Analyzing Potential Location for a New Café

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Introduction

Background

Frankfurt am Main is a hub for commerce, culture, education, tourism, and transportation in Germany and in Europe. According to data from the city register of residents, 51.2% of the population had a *migration background* as of 2015, which means that a person or at least one or both of their parents was born with foreign citizenship. And 27.7% of residents had a foreign citizenship.[1] Because of these, the city has become a multicultural city. Therefore, the client wants to open a Café with the new concept. And this concept requires that the potential customer be curious and have the cultural tolerance.

Problem

The Client needs the potential location who customer is curious and has the cultural tolerance, but not nearly schools and not at the airport. The task for us is to find out the suitable area(s) in Frankfurt.

Data Preparing

Data Source

1. List of Ortsbezirke of Frankfurt am Main:
   https://en.wikipedia.org/wiki/List_of_Ortsbezirke_of_Frankfurt_am_Main
2. The geodata of city districts (neighborhood):
   https://offenedaten.frankfurt.de/dataset/wahlatlas-2015-geodaten
3. Foursquare API to get the most common venues in Frankfurt districts
   https://api.foursquare.com
4. List of schools
   https://schulaemter.hessen.de/standorte/frankfurt-am-main/schulangebot/schulliste
5. Optional: addresses in the city area
   https://offenedaten.frankfurt.de/dataset/hauskoordinaten-franfurt
6. Optional: tourist attractions in Frankfurt
   https://www.thecrazytourist.com/25-best-things-frankfurt-germany/

[1] https://en.wikipedia.org/wiki/Frankfurt

Data Description

List of Ortsbezirke of Frankfurt am Main

An Ortsbezirk is an administrative division of the city of Frankfurt in Germany. Frankfurt comprises 16 Ortsbezirke which are subdivided into 46 quarters or city districts (here these are neighborhood). While Frankfurt citizens identify themselves more with the city district they live in, Ortsbezirke are the highest political divisions of the city.[2] This list lets people know which city districts are neighbors and nearly city center.

The geodata of city districts

The geodata of city districts is polygon. The area of each district can be plotted. The centroids will be calculated. Each centroid will be used to find out the near venues.

Foursquare API to get the most common venues in Frankfurt districts

The information about venues will be read there. It is easy to find out the name of category and the coordinates through this information. The next step is to look for the suitable area and similar areas.

List of schools

The list includes names and addresses of schools. The Location near schools is not expected. The geographical coordinates of schools will be plotted.

Addresses in the city area

The list has street name, house number, and their coordinates etc. There is more potential customer near shopping street.

Tourist attractions

The name of sights will be read from webpage. Tourist will be the potential customer.

Methodology

Data Wrangling

Firstly, List of Ortsbezirke of Frankfurt am Main was read from web page, as follows:

Table 1. List of Ortsbezirke of Frankfurt am Main

	No.	Borough	Neighborhood	Population	Area	Population Density
0	1	Innenstadt I	Altstadt, Bahnhofsviertel, Gallus, Gutleutvier...	44.183	8,987	4.916
1	2	Innenstadt II	Bockenheim, Westend-Nord, Westend-Süd	57.629	9,493	6.071
2	3	Innenstadt III	Nordend-Ost, Nordend-West	51.671	4,744	10.892
3	4	Bornheim/Ostend	Ostend, Bornheim	56.723	9,212	6.158
4	5	Süd	Flughafen, Niederrad, Oberrad, Sachsenhausen-S...	91.662	84,831	1.081

[2] https://en.wikipedia.org/wiki/List_of_Ortsbezirke_of_Frankfurt_am_Main

There are 16 Ortsbezirke which are in Table 1 as Borough. Each Borough has one or several neighbors which are city districts in Frankfurt am Main. There are 46 neighbors in Table 1.

Secondly, the geographical coordinates of neighbors were downloaded. Table 2 shows only 44 neighbors, because the airport Frankfurt is included in Sachsenhausen-Süd as well as Gutleutviertel and Bahnhofviertel are together.

	STTLNR	STTLNAME	geometry
0	1	Altstadt	POLYGON ((8.68787 50.11416, 8.68789 50.11375, ...
1	2	Innenstadt	POLYGON ((8.68683 50.12013, 8.68891 50.11848, ...
2	4	Westend-Süd	POLYGON ((8.66070 50.12310, 8.66181 50.12308, ...
3	5	Westend-Nord	POLYGON ((8.67113 50.13696, 8.67140 50.13610, ...
4	6	Nordend-West	POLYGON ((8.69722 50.13692, 8.69669 50.13579, ...

Table 2. Geographical coordinates of neighbors

Thirdly, because the new business is not planned for surround areas, so the neighbors which are within 4.5 km from centroid of Frankfurt were looked for, like Figure 1. The neighbors in the circle were analyzed further.

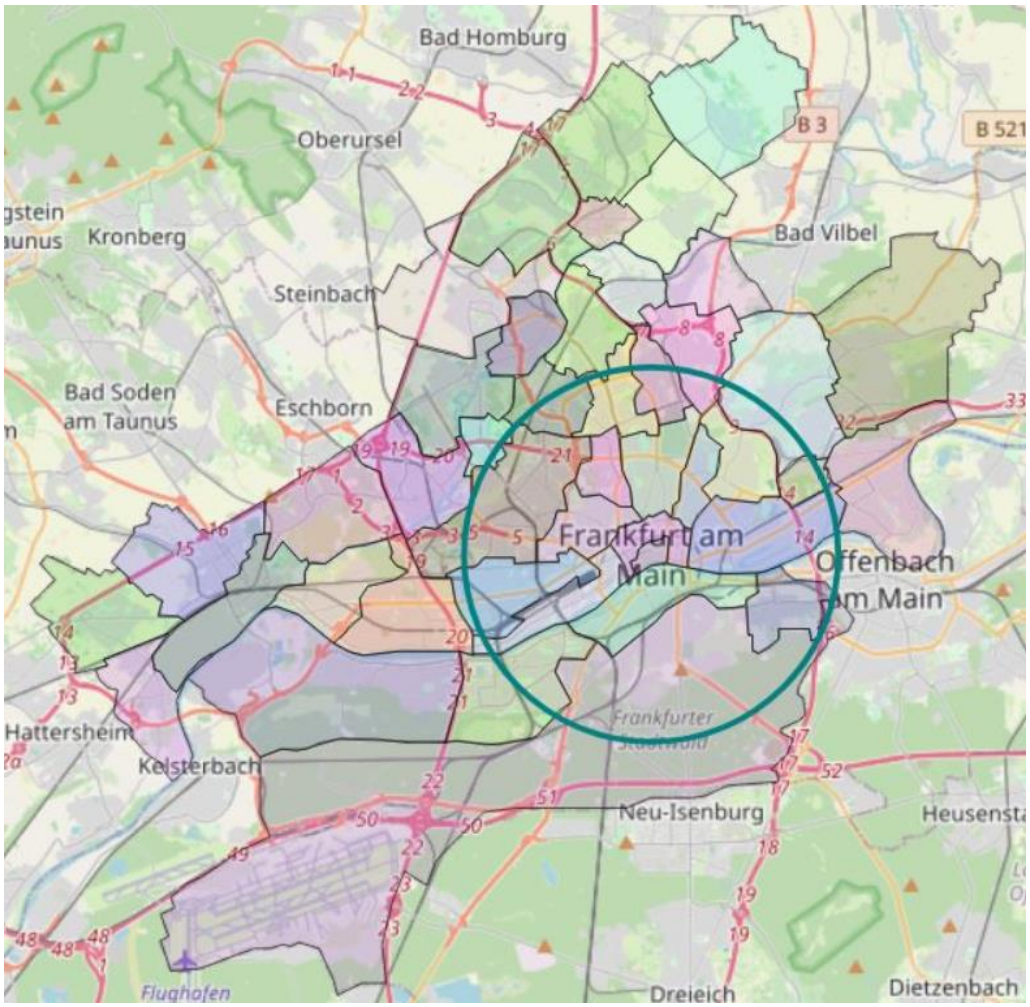

Figure 1. All the neighbors and city circle

The neighbors in the city circle were copied in the new table and ordered according to the Borough in Table 1. There are 15 neighbors in the city circle.

	STTLNR	STTLNAME	geometry
0	1	Altstadt	POLYGON ((8.68787 50.11416, 8.68789 50.11375, ...
1	2	Innenstadt	POLYGON ((8.68683 50.12013, 8.68891 50.11848, ...
2	10	Gutleut-/Bahnhofsviertel	POLYGON ((8.67156 50.10376, 8.66937 50.10247, ...
3	11	Gallus	POLYGON ((8.66063 50.10947, 8.66200 50.10882, ...
4	12	Bockenheim	POLYGON ((8.64223 50.13694, 8.64258 50.13692, ...
5	5	Westend-Nord	POLYGON ((8.67113 50.13696, 8.67140 50.13610, ...
6	4	Westend-Süd	POLYGON ((8.66070 50.12310, 8.66181 50.12308, ...
7	7	Nordend-Ost	POLYGON ((8.69783 50.11916, 8.69684 50.11830, ...
8	6	Nordend-West	POLYGON ((8.69722 50.13692, 8.69669 50.13579, ...
9	8	Ostend	POLYGON ((8.74758 50.12123, 8.74726 50.12050, ...
10	9	Bornheim	POLYGON ((8.70567 50.12289, 8.70565 50.12293, ...
11	17	Niederrad	POLYGON ((8.66060 50.08916, 8.65969 50.08809, ...
12	16	Oberrad	POLYGON ((8.72785 50.10657, 8.72817 50.10632, ...
13	13	Sachsenhausen-Nord	POLYGON ((8.71821 50.10243, 8.71417 50.10120, ...
14	14	Sachsenhausen-Süd	POLYGON ((8.70463 50.09910, 8.70610 50.09887, ...

Table 3. Neighbors in the city circle

Fourthly, the geometry in Table 3 is the boundary of a neighbor. The centroid of each neighbor (Table 4) was calculated from geometry to search the venues for each neighbor in the next step.

	dist	Latitude	Longitude
0	Altstadt	50.110597	8.682386
1	Innenstadt	50.113791	8.682665
2	Gutleut-/Bahnhofsviertel	50.099673	8.651434
3	Gallus	50.103223	8.635295
4	Bockenheim	50.121288	8.632922

Table 4. centroids of neighbors

The geographical coordinates and centroid of each neighbor were plotted to check the centroid which are right to the next step. The rot circle in Figure 2 shows the centroid in Sachsenhausen-Süd. Because Sachsenhausen-Süd is mostly comprised by the Frankfurt City Forest, so the neu coordinate at a parking space is as the new centroid, like Figure 3.

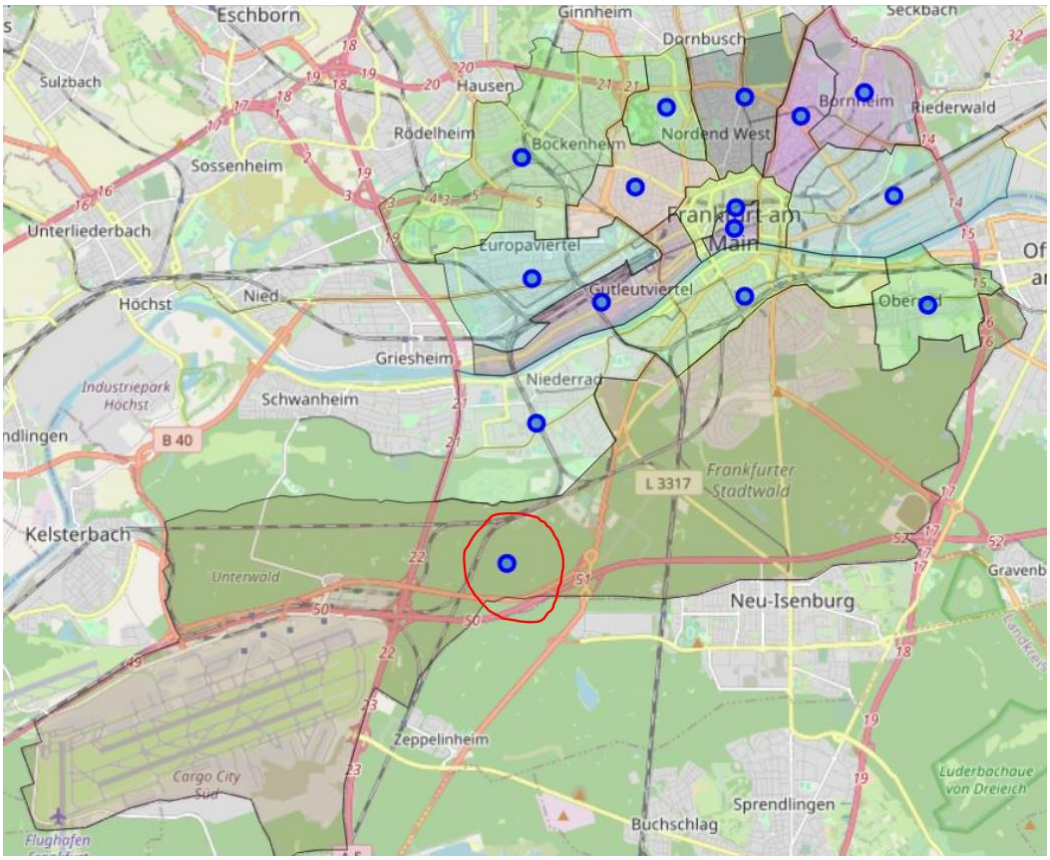

Figure 2. Centroids of neighbor in the city circle

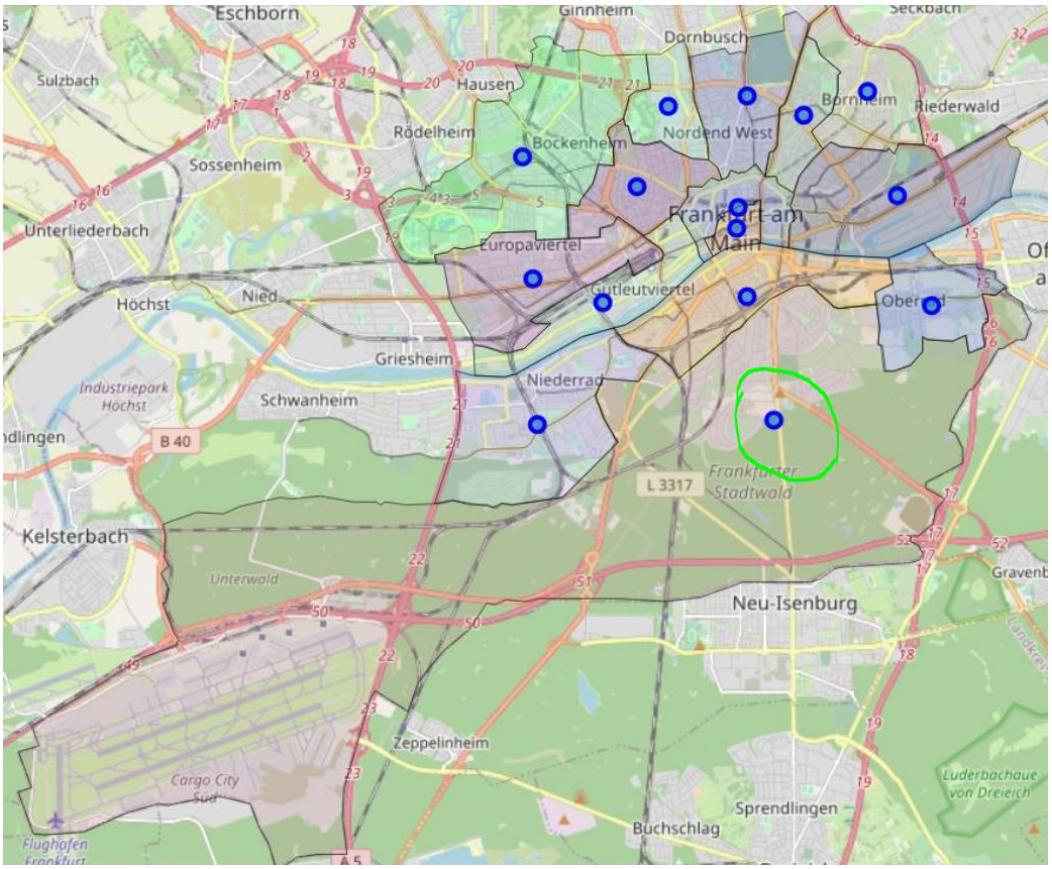

Figure 3. Right centroids of neighbor in the city circle

Fifthly, the venues in each neighbor were searched from foursquare.com. Because the size of each neighbor is vastly different, so the radius war set 2 km and the limit is 250. It means, that the redundant data was dropped according to the distance to centroids after all venues had been founded.

Sixthly, because the neu business is in catering. Food and drink reflect culture of people and society. Therefore, all the caterings from the venues were copied in the neu table.

Finally, the unique categories were figured out. The frequency of occurrence of each category in each neighbor was analyzed. Then, a neu table for top 10 venues/caterings for each neighbor was created. This processing was done with all the venues and with caterings.

Method

According to analysis of categories, Clustering is suitable. The method k-Means was used here exactly for clustering all venues for each neighbor and only caterings for each. The goal is to find out, which neighbors are in the same cluster not only for all venues but also for caterings. Because there are only 14 neighbors in analysis of categories. The k for cluster was set 3 at the beginning.

K = 3:

The numbers of neighbors in each cluster with all venues in Figure 6 are 8, 5, and 1. The numbers of neighbors in each cluster with caterings in Figure 7 are 7, 4, and 3.

K = 4:

The numbers of neighbors in each cluster with all venues in Figure 4 are 6, 6, 1, and 1. The numbers of neighbors in each cluster with caterings in Figure 5 are 9, 2, 2, and 1.

Result

To compare with k=4, k=3 spread the neighbors better. According to read every cluster for all venues and for caterings. The neighbors-Bockenheim, Nordend-West, Ostend, Bornheim and Sachsenhausen-Nord are in the same cluster not only for all venues but also for caterings. So, these 5 neighbors are the first result. The final decision will be done in the Discussion section.

Discussion

The information about venues is found out from foursquare.com. But another information is also important for the decision, e.g.: the people there, the atmosphere etc.

Sachsenhausen-Nord

This neighbourhood south of the river is a mix of old and new. But it retains more charm, making it popular with tourists and young locals. Schweizerstraße is the main street and offers some of the city's better shopping. Many of the city's museums are located along the Schaumainkai on this side of the river, as is a large flea market on Saturday mornings. Brückenviertel, the little corner, has developed into one of the most creative places in the city in recent years.

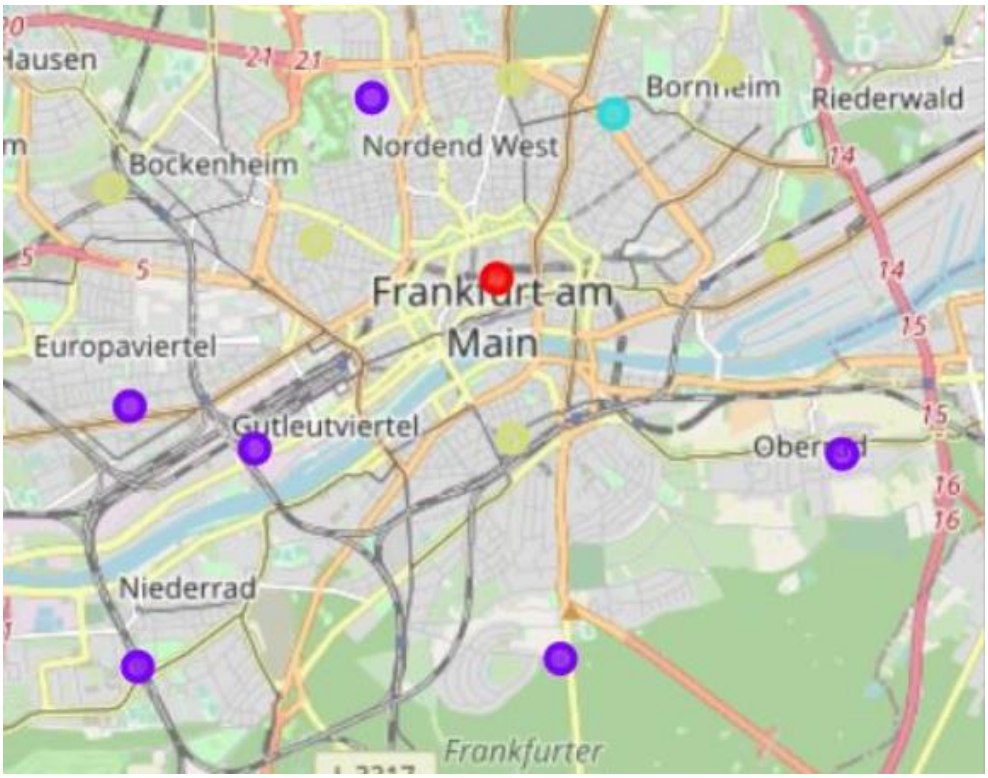

Figure 4. k = 4 for all venues of each neighbor

Figure 5. k = 4 for caterings of each neighbor

Figure 6. k = 3 for all venues of each neighbor

Figure 7. k = 3 for caterings of each neighbor

Bornheim

Bornheim, northeast of the center and nicknamed *das Lustige Dorf* (The Funny Village) is the most highly populated area in Frankfurt. Berger Straße is considered the most popular shopping street, as the shops here often have much more charm and individuality than the branches of large chains on the Zeil. It has several local festivals every year.

Bockenhim

On one side, it is adjacent to exclusive Westend and as such contains impressive estates, mansions, and foreign consulate dwellings located on the outskirts of the *Palmengarten*. On the other side it is lined with the dreadfully dull concrete campus of the University of Frankfurt. Perched in the middle of it all is the city's other remaining medieval watchtower.[3]

Nordend-West

The Nordend has a vibrant mix of artists, working-class people, students, drop-outs, gays, and lesbians, and - as of recently - bankers and consultants. The students of the seventies still live here, but they are now best-agers with a high disposable income, which they spend in local wine stores and organic grocery stores.

Ostend

The Frankfurt Zoological Garden, the East Harbor, the former Großmarkthalle and the Frankfurt School of Finance & Management are some of the well-known institutions in the Ostend. The European Central Bank has also built their new seat close to the Großmarkthalle at the Main river. The Hoch Conservatory are also located in the Ostend.

To think about local culture, tourists, and the curiosity of people, not politic and business, Sachsenhausen-Nord is the best. Then, Bornheim is second. The client also wants to know the location of schools, e.g. in Sachsenhausen-Nord in Figure 8.

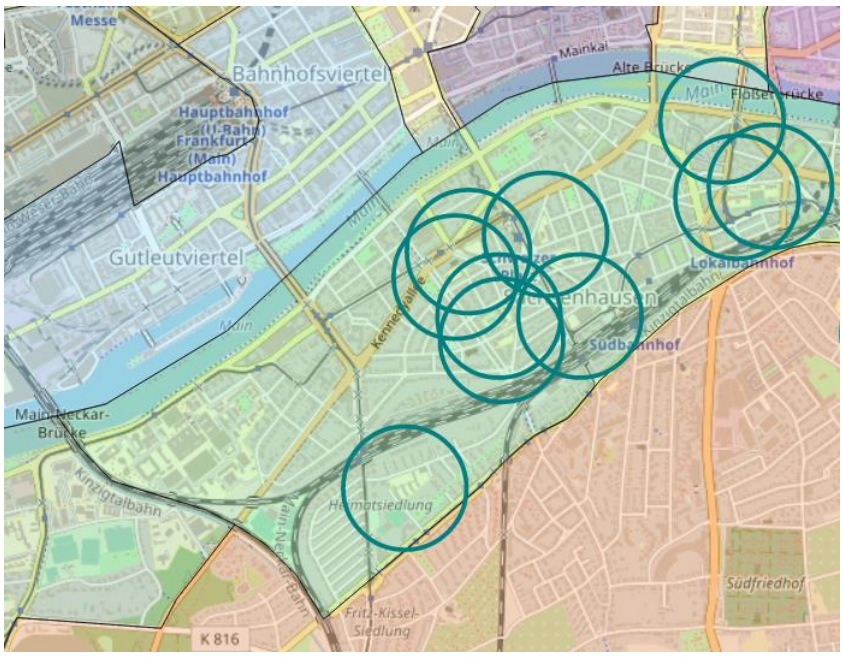

Figure 8. Locations of schools

[3] https://www.inyourpocket.com/frankfurt/Frankfurt-s-Districts_54807f

Conclusion

In this study, the location for a new business was analyzed. The data was found from web page in different format. The data was selected, transformed, and plotted etc. The Clustering, k-means method, was chosen. The value of k was played to figure out which value was better. Further information was used, to decide the better result.