Finding a best place for a new Chinese restaurant in city of Copenhagen

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Contents

1. Introduction: Business Problem

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 Chinese restaurant **in** Copenhagen, Denmark.

Since there are lots of restaurants in City of Copenhagen, we will try to detect locations that are not already crowded with restaurants**.** We are also particularly interested in areas with no Chinese restaurants in vicinity. We would also prefer locations as close to city center as possible, assuming that first two conditions are met.

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

2. Data

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

- number of existing restaurants in the neighborhood (any type of restaurant)
- number of and distance to Chinese restaurants in the neighborhood, if any
- distance of neighborhood from city center

We decided to use regularly spaced grid of locations, centered around city center, to define our neighborhoods.

Following data sources will be needed to extract/generate the required information:

- centers of candidate areas will be generated algorithmically and approximate addresses of centers of those areas will be obtained using **Google Maps API reverse geocoding**
- number of restaurants and their type and location in every neighborhood will be obtained using **Foursquare API**
- coordinate of Copenhagen center will be obtained using **Google Maps API geocoding** of well-known Copenhagen location (Tivoli)

3. Methodology

In this project we will direct our efforts on detecting areas of Copenhagen that have low restaurant density, particularly those with low number of Chinese restaurants. We will limit our analysis to area ~6km around city center.

In first step we have collected the required **data: location and type (category) of every restaurant within 6km from Copenhagen center** (Tivoli). We have also **identified Chinese restaurants** (according to Foursquare categorization).

Second step in our analysis will be calculation and exploration of '**restaurant density**' across different areas of Copenhagen - we will use **heatmaps** to identify a few promising areas close to center with low number of restaurants in general (*and* no Italian restaurants in vicinity) and focus our attention on those areas.

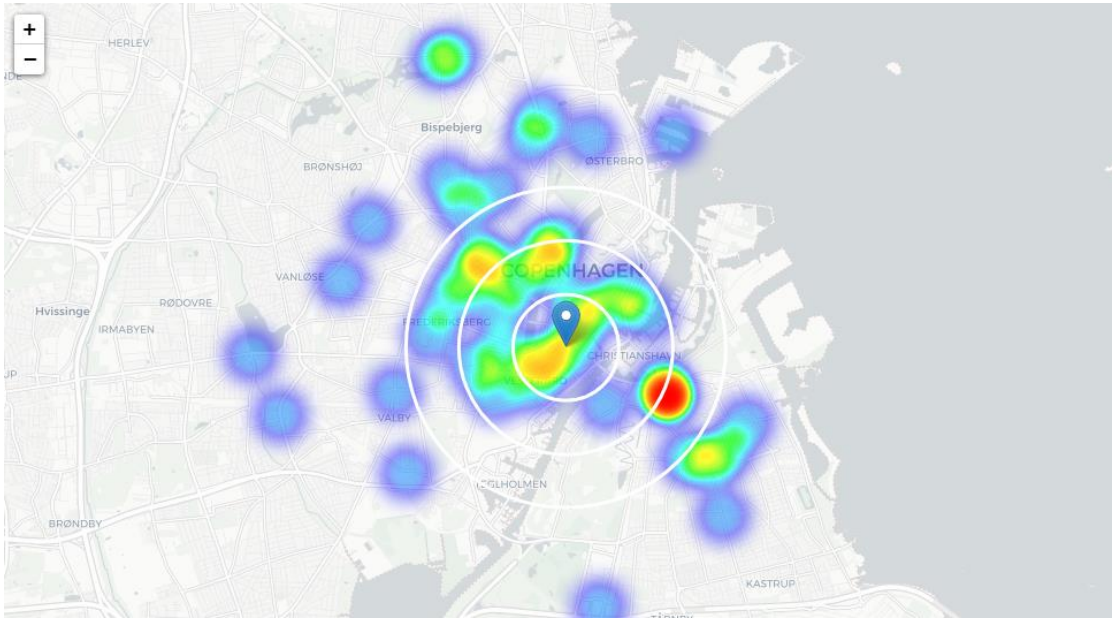
In third and final step we will focus on most promising areas and within those create **clusters of locations that meet some basic requirements** established in discussion with stakeholders: we will take into consideration locations with **no more than two restaurants in radius of 250 meters**, and we want locations **without Chinese restaurants in radius of 400 meters**. We will present map of all such locations but also create clusters (using **k-means clustering**) of those locations to identify general zones / neighborhoods / addresses which should be a starting point for final 'street level' exploration and search for optimal venue location by stakeholders.

4. Analyze

4.1 First, count the number of restaurants in area candidate and calculate the distance to nearest Chinese restaurant from every area candidate center (not only those within 300m - we want distance to closest one, regardless of how distant it is)

	Address	Latitude	Longitude	X	Y	Distance from center	Restaurants in area	Distance to Chinese restaurant
0	Sneppestien, 2770 Kastrup	55.621803	12.542770	345271.898787	6.166728e+06	5992.495307	0	2423.561542
1	Unnamed Road, 2770 Kastrup	55.621993	12.552289	345871.898787	6.166728e+06	5840.376700	0	1873.800516
2	Kanonvej, 2770 Kastrup	55.622183	12.561808	346471.898787	6.166728e+06	5747.173218	0	1366.969714
3	Richard Mortensens Vej 20, 2300 København S	55.622372	12.571327	347071.898787	6.166728e+06	5715.767665	0	972.668508
4	Hf. Kongedybet 31, 2770 Kastrup	55.622560	12.580846	347671.898787	6.166728e+06	5747.173218	1	862.300326
5	Hf. Sydgrænsen 98, 2770 Kastrup	55.622747	12.590365	348271.898787	6.166728e+06	5840.376700	0	1122.960231
6	Præstefælledvej 32, 2770 Kastrup	55.622934	12.599884	348871.898787	6.166728e+06	5992.495307	0	1580.669955
7	Selinevej 10, 2300 København	55.626180	12.528198	344371.898787	6.167247e+06	5855.766389	0	2989.236353
8	Selinevej 8, 2300 København	55.626372	12.537718	344971.898787	6.167247e+06	5604.462508	0	2590.216460
9	Fasanskovvej, 2770 Kastrup	55.626563	12.547238	345571.898787	6.167247e+06	5408.326913	0	1996.672015

4.2 Crete a map showing heatmap / density of restaurants and try to extract some meaningfull info from that. Also, show a few circles indicating distance of 1km, 2km and 3km from Tivoli



4.3 Analyses the heatmap / density of restaurants

From above map we can easily find that is not so 'hot' (Chinese restaurants represent a subset of ~6% of all restaurants in Copenhagen) but it also indicates higher density of existing Chinese restaurants directly north and west from Tivoli, with closest pockets of low Chinese restaurant density positioned south-west and north-east from city center.

Based on this we will now focus our analysis on areas *south-west, north-east from* Copenhagen center - we will move the center of our area of interest and reduce it's size to have a radius of 2.5km. This places our location candidates mostly in boroughs København S and Amager (another potentially interesting borough is Valby with large low restaurant density west from city center, however this borough is less interesting to stakeholders as it's mostly residential and less popular with tourists).

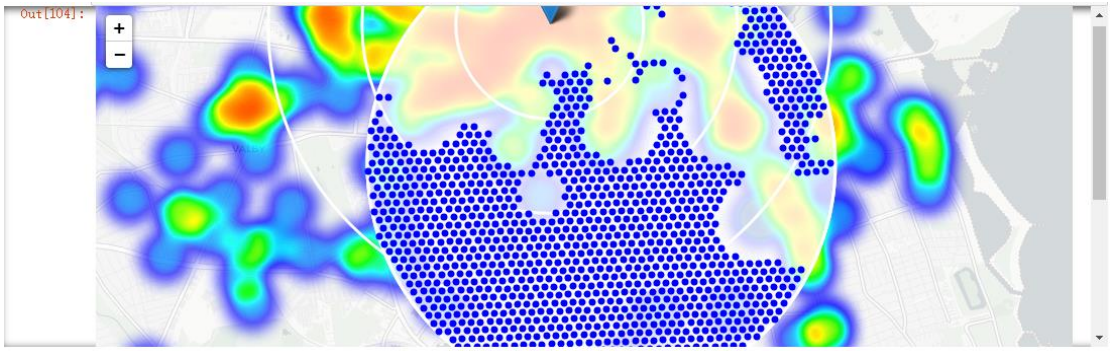
4.4 Analyses of **København SV and Amager**

Analysis of popular travel guides and web sites often mention København SV and Amager as beautiful, interesting, rich with culture, 'hip' and 'cool' Copenhagen neighborhoods popular with tourists and loved by københavner.

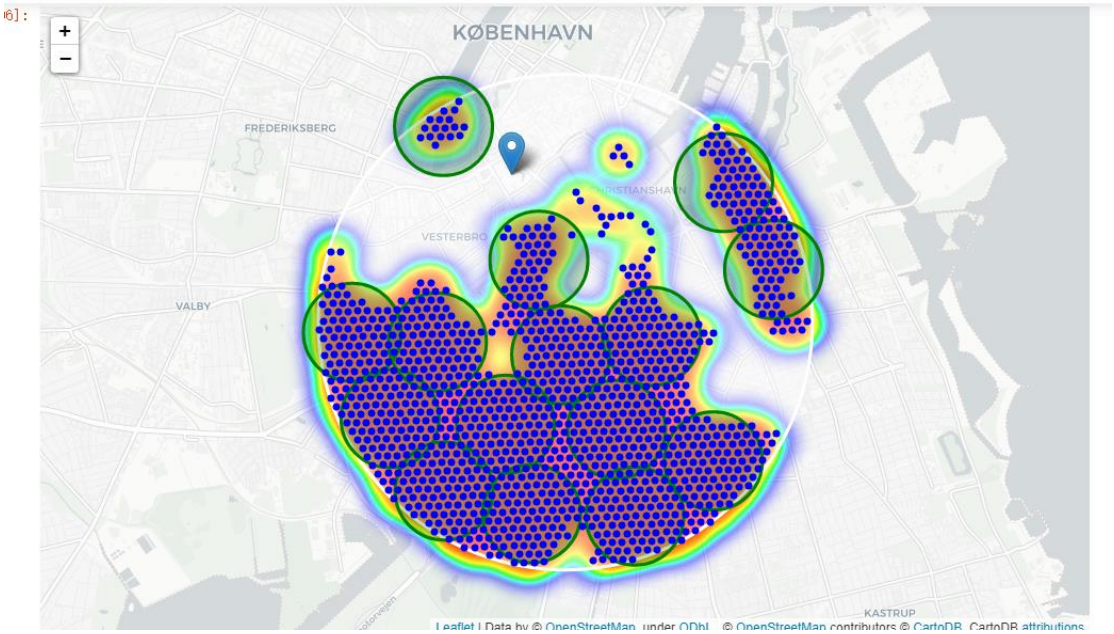
Popular with tourists, alternative and bohemian but booming and trendy, relatively close to city center and well connected, those boroughs appear to justify further analysis.

Let's define new, narrower region of interest, which will include low-restaurant-count parts of København SV and Amager closest to Tivoli.

4.5 calculate two most important things for each location candidate: **number of restaurants in vicinity and filter those locations: locations with no more than two restaurants in radius of 250 meters, and no Chinese restaurants in radius of 400 meters. Show on the map



4.6 Cluster those locations to create **centers of zones containing good locations**. Those zones, their centers and addresses will be the final result of our analysis.



4.7 Finally, reverse geocode those candidate area centers to get the addresses which can be presented to stakeholders.

Addresses of centers of areas recommended for further analysis

Otto Busses Vej 43, 2450 København => 2.3km from Tivoli

Stjernevej 5, 2300 København => 3.7km from Tivoli

Bryllupstræet, Artillerivej 73A, 2300 København => 1.9km from Tivoli

Lyneborggade 9, 2300 København => 2.8km from Tivoli

Bonderosestien 160, 2300 København => 3.3km from Tivoli

Toldkammeret (Vasbygade), 2450 København => 1.8km from Tivoli

Norsvej 7, 1916 Frederiksberg => 0.8km from Tivoli

Artillerivej 174, 2300 København => 2.5km from Tivoli

Kaj Munks Vej 5, 2300 København => 2.2km from Tivoli

Vejlands Allé 200, 2300 København => 3.4km from Tivoli

Fabriksområdet 86, 1440 København => 2.2km from Tivoli

Teglholmsgade 34, 2.th, 2450 København => 2.7km from Tivoli

Nordre Digevej 52, 2300 København => 2.8km from Tivoli

Grundejerforeningen Havnestads Havnepark - åbent alle dage kl. 7.00-22.00, Islands Brygge 22, 2300 København S => 0.9km from Tivoli

Sundbyvestervej 50, 2300 København => 3.5km from Tivoli

5. Results and Discussion

Our analysis shows that although there is a great number of restaurants in Copenhagen (~910 in our initial area of interest which was 12x12km around Tivoli), there are pockets of low restaurant density fairly close to city center. Highest concentration of restaurants was detected north and west from Tivoli, so we focused our attention to areas south and south-west, corresponding to boroughs København SV, Amager and north-west corner of København. Another borough was identified as potentially interesting (valby and Bornbyst), but our attention was focused on København SV and Amager which offer a combination of popularity among tourists, closeness to city center, strong socio-economic dynamics *and* a number of pockets of low restaurant density.

After directing our attention to this more narrow area of interest (covering approx. 5x5km south-east from tIVOLI) we first created a dense grid of location candidates (spaced 100m appart); those locations were then filtered so that those with more than two restaurants in radius of 250m and those with an Italian restaurant closer than 400m were removed.

Those location candidates were then clustered to create zones of interest which contain greatest number of location candidates. Addresses of centers of those zones were also generated using reverse geocoding to be used as markers/starting points for more detailed local analysis based on other factors.

Result of all zones containing largest number of potential new restaurant locations based on number of and distance to existing venues - both restaurants in general and Chinese restaurants particularly. This, of course, does not imply that those zones are actually optimal locations for a new restaurant! Purpose of this analysis was to only provide info on areas close to Copenhagen center but not crowded with existing restaurants (particularly Chinese) - it is entirely possible that there is a very good reason for small number of restaurants in any of those areas, reasons which would make them unsuitable for a new restaurant regardless of lack of competition in the area. Recommended zones should therefore be considered only as a starting point for more detailed analysis which could eventually result in location which has not only no nearby competition but also other factors taken into account and all other relevant conditions met.

6. Conclusion

Purpose of this project was to identify Copenhagen areas close to center with low number of restaurants (particularly Chinese restaurants) in order to aid stakeholders in narrowing down the search for optimal location for a new Chinese restaurant. By calculating restaurant density distribution from Foursquare data we have first identified general boroughs that justify further analysis (København SV and Amager), 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 decission 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.