

Capstone Project - The Battle of Neighborhoods

Find the potential location for a new gym in Stuttgart, Germany

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1. Introduction

Stuttgart is located in southwestern Germany, with a population of more than 600 thousand [1]. With this high population, the need to find an appropriate gym for working out is increasing. Different from other categories of venues, people tend to choose one gym, and the possibility to change gyms is low. The distance of gym to customers and the gym number around the customers are critical. Therefore, this Capstone Project aims to find the potential location to open a new gym in Stuttgart.

2. Data

2.1. Data sources

The updated population of Stuttgart, including all the boroughs and neighborhoods, are found in stuttgart.de [2]. This dataset contains the gender, nationality, and monthly changes. The latest dataset of 05.2020 was taken for further analysis.

2.2. Data cleaning

The data in the excel file was converted to a data frame, and three columns were remained: Borough, Neighborhood, and Population. Then this original data frame was separated into two sub data frames. The first sub data frame includes the boroughs and corresponding populations. All the neighborhoods and the related population are summarized in the second sub data frame.

3. Methodology

3.1. Location and venue acquisition

The latitude and longitude values of two sub data frames are obtained by geopy.geocoders in python. To find out how many gyms are accessible to the people of each borough, the gyms within 5 km of each neighborhood were collected by the Foursquare API with the category Id of '4bf58dd8d48988d175941735' (Gym/Fitness center). Then the gym number of each borough was acquired by deleting the repeated gyms.

3.2. The potential borough

Equation 1 was applied to explore how many gyms are available for every 10,000 people of each borough.

$$\text{Gym to population ratio} = \text{Gym number} / \text{Population of borough} * 10000 \quad 1$$

3.3. The potential location for a new gym

The borough with the lowest gym to population ratio was chosen to explore the potential location for a new gym. Then all gyms within 1 km of each neighborhood in the chosen borough were plotted in the map built by the map rendering library – folium. Together with the population of each neighborhood in the chosen borough, the potential location was proposed.

4. Results and discussion

As shown in Fig.1, Bad Cannstatt has the highest population (> 70,000), followed by Stuttgart-West and Stuttgart-Ost. These boroughs are located in or near the city center. Thus, more gyms are surrounding these boroughs (Fig. 2). More gyms mean that more competition among the gyms. As mentioned in Introduction, people tend to find an appropriate gym, which is suitable for themselves. Usually, the price of the gym is lower when customers have a longer contract. Therefore, the gym number to population ratio is an important parameter to determine the location of a new gym.

Weilimdorf has the lowest surrounding gyms compared to other boroughs, and its population is at the middle level. Thus, the gym to population ratio of Weilimdorf is the lowest (Fig. 3), followed by Vaihingen and Bad Cannstatt. Therefore, Weilimdorf has the highest potential to open a new gym.

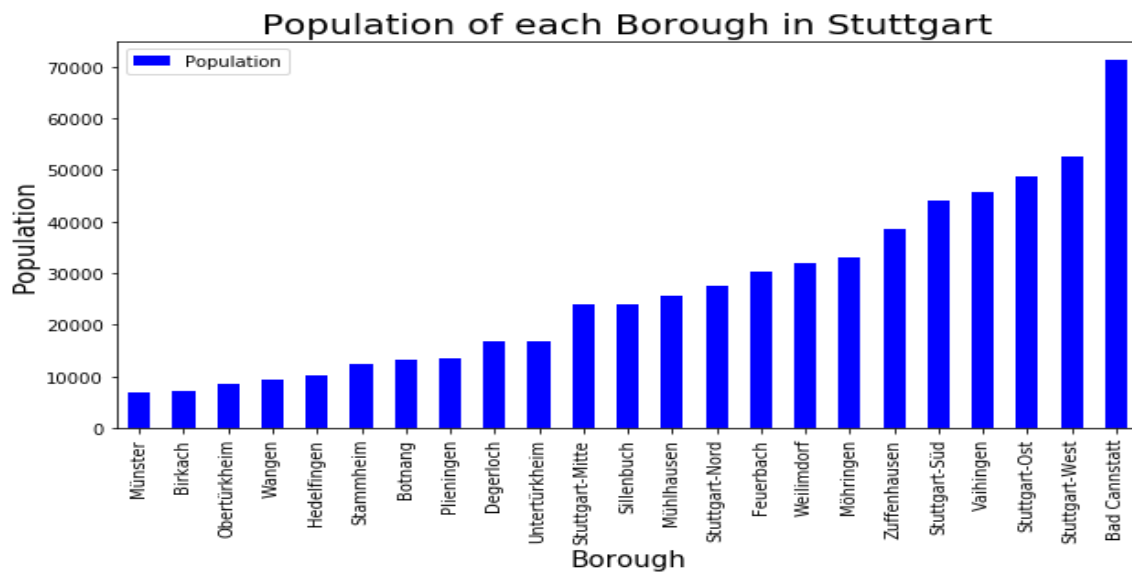


Fig. 1. The population distribution of each borough in Stuttgart

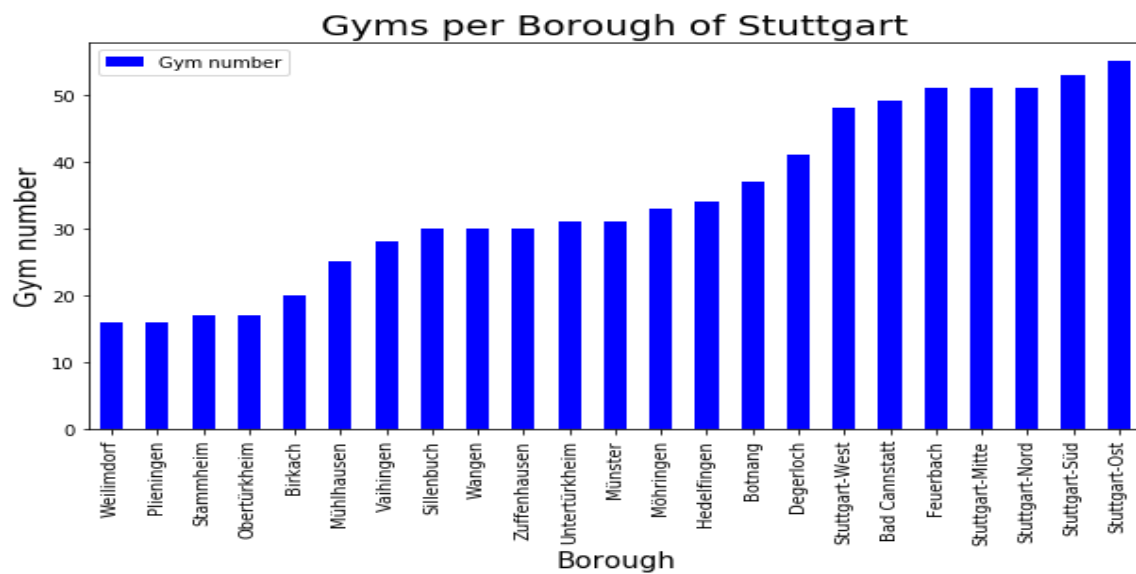


Fig. 2. The total gym numbers of each borough (within 5 km) in Stuttgart

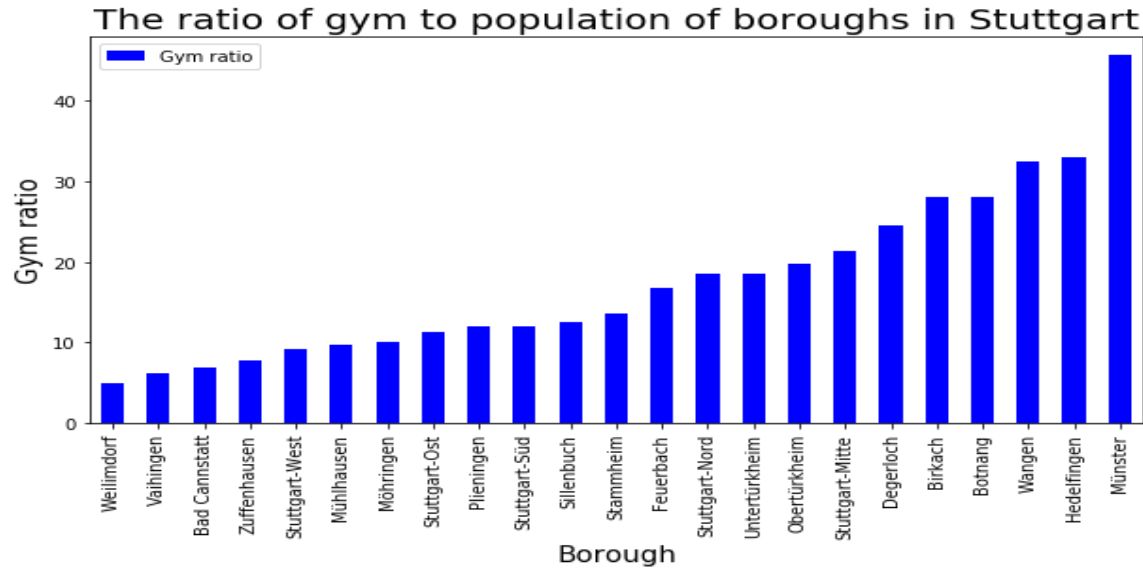


Fig. 3. The gym to population ratio of each borough in Stuttgart (number/10,000 people)

The neighborhoods and population of neighborhoods in Weilimdorf are listed in Table 1. There are six neighborhoods. The four neighborhoods with most populations are Weilimdorf, Giebel, Hausen, and Wolfbusch. However, a close look at the map of Weilimdorf with the plotting of gyms in Weilimdorf (Fig. 4). The four gyms only locate in Weilimdorf-Nord. No gym was located in the southwest or south (by Foursquare), which is proposed to open a new gym. However, to verify the accuracy of the gym location, I found there is one gym in Weilimdorf (neighborhood) by Google Maps. Therefore, the ideal place for a new gym is in Giebel.

Table 1. The neighborhoods and population of neighborhoods in Weilimdorf

Borough	Neighborhood	Population	Latitude	Longitude
Weilimdorf	Weilimdorf	16757	48.815276	9.112444
Weilimdorf	Weilimdorf-Nord	587	48.8268087	9.097610866
Weilimdorf	Bergheim	2954	48.8013	9.0897
Weilimdorf	Giebel	5190	48.8045564	9.0900385
Weilimdorf	Hausen	3415	48.8164542	9.0867222
Weilimdorf	Wolfbusch	2970	48.8052172	9.1085943

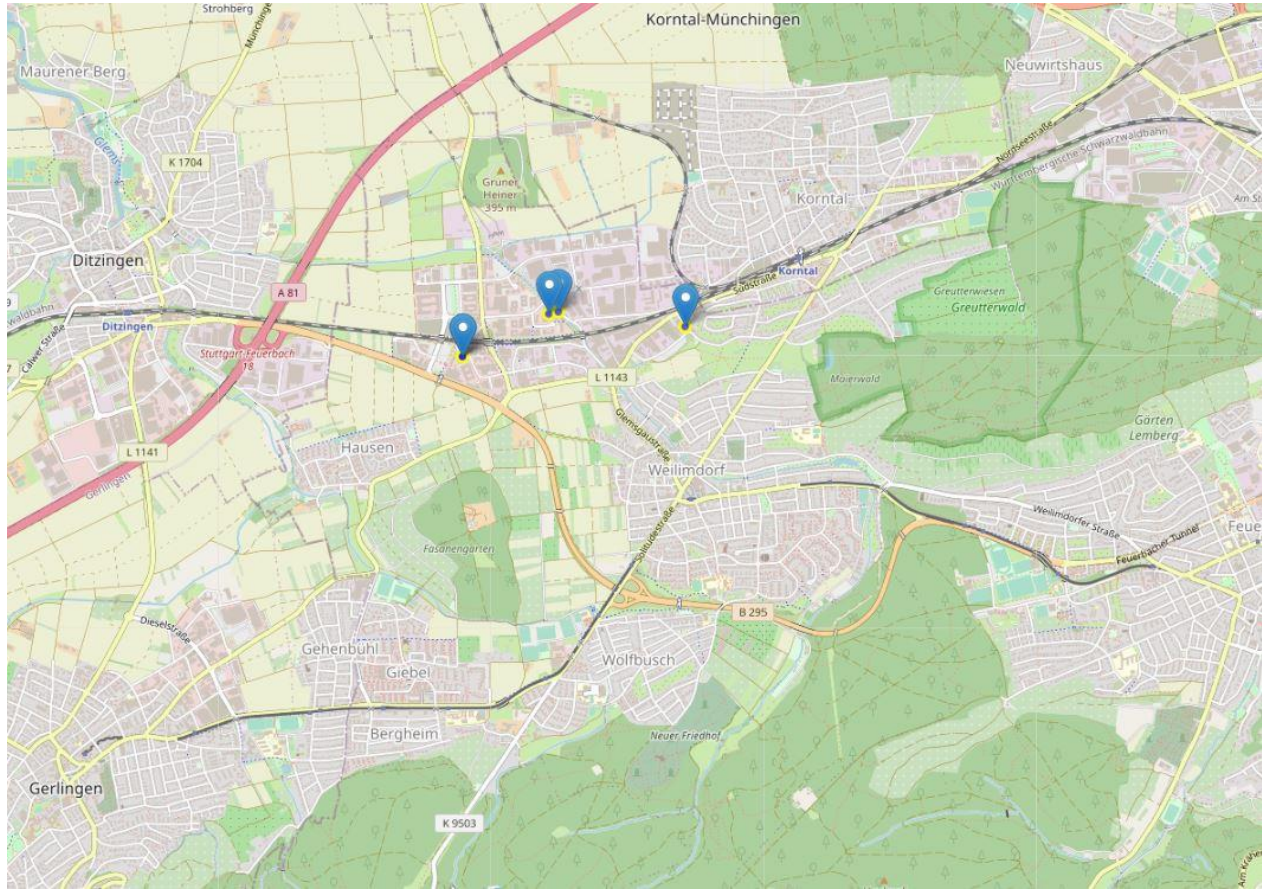


Fig. 4. The plot of gyms in Weilimdorf, Stuttgart

5. Conclusion

There are more gyms in or near the Stuttgart city center. The high number of gyms will have more competition among the gyms. This study focuses on the gym to population ratio of each borough and finds Weilimdorf has the lowest ratio. The ideal location for a new gym is Giebel, Weilimdorf, due to the low surrounding gym density and relatively high population. However, this project is depending on the adequacy and accuracy of the Foursquare API. More analyses are still needed to determine the optimal location for a new gym.

Reference

[1] <https://en.wikipedia.org/wiki/Stuttgart>

[2] File name: btp01_

Link:

<https://www.domino1.stuttgart.de/web/komunis/komunissde.nsf/a9830f07fd8c0e7dc1257cb70033e711/93b78f94cf10ec41c125851a002bb4e2?OpenDocument>