

Capstone Project for Opening a Thai Restaurant in Frankfurt am Main

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1 Introduction

In this project, we are trying to find a solution to the stakeholders that want to open a Thai Restaurant in Frankfurt.

Since there are lots of parameters to find a best place to open a Thai Restaurant, we can use data science techniques to handle with this problem.

Especially important facts that must be considered are;

- How many restaurants are in a special neighborhood?
- What type of restaurants are there?
- Is a neighborhood special or not with people's culture who lives there? (For example there can be a lot of Thai restaurants in the neighborhood where mostly people with Asian culture live)



Figure 1. Map of Frankfurt am Main

2 Data

We will use;

- Pgeocode api to get the coordinates of the neighborhoods in Frankfurt am Main.
- Foursquare api to get the venues in Frankfurt am Main.

There are totally 39 neighborhoods in Frankfurt. We get the coordinates of these neighborhoods with pgeocode api.

After getting coordinates, it is time for foursquare api. Foursquare api provide us venues in Frankfurt. When we fetch the data from Foursquare, We have 951 venues in Frankfurt.

Our data frame includes the features;

- Postal code
- Neighborhood Latitude
- Neighborhood Longitude
- Venue Name
- Venue Latitude
- Venue Longitude
- Venue Category

In our project, we will mostly interested in the location and the category of the venues.

As shown in Figure 2, These venues are mostly located in Frankfurt Center. There is an attraction point in Frankfurt Center. So we will take this into account for the stakeholders.



Figure 2. Venues in Frankfurt am Main

3 Methodology and Analysis

In our case, Stakeholders are looking for a place to open a Thai Restaurant. So we take only the restaurants into consideration.

There are totally 306 restaurants and 44 unique restaurant types in Frankfurt. To understand better, we look at the frequency of different type of restaurants. As seen in Figure 3, Italian restaurants are very popular in Frankfurt and also there are a large amount of restaurants without any specific category. When it comes to Thai restaurants, there are 21 in Frankfurt.

As seen in figures, the neighborhood with 60313 postal code have 4 Thai Restaurants, it is the highest number compared with the other neighborhoods.

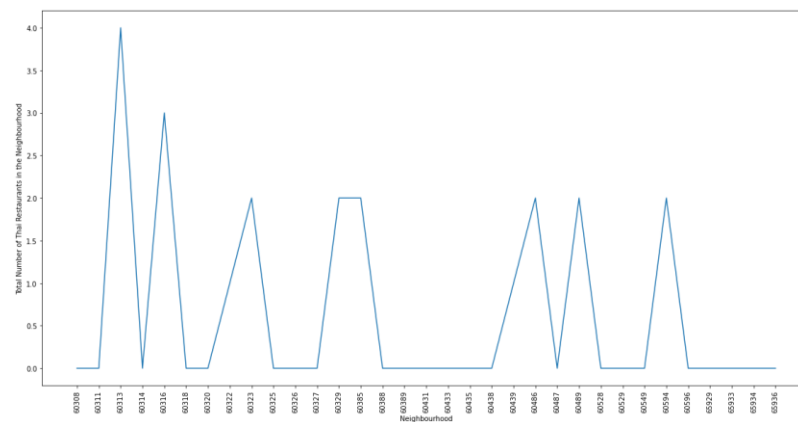


Figure 3. Thai restaurants in Frankfurt am Main according to postal code

Data doesn't mean much by itself. We will implement k-means algorithm to understand data better. For k-means, we will use top ten popular restaurant types as 10 features.

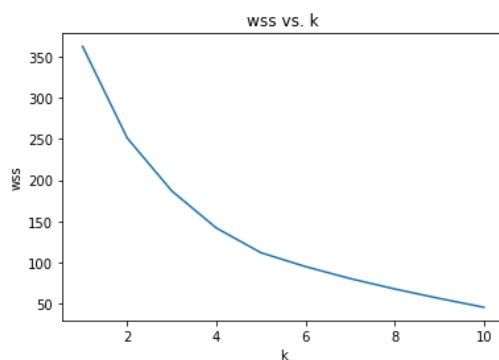
Top ten restaurants are;

- Italian Restaurant
- Restaurant
- German Restaurant
- Thai Restaurant
- Asian Restaurant
- Vietnamese Restaurant
- Japanese Restaurant
- Falafel Restaurant
- Sushi Restaurant
- Indian Restaurant

We determined k with elbow method. As seen in Figure 4 elbow point is 5. So k is selected 5.

K-means clustering shows us the specific neighborhoods with specific restaurants. We can see these neighborhoods with their features.

1. While cluster 0 is so common, there is not many restaurants in that areas. So we can think that we don't suggest these neighborhoods to the stakeholders.
2. Cluster 1 and 2 has more average restaurants than cluster 0. But it is really low when we compare with other clusters 3 and 4.
3. Cluster 4 has the highest average number of Thai Restaurants. So, maybe these neighborhoods are places where Thai people live.
4. Cluster 3 has more restaurants than other Clusters. But there are a lot of restaurants without any specific category. So, this cluster needs more research. If we can be sure, that we have certain data, we can say, that here is the most probable place to open Thai restaurant. Because, this area is known for restaurants and the ratio of Thai restaurants is relatively low.
5. Even though cluster 4 has a lot of restaurants, it has a huge number of Italian Restaurants. I can assume that the people lives in those areas really like Italian cuisine. So opening a Thai restaurant in these neighborhoods may not be a good idea.



As you can see, $k = 5$ is the elbow point in the graph. Then we will select k equals 5.

Figure 4. Selection of k for k-means-clustering

After clustering, we can see that cluster 3 and cluster 4 are more suitable when compared with other clusters.

So, we will decide where to open a Thai Restaurant according to some parameters like restaurant density of the neighborhood, distance from Frankfurt Center etc.

When we look at the distance from Frankfurt center feature, there are only 5 neighborhoods with distance less than 2 km. They are neighborhoods with 60316, 60318, 60323, 60325 and 60329 postal codes. 60329 has highest number of restaurants. But, we selected 60316 for opening a new restaurant, because it has not too many restaurants and there are some more market place.

So the attraction point where we are looking for should be here. After determining neighborhood, we can dive into more details about the neighborhood. There are 16 restaurants in our selected neighborhood.

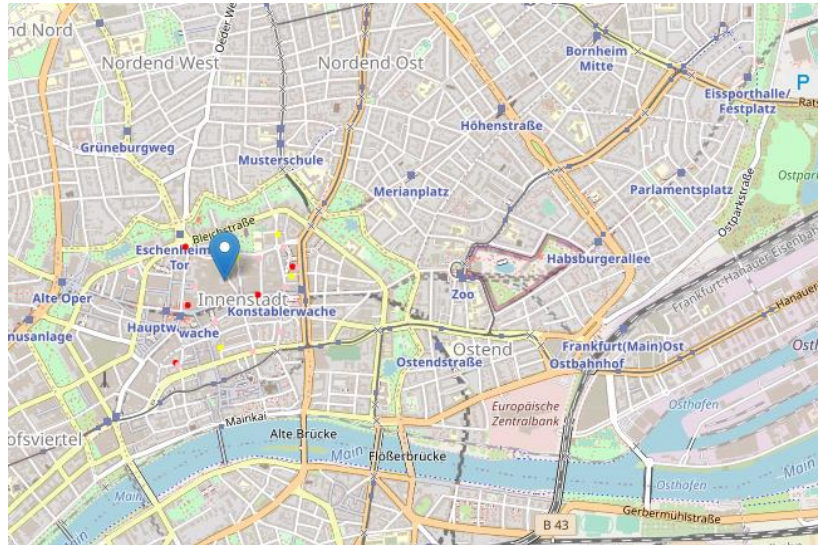


Figure 5. Restaurant types in the neighborhood

The intersection of Zeil street and Alte Gasse street is an attraction center for restaurants and people. And also there are some restaurants that we don't know their exact category. It is a good place to open a Thai Restaurant but it still needs more research like;

1. What are the demographic information of the people who lives there?
2. What are the exact category of these restaurants?
3. Do the people like Thai food there?
4. Is the market is big enough to withstand another restaurant?

4 Results

Our analysis shows that neighborhood with 60316 postal code is the best place according to our data. Following results are written below:

- Even though there are 39 neighborhoods across Frankfurt, many of them have a small number of restaurants. We think that it is because of the attraction of city center. So we focused on neighborhoods that are closer to city center.
- Also there is a neighborhood with 5 Thai Restaurants, we don't prefer to open another Thai restaurant there. We assume that it is a place where mostly Thai people live. Despite it looks good to open a Thai Restaurant in a place where mostly Thai people live, the market is shared by only 5 Thai restaurants.
- Italian restaurants are very popular in Frankfurt thanks to the Italian Cuisine.

5 Discussion

In addition to these results, there are also missing points to lighten for opening a Thai Restaurant.

- What are the rental costs for restaurants compared with the market in that region?
- Is there any good place to rent in these neighborhoods for a restaurant?
- Why are specific types of restaurants so common in some neighborhoods? What are the exact reason? In this project, we only assumed some of these reasons.

6 Conclusion

In this project, we try to find the best place for a Thai Restaurant according to foursquare venue data. We try to understand the characteristics of neighborhoods by looking the venues in these places. There are some neighborhoods with mostly one specific type of restaurants. Then, we turned our focus to neighborhoods that have different kinds of restaurants. When the distance from the city center and the total number of restaurants of the neighborhoods is taken into consideration, Neighborhood with 60316 postal code is the best place to open a Thai Restaurant.

During this project, we come to a point but it still needs more research to decide the optimal place for a Thai Restaurant.