Introduction

Hamburg is the second largest city in Germany after Berlin and the 7th largest city in the European Union with a population of over 1.84 million. Hamburg is Europe's third largest port and different big companies (as Airbus, Grüner + Jahr, Beiersdorf, , Blohm + Voss, and Der Spiegel and Die Zeit, between others) are based in this German city. The location of these big companies and tourist sights as the Speicherstadt, Kontorhausviertel (UNESCO World Heritage Sites), as the Elbphilarmonie, Hamburger Rathaus bring almost 7 million visitors (data from 2017) and a revenue of 9 billion €. This amount of visitors brings the goal of this project: Where is the neighborhood with more number of restaurants? Which variety of food is served there? Which is the most popular kind of food served in Hamburg?

The answer of these questions can also answer: If I want to open a restaurant, where I should open? Should I decide in the most populated neighborhood or should I decide the most popular neighborhood to open a restaurant? Which kind of food should be my restaurant?

Data Acquisition

1.Districts and Population from Hamburg (from different years, I will use the most recent data from there) : https://www.citypopulation.de/en/germany/hamburg/admin/.
2. Latitude and Longitude values from Hamburg are obtained from wikipedia: https://de.wikipedia.org/wiki/Liste_der_Bezirke_und_Stadtteile_Hamburgs(Since there are different tables, and I had troubles to get the desired data, I created a csv file with the coordinates)
3. Using Geopy to get geological location by address name.
4. Using Foursquare API to get the most common venues of given Borough of Hamburg.
5. Using Foursquare API to get the venues' record of given venues of Hamburg.

Methodology and Results

- Scrape the Districts and Population page and transform it into a pandas dataframe. We will filter the results only for "Quarter". The dataframe consists of three columns: 'Name', 'Status', 'PopulationEstimate2019'. The dataframe cleaned has 3 columns and 104 rows. The first five rows are shown below.

Out[28]:

	Name	Status	PopulationEstimate2019-12-31
104	Rahlstedt	Quarter	92087
42	Billstedt	Quarter	70410
32	Eimsbüttel	Quarter	58005
74	Winterhude	Quarter	55492
60	Wilhelmsburg	Quarter	53519

As we can see, the most populated neighborhoods are Rahlstedt, Billstedt, Eimsbüttel, Winterhude and Wilhemsburg.

- Acquire the data of latitude and the longitude coordinates in Hamburg using a Wikipedia table. Since the wikipedia page has different tables and I had problems to get the desired data so I downloaded it and put it into a cdv file. After that, I combined above data frame with the coordinates. Here I have the dataset that contains Name, Latitude, Longitude, Status, PopulationEstimae2019 of each neighborhood. The table below shows the first rows of the new dataframe.

```
In [11]: table_merged.head()
```

Out[11]:

	Name	Latitude	Longitude	Status	PopulationEstimate2019-12-31
0	Hamburg-Altstadt	53°33′0″N	10°0′0″O	Quarter	2350
1	HafenCity	53°32′28″N	10°0′1″O	Quarter	4925
2	Neustadt	53°33′7″N	9°59′8″O	Quarter	12762
3	St. Pauli	53°33′25″N	9°57′50″O	Quarter	22097
4	St. Georg	53°33′18″N	10°0′44″O	Quarter	11358

- As you can see the latitude and longitude are in DMS format and Foursquare API works in DEC format, so, the merged data frame should be reworked and Long_dec and Latitud_dec is added

```
table_merged.sort_values(by=['PopulationEstimate2019-12-31'], ascending=False).head()
```

Out[23]:

	Name	Latitude	Longitude	Status	PopulationEstimate2019-12-31	Longitude_dec	Latitude_dec
70	Rahlstedt	53°36′7″N	10°9′24″O	Quarter	92087	10.156667	53.601944
8	Billstedt	53°32′26″N	10°6′4″O	Quarter	70410	10.101111	53.540556
31	Eimsbüttel	53°34′33″N	9°57′6″O	Quarter	58005	9.951667	53.575833
44	Winterhude	53°36′0″N	10°0′0″O	Quarter	55492	10.000000	53.600000
12	Wilhelmsburg	53°29′42″N	10°0′40″O	Quarter	53519	10.011111	53.495000

- Explore the neighborhoods in Hamburg using Foursquare API. The limit is set as 100 venues, and the radius is set as 500 meters for each borough from their given latitude and longitude. As the header of the dataset shows below, the dataset contains Neighborhood, Neighborhood Latitude, Neighborhood Longitude, Venue, Venue Latitude, Venue Longitude, Venue Category.
An we will focus only in restaurants that are in the neighborhoods.

- First, I will take the number of restaurants that are in every neighborhood:

Number of Resturants for each Quarter in Hamburg (Germany)
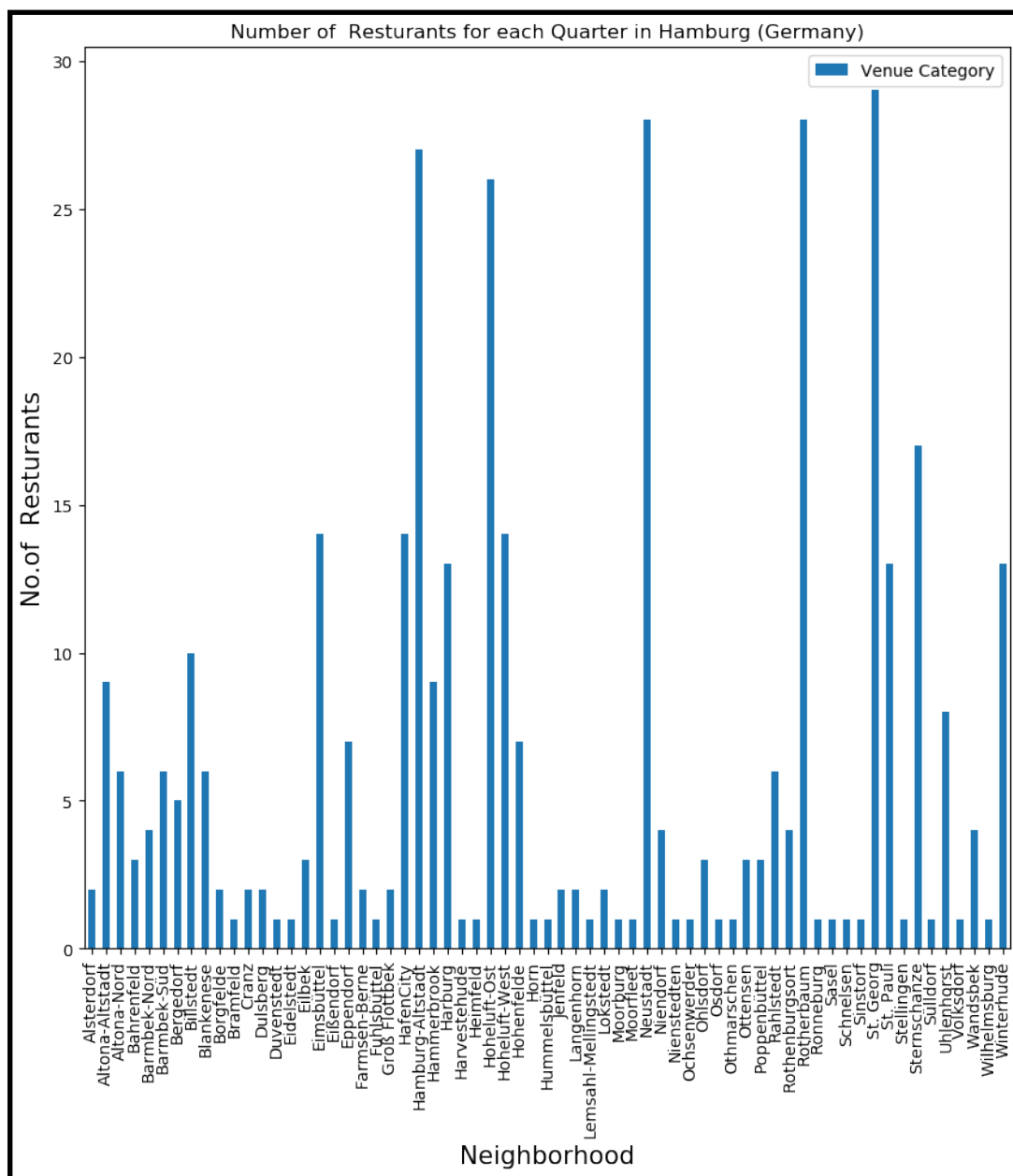
And we can see that the most popular neighborhoods (according to number of restaurants) are St Georg, Neustadt, Rotherbaum, Hamburg Altstadt and Hoheluft-Ost

Out[40]:

	Neighborhood	count
55	St. Georg	29
39	Neustadt	28
50	Rotherbaum	28
23	Hamburg-Altstadt	27
28	Hoheluft-Ost	26

Now, we are going to check which kind of restaurants are the most popular in Hamburg.
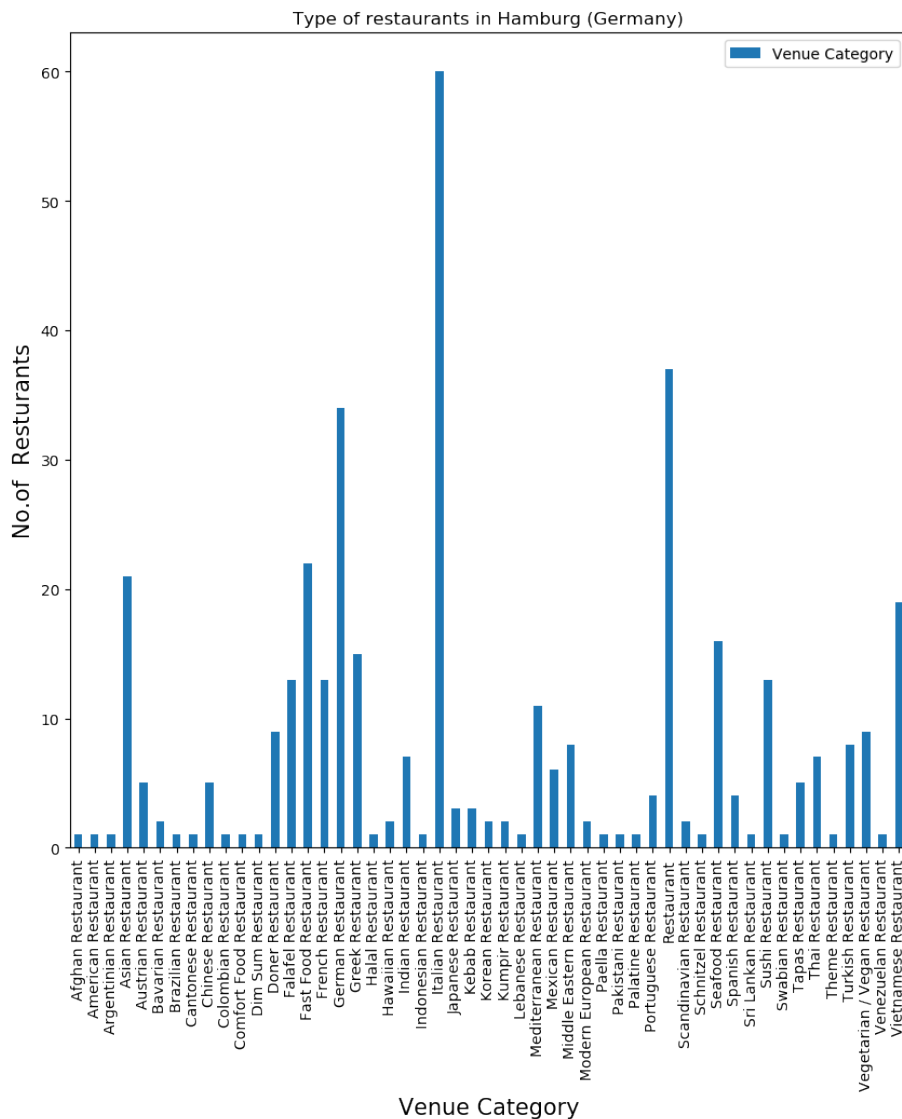
Here we can see that the most popular kind of restaurants are: Italian, German, Fast Food, Asian, and let's called "Diverse" (Only "Restaurant according to Foursquare)

Out[38]:

	Venue Category	count
22	Italian Restaurant	60
36	Restaurant	37
16	German Restaurant	34
14	Fast Food Restaurant	22
3	Asian Restaurant	21

Now, with this info, we can visualize how many restaurants of the most popular type are in the most popular neighborhoods (in terms of number of restaurants) and in the most populated neighborhoods.

```
Out[72]: Neighborhood      Venue Category
         Hamburg-Altstadt  Asian Restaurant        3
                           Fast Food Restaurant    1
                           German Restaurant       3
                           Italian Restaurant      2
                           Restaurant              3
         Hoheluft-Ost      Asian Restaurant        1
                           Italian Restaurant      5
                           Restaurant              1
         Neustadt          Asian Restaurant        1
                           German Restaurant       2
                           Italian Restaurant      3
                           Restaurant              3
         Rotherbaum        German Restaurant       1
                           Italian Restaurant      7
                           Restaurant              2
         St. Georg         Asian Restaurant        1
                           German Restaurant       1
                           Italian Restaurant      8
```

```
Out[75]: Neighborhood    Venue Category
         Billstedt       Asian Restaurant        1
                         Fast Food Restaurant    3
                         German Restaurant       1
                         Restaurant              1
         Eimsbüttel      Asian Restaurant        1
                         Fast Food Restaurant    2
                         Italian Restaurant      2
         Rahlstedt       Fast Food Restaurant    2
                         German Restaurant       1
                         Restaurant              2
         Wilhelmsburg    German Restaurant       1
         Winterhude      Asian Restaurant        1
                         Italian Restaurant      3
         Name: COUNTER, dtype: int64
```

Discussion:

To have a better view of the results, let's put the restaurants into a map
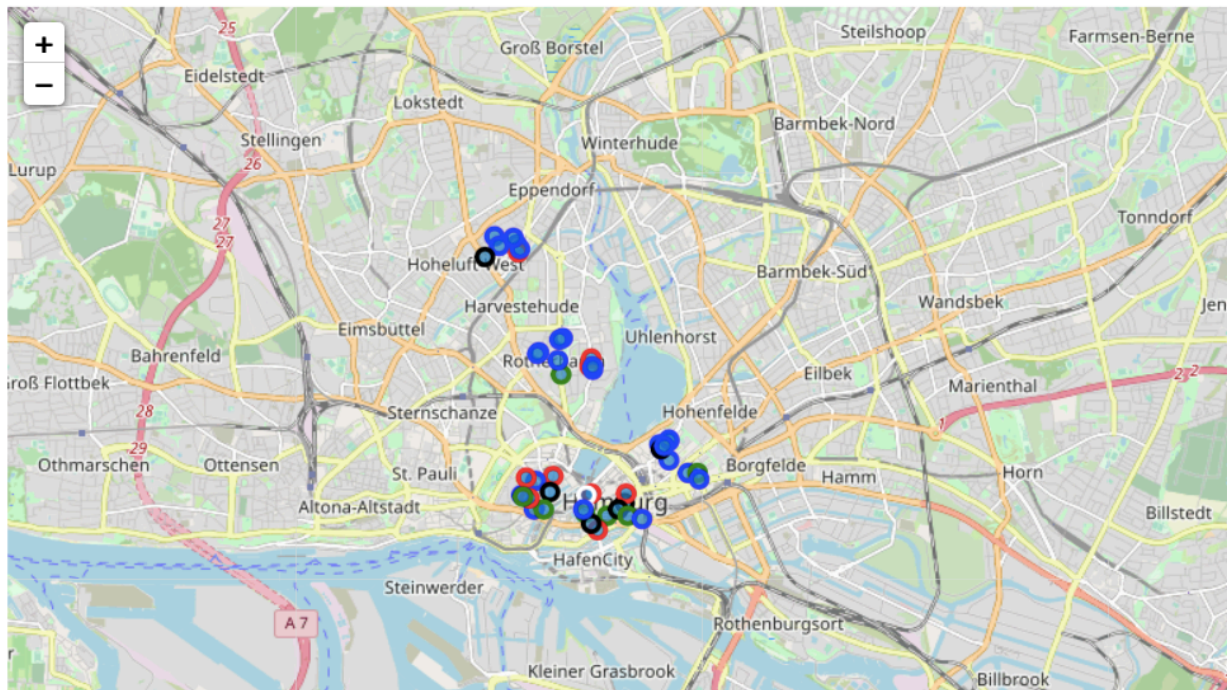
Here, we can see that almost the most trending kind of food are located in areas around the lake in the city (could be considered in the city center). I defined different colors depending on the type of restaurant.

On the other hand, the most populated areas in Hamburg are located in the outsides of the city, and they have lack of the restaurants (and also, the number of the most trending restaurants are low)
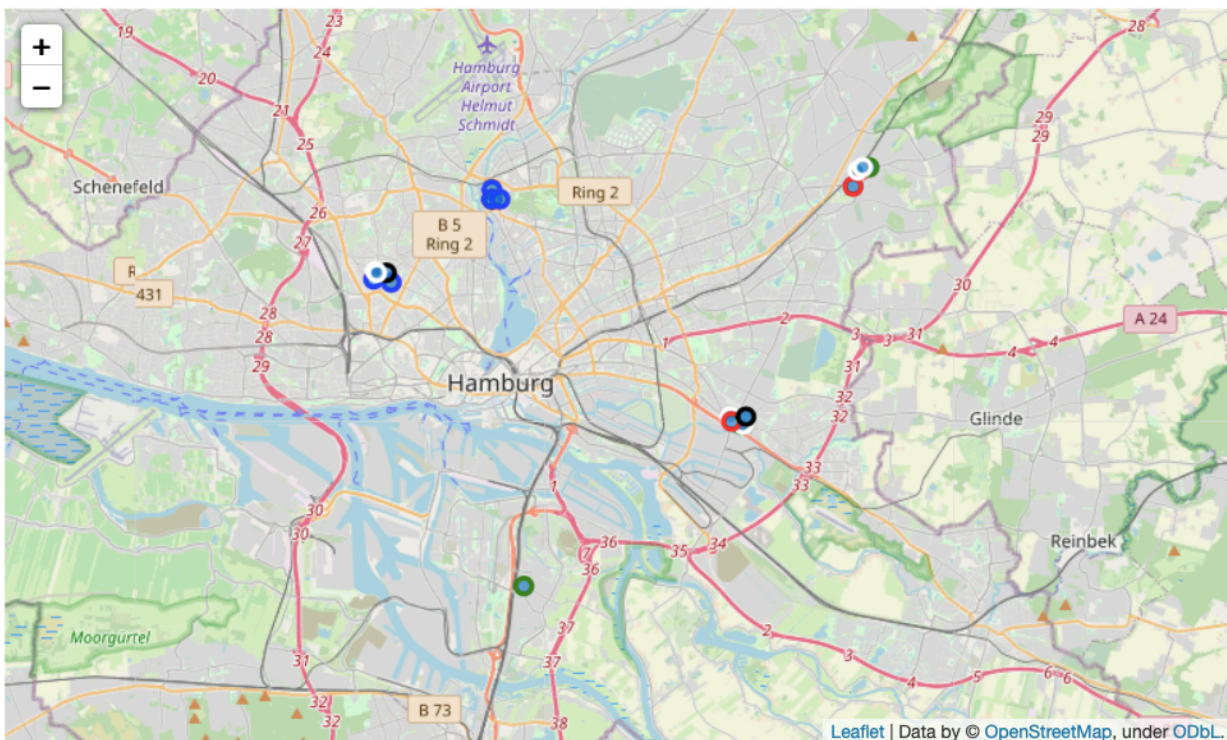
- We can extract meaningful information from the point of view of restaurant owners, that they are focused on opening new restaurants in the "city" center, and also the kind of food that a visitor could request (Italian, Asian, or German, since the visitors are coming to a German Country) and we can see, that the neighborhoods "not close" to the city center, are the most populated, but there are not so many "trending" restaurants and the owners are not opening a lot of restaurants there.
- This report could give a recommendation of neighborhood and location to those who plan to open a restaurant and what could be the focus (tourism or residents), but in real world, there must be more factors to consider, such as the cost of the location. This analysis can not solve the problem of how many customers will visit the restaurant everyday but could answer where to eat if I fly to Hamburg, and the type of food I am interested on.