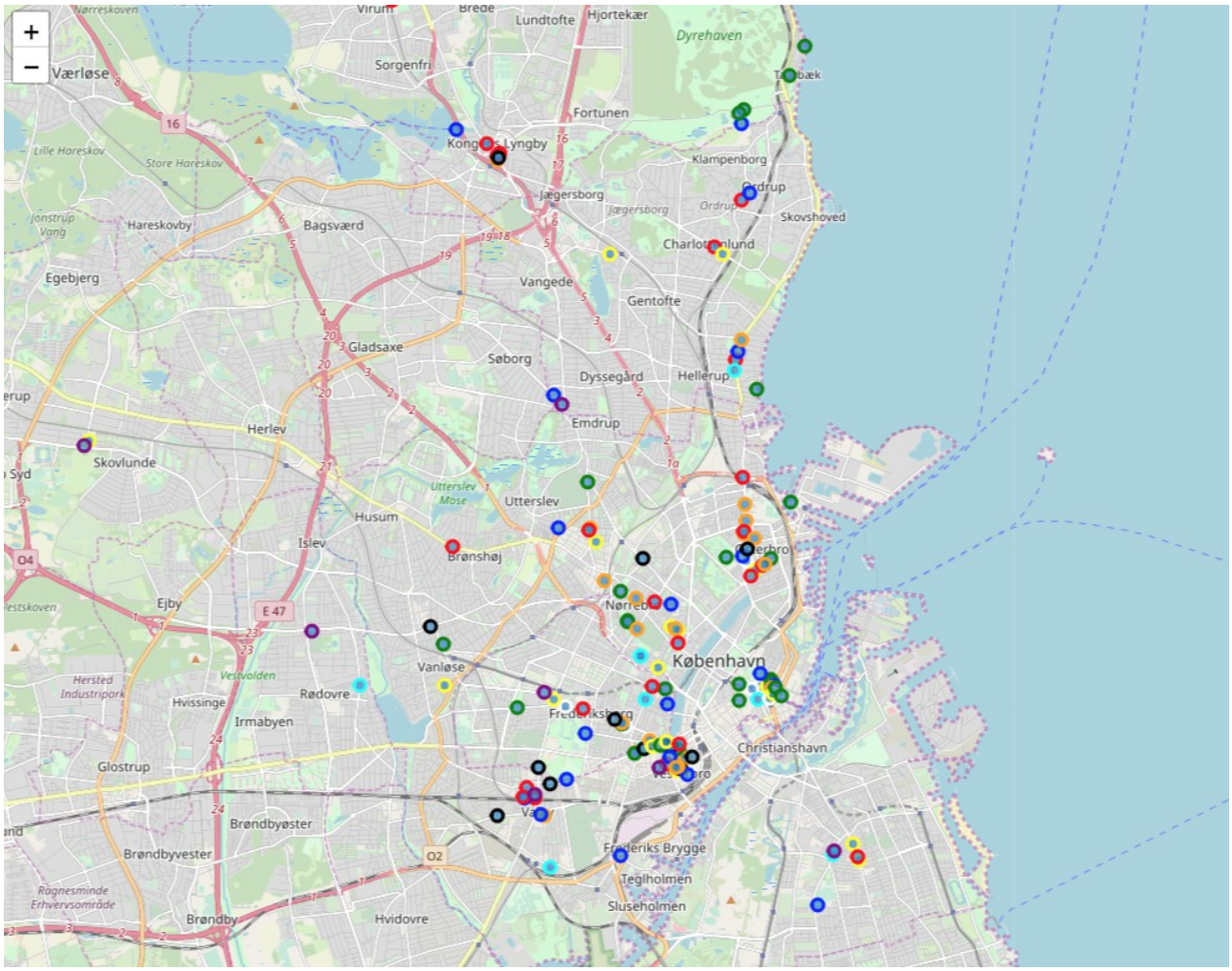

Figure 5: Location of the best 9 types of Copenhagen restaurants. ***Color code:*** Generic in blue, Sushi in red, Italian in yellow, Scandinavian in green, Thai in orange, Fast Food in purple, French in white, Indian in black and Asian in cyan.

Indre By (Copenhagen Center) offers quite a different scenario, as it counts several entries in the French, Generic and Scandinavian restaurants; Scandinavian restaurants are evenly scattered between Indre By, Nørrebro, Østerbro, Vesterbro and Fredericksberg or located on the coast north of Copenhagen: They are often very high-end venues. Generic restaurants enjoy a similar kind of scattering.

Sushi places are scattered all over Copenhagen Urban Area, but are totally absent from the Indre By (City Center), while Italian restaurants are equally well distributed, but less present in Østerbro and Valby and totally absent from the rather wealthy Hellerup (although a couple are located nearby in Dyssegaard and Gentofte); Indian restaurant appear more frequently in Vesterbro and Valby, while Asian are mainly located between the City Center, Nørrebro, and Fredericksberg, with some presence in outer boroughs, such as Valby and Hellerup.

Finally, Fast Food seems to be scattered well out of the heart of the city, in residential boroughs, where the competition is probably less fierce.

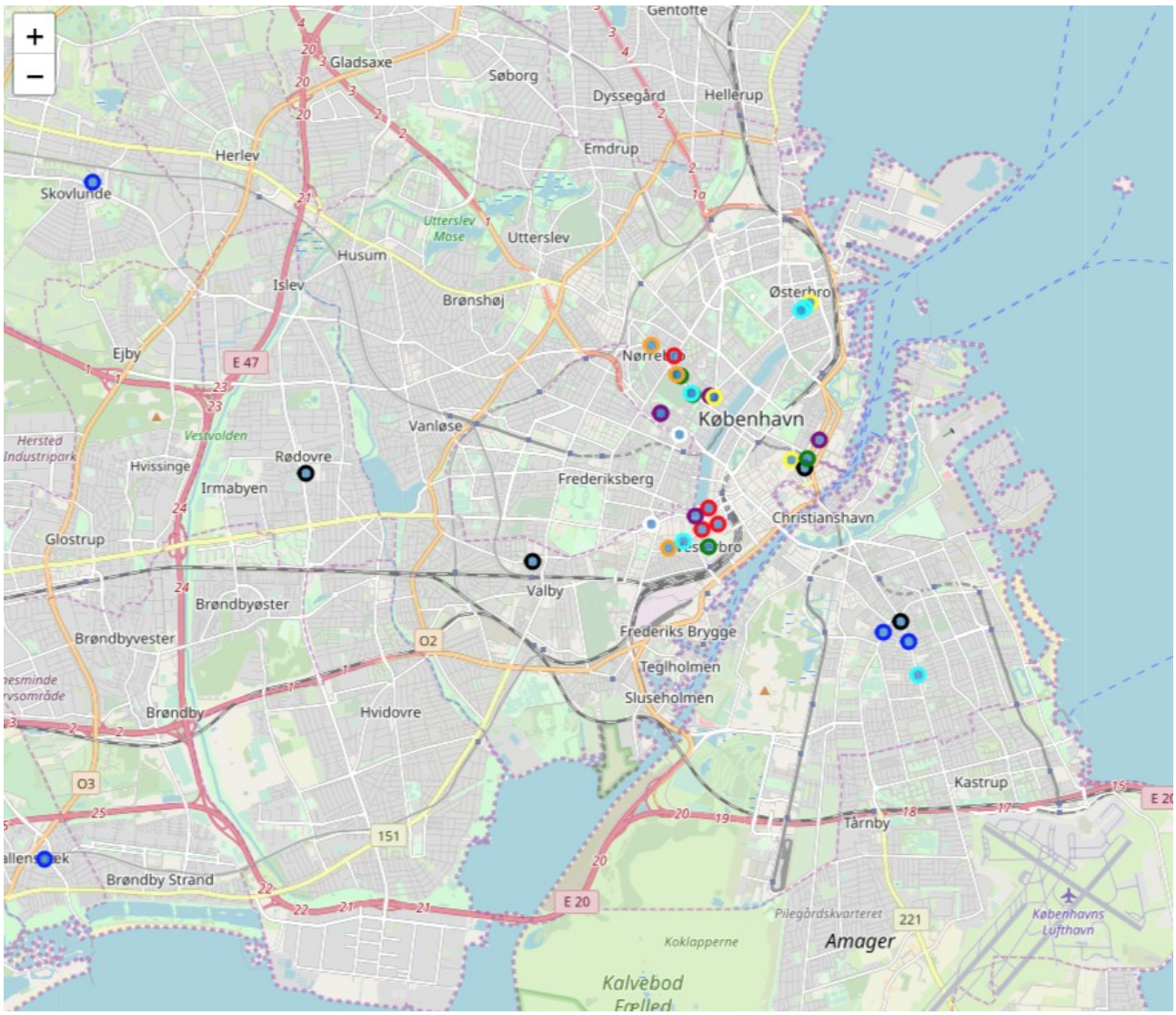

Figure 6: Location of the second best nine types of Copenhagen restaurants. ***Color code:*** Chinese in blue, Japanese in red, Seafood in green, Vegetarian/vegan in yellow, Kebab in orange, Vietnamese in purple, Greek in white, American in black and Falafel in cyan.

The branch containing the eight types of second most frequent restaurants (plotted in Figure 6) counts fewer and fewer entries compared to the previous one. In greater detail, we notice a clustering of Vietnamese restaurants between the City Centre, Nørrebro and Vesterbro; Japanese restaurants are mainly located in Vesterbro, while Kebab, Greek, Seafood are mainly located between Nørrebro and Vesterbro. Falafel restaurants can be found a bit everywhere around the lakes (i.e. in Nørrebro, Østerbro, Vesterbro). American restaurants are widely scattered throughout the city map, spanning from Rødovre to Valby and Amager (Copenhagen SW); on the contrary, Vegetarian/Vegan are concentrated between Nørrebro, Østerbro and Indre By.
Finally, Chinese restaurants are scattered mostly in the suburbs, the closest to the city center being located in Amager.

Price of rents

Rents are an important factor to take into consideration when opening any commercial activities, including restaurants. To make it easier for the client to make a decision, we created a map plot (Figure 7) which summarizes the cost of rent in the various boroughs of Copenhagen.
Unfortunately, in our map we could only plot the data for the Copenhagen Kommune, i.e. Indre By, Nørrebro, Østerbro (including Nordhavn),Vesterbro, South and South West Copenhagen (a.k.a as North and North West Amager), Valby, Vanløse, Brønshøj-Husum and North West Copenhagen (a.k.a. Bispebjerg). Fredericksberg is and independent Kommune and no geojson data was available to include it in the map in Figure 7: nonetheless, the map is quite useful to make a decision on which borough is the most suitable.

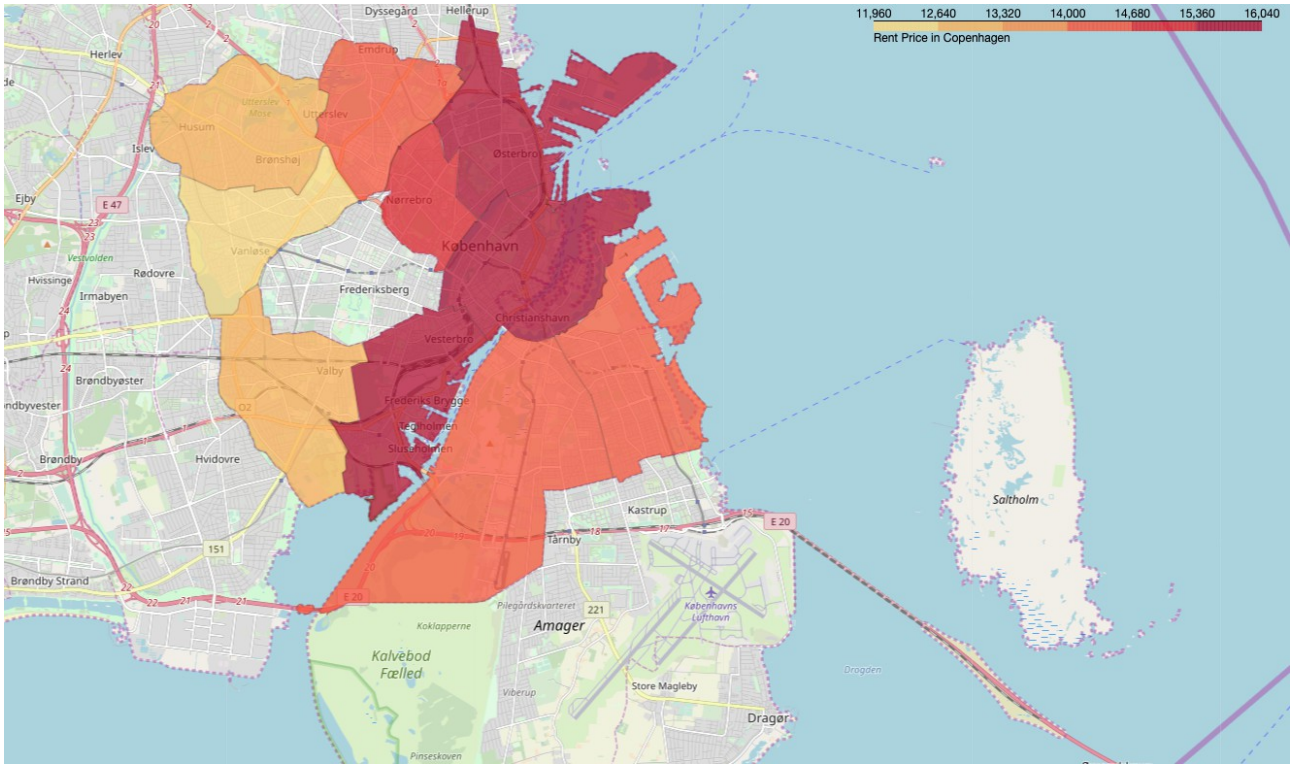

Figure 7: Choropleth Map of the prices for the different boroughs of Copenhagen Kommune

The map rents are reported in the local danish currency:, the danish crown or DKK. As we can see, the center of Copenhagen and the immediately adjacent areas (Indre By, Nørrebro, Østerbro, Nordhavn, Vesterbro and South Copenhagen) are, as it was predictable, the most expensive areas. As one moves northwards (Nørrebro, Bispebjerg) and southwards (Amager) the rent price decreases, but not as much as it would decrease going westwards (Valby, Vanløse, Brønshøj-Husum). Fredericksberg is not shown, but we can safely assume its rent prices are not too different from those in the most central boroughs, given its rather “posh” character (this also holds for Hellerup, close to northern Østerbro).

Conclusions

Ideally, one would choose a type of restaurant which represents a compromise between the very high level of competition and culinary skills required to prosper in the most represented group of restaurants (the first nine types we presented above) and the low profits one can make with the type of restaurants which populate the lowest category: therefore, one could decide to go with the second most populated category, which counts eight different types of restaurants. For example, one could open an American restaurant, or a Vietnamese one, if he/she is careful to establish it far from the existing competitors of the category.

It would also be best to minimize the cost of rent, while at the same time keeping a reasonable distance from the City Centre. For this purpose, the best boroughs are Vanløse, Bispebjerg (or Copenhagen NV) and the island of Amager (or Copenhagen SV), as they combine both these features.

References:

[1] Wikipedia- Copenhagen

[2] https://www.postnord.dk/kundeservice/find-postnummer/postnummerkort

[3] https://data.kk.dk/dataset/bydele/resource/35c4597f-9dfb-4d60-929d-7e6e4bc9486b