

CAPSTONE PROJECT

Exploring Neighbourhoods of Munich, Germany using Foursquare API & Openweathermap API



Introduction

In the Year 2020, I am planned to relocate to Germany – Munich from Calicut – India. With this transition , it is required to understand the locality of Munich and its various Boroughs and subconsciously compare them with my Hometown of Calicut in India in terms of venues and weather conditions.

It would be beneficial and nice to have a platform which could make easy by considering a comparative analysis between the top 5 neighbourhoods and its comparison with Hometown of Calicut in India with provided factors.

Munich is the capital and most populous city of Bavaria the second most populous German State with a population of around 1.5 million, it is the third-largest city in Germany, after Berlin and Hamburg. Munich is divided into 25 boroughs or Stadtbezirke

To explore this information, this project involves the usage of both the Foursquare API and the Openweathermap API to fetch complete information of various venues (including name, address, category, weather, population estimates). Further, a map of the venues with specific color attributes will be plotted to highlight their position, and information about these venues. Such plots imbibe bountiful information in the form of their colored representations and location on the map.

This project helps the end user or the stakeholder to achieve the results which will not only recommend but also saves a lot of time in manual search. This will indeed save the time and money of the user.

Target Audience:

- Anyone who would be visiting or relocating to Munich in Germany.
- Anyone looking to expand their business or wants to setup a new business in Munich

Data:

To get location and other information about various venues in Munich, I used two APIs - Foursquare and Openweather map and decided to combine the data from both of them together.

The Foursquare API has a database of more than 105 million places. This project would use Four-square API as its prime data gathering source. Using the Foursquare's explore API (which gives venues recommendations), I fetched venues up to a certain range from the center of Munich and collected their names, categories and locations (latitude and longitude).

HTTP requests would be made to this Foursquare API server using Borough names of the Munich city to pull the location information (Latitude and Longitude). Foursquare API search feature would be enabled to collect the nearby places of the neighborhoods. Due to http request limitations the number of places per neighborhood parameter would reasonably be set to 100 and the radius parameter would be set to 700

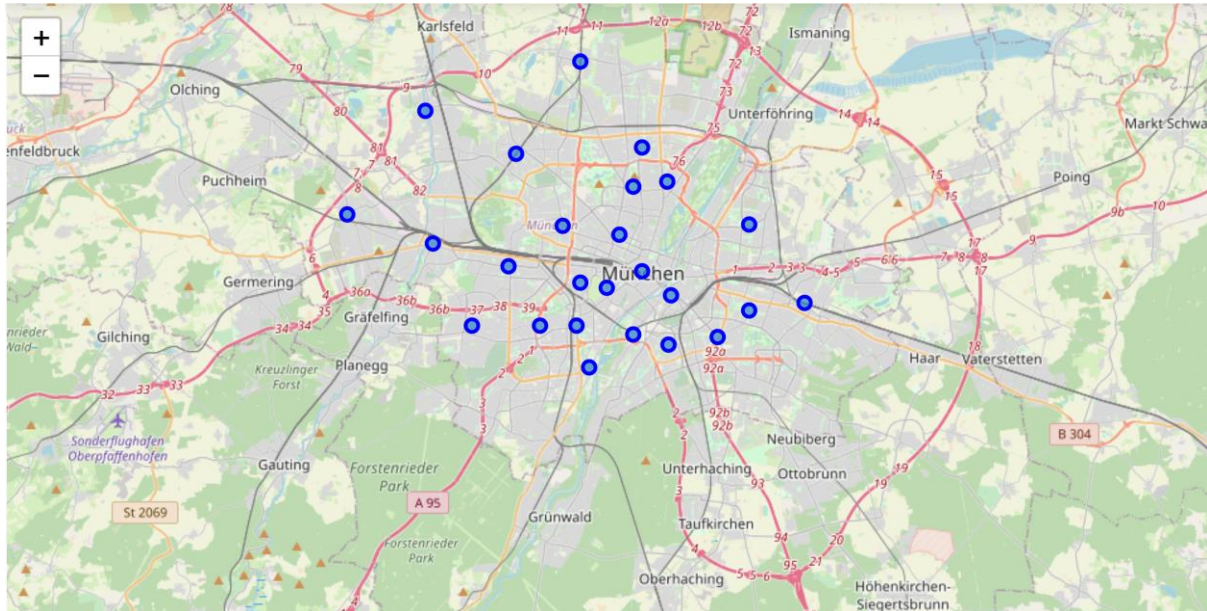
Using the name, latitude and longitude values, I used the **Openweathermap search API** to fetch weather details from its database. This API allows to find the weather, humidity, wind details based on search criteria (usually the name), latitude and longitude values.

Folium - Python visualization library would be used to visualize the neighborhoods cluster distribution of Munich city over an interactive leaflet map. Extensive comparative analysis of two randomly picked neighborhoods would be carried out to derive the desirable insights from the outcomes using python's scientific libraries Pandas, NumPy and Scikit-learn.

Unsupervised machine learning algorithm K-mean clustering would be applied to form the clusters of different categories of places residing in and around the neighborhoods. These clusters from each of those two chosen neighborhoods would be analyzed individually collectively and comparatively to derive the conclusions.

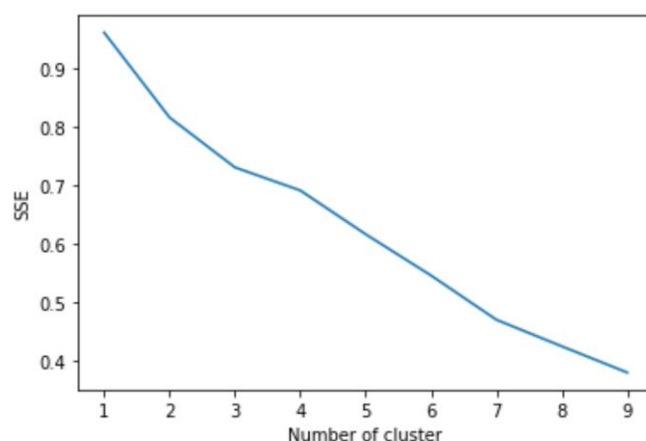
Methodology

The project starts with scrapping the Munich Wikipedia page for the 25 Boroughs of Munich and storing it in an excel file that is read to a data frame. Using Folium maps, the latitude and Longitude of the Boroughs are identified and provides the choropleth visualization.



Foursquare API is then used to identify the Top 10 common venues in each Borough and the Boroughs are clustered using **K means Clustering algorithm**. The Elbow method as well as the Silhouette Coefficient analysis is used to find the optimum number of clusters for the dataset.

Elbow Method:



Data from the **Openweathermap API** was also used to understand the weather details of the Boroughs (in this case – Temperature in Celcius) to aid comparison between the Boroughs as well as to compare it with my hometown Calicut in India.

The dataset from the two APIs will be combined based on the venue names, latitude, longitude, temperature, top 10 venue values.

I also found out the % expats population in each of the Boroughs to aid further decision making for any user (non-resident) looking to relocate or open business in Munich.

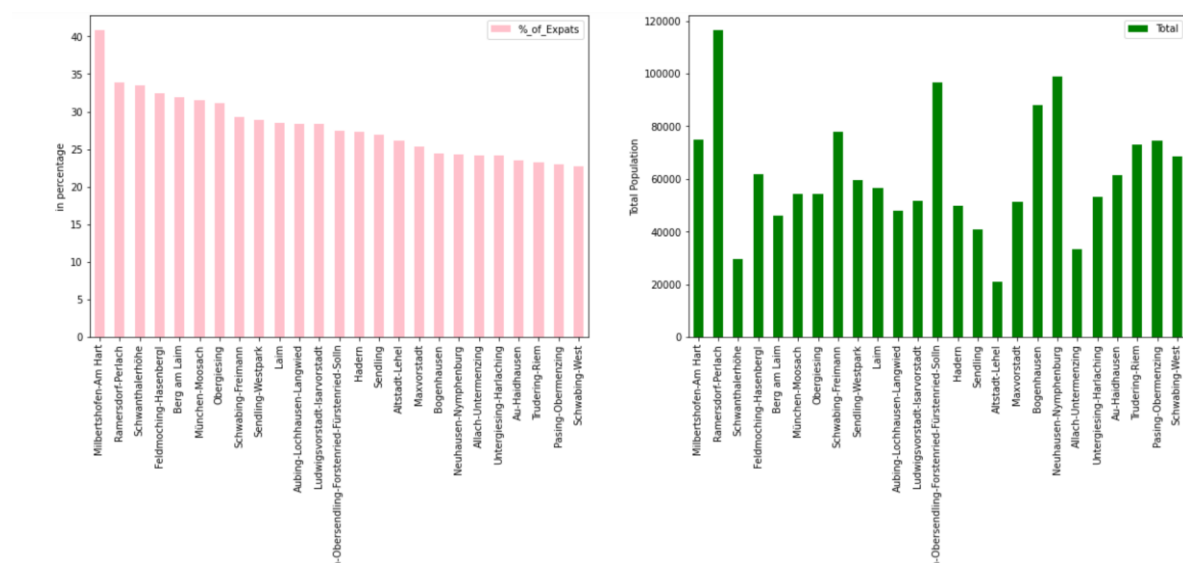
I have clustered the top 10 venues and identify the top 5 of them based on the % Expat population in the areas and see if we can draw meaningful information out of what kind of venues exist in Munich.

As a final step, I have analysed these plots and drew a couple of conclusions on what places can be recommended to a new resident.

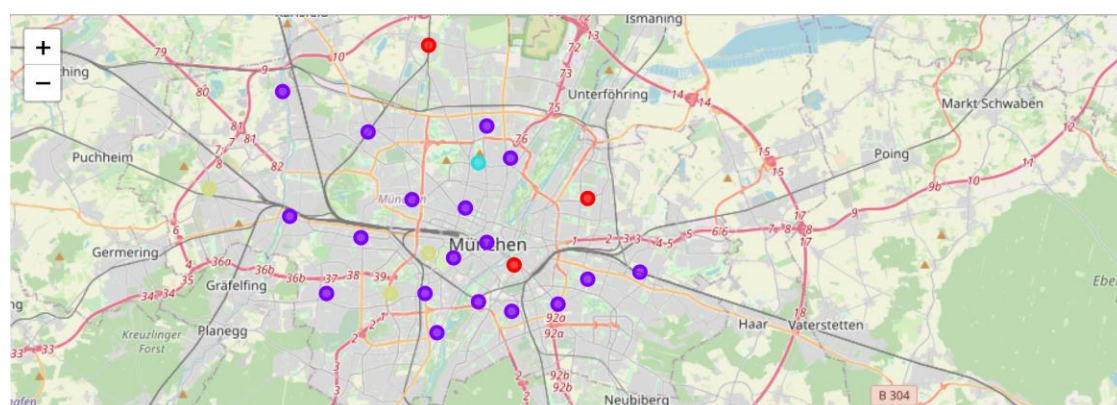
Results and Discussion

With the help of the above methodologies, the project would help the user to decide which neighbourhood is better to stay based on factors of number of population (% expat population), top 10 venues in the neighbourhood as well as the weather conditions. He can also compare the Boroughs of Munich with his hometown (in this project , the hometown is Calicut in India from where the user is coming from).

Population data for each Borough/Neighbourhood of Munich



Clusters Identified for Munich



There are 4 Clusters Identified –

Cluster 0 (red)

This is the poshest cluster in Munich and considered the most expensive and classy of Munich's numerous upscale residential districts. Bogenhausen is one of the districts with the lowest percentage of foreigners living in it. It is also home to some of the best and most beautiful beer gardens of the city.

Cluster 1 (purple)

As observed, most of the cities landscapes (Museums,Churches) are located in Cluster 1 as well as the main shopping areas. Both the above Boroughs are located in the City central

Cluster 2 (blue)

Schwabing in Cluster 2 used to be known as Munich's bohemian quarter and remains popular with both tourists and locals, especially young people (Leopoldstrasse), for its numerous bars, clubs, and restaurants

Cluster 3(green)

This cluster is more Affordable to live in. Munich's district with the highest percentage of foreigners living in it.

Top 5 Neighbourhoods based on Expat Population

	Borough	German	Others	Total	%_of_Expats	Cluster Labels
0	Milbertshofen-Am Hart	44473	30621	75094	40.78	1
1	Ramersdorf-Perlach	76902	39425	116327	33.89	1
2	Schwanthalerhöhe	19775	9968	29743	33.51	3
3	Feldmoching-Hasenbergl	41737	20037	61774	32.44	0
4	Berg am Laim	31396	14702	46098	31.89	1

For many non-residents of Germany, the most important criteria is the Foreign population since not only will the country be a change for them but also German language and culture. Residing in a neighbourhood with a percentage of non German population would be looked for.

Comparison with Hometown in India

```
#Now comparing the Neighborhoods in Munich Germany VS Neighborhoods in Calicut India
Input1=input("Enter the Neighborhood: ")
```

Enter the Neighborhood: Laim

```
Input2=input("Enter the Neighborhood: ")
```

Enter the Neighborhood: Schwanthalerhöhe

	Laim	Schwanthalerhöhe	Calicut
%_of_Expats	28.47	33.51	NaN
10th Most Common Venue	Motel	Indian Restaurant	Bowling Alley
1st Most Common Venue	Supermarket	Café	Indian Restaurant
2nd Most Common Venue	Italian Restaurant	Hotel	Hotel
3rd Most Common Venue	Doner Restaurant	Bar	Fast Food Restaurant
4th Most Common Venue	Bank	German Restaurant	Clothing Store
5th Most Common Venue	Bakery	Ice Cream Shop	Vegetarian / Vegan Restaurant
6th Most Common Venue	Park	Italian Restaurant	South Indian Restaurant
7th Most Common Venue	Tram Station	Pizza Place	Pizza Place
8th Most Common Venue	Restaurant	French Restaurant	Movie Theater
9th Most Common Venue	Plaza	Burger Joint	Juice Bar
Cluster Labels	1	3	NaN
Latitude	48.1396	48.1338	11.25
Longitude	11.5022	11.5411	75.78
Temp(Celcius)	17.15	17.15	29
Total_Population	56546	29743	608000

This project is advantageous since it will save the user money and time when he/she is planning to relocate to Munich.

Conclusion

The project concludes that there are 5 top Boroughs out of 25 in Munich that the user can consider relocating to.

3 out of 5 of the Top 5 Boroughs are from Cluster 1 which are indicating the Boroughs located at the City central and has Museums and Churches.

As compared to the Hometown in India, there will be a pleasant change to the weather as well as the Population density in these Boroughs. The user can now make a calculated decision on which Borough amongst the top5 in Munich would be ideal for him.