

# The Battle of Neighborhoods – Week 2

Coursera Capstone Project

# Problem description

- Moving from one place to another is something that is done very frequently in our times and can both be very exciting and challenging
- People often want to find a similar place to the one they lived before, especially when they got used to their former neighborhood and felt very comfortable there
- We are exploring neighbourhoods in the city of Munich, Germany, to find a new apartment for Anna that meets her requirements:
  - neighborhood should be similar to Maxvorstadt
  - pay less rent than now (19.50 €)
  - area that is less crowded than Maxvorstadt
  - have the following venues nearby:

Venue	Reason	Priority
Park	Anna likes to take a walk in the park after work.	1
Tram Station	Anna requires a tram station nearby to get to work easily.	2
German Restaurant	Anna often comes home late from work and has no time to cook on her own. She is very much into German food.	3
Thai Restaurant	Anna also likes Thai food.	4
Cupcake Shop	Anna loves cupcakes and is thinking about opening her own shop.	5

# Data description and usage

In order to find the most promising neighborhood for Anna the following data is needed:

- A list of existing boroughs in Munich, including additional information, from the following webpage: ['https://en.wikipedia.org/wiki/Population\\_growth\\_of\\_Munich#Age\\_distribution'](https://en.wikipedia.org/wiki/Population_growth_of_Munich#Age_distribution).
- Geospatial data (latitude, longitude) for each borough. This data is gathered using the Geocoder API based on Open Street Map data and is used as an input for the Foursquare API.
- Average rental prices for all boroughs in Munich from: ['https://www.tz.de/leben/wohnen/uebersicht-muenchner-mieten-preise-nach-postleitzahlen-tz-6133643.html'](https://www.tz.de/leben/wohnen/uebersicht-muenchner-mieten-preise-nach-postleitzahlen-tz-6133643.html).
- To work with this data, the postal codes need to be attributed to the corresponding borough via ['https://www.muenchen.de/leben/service/postleitzahlen.html'](https://www.muenchen.de/leben/service/postleitzahlen.html).
- Information about nearby venues for all boroughs of Munich using the Foursquare API.

# Data preparation – Table 1

- Combining the data sources we end up with the following table defining the boroughs (first 15 rows shown):

	Borough	Area in km <sup>2</sup>	Inhabitant Count	Inhabitants per km <sup>2</sup>	Longitude	Latitude	Rent per m <sup>2</sup>
0	Allach-Untermenzing	15.45	27730	1795	11.462973	48.195157	13.71
1	Altstadt-Lehel	3.16	18876	5973	11.574582	48.137828	18.78
2	Aubing-Lochhausen-Langwied	34.06	37857	1111	11.400221	48.165059	17.09
3	Au-Haidhausen	4.22	54382	12887	11.590536	48.128753	13.78
4	Berg am Laim	6.31	39009	6182	11.633600	48.133971	14.79
5	Bogenhausen	23.71	75657	3191	11.633484	48.154782	17.29
6	Feldmoching-Hasenbergl	28.71	54245	1889	11.541275	48.213804	14.01
7	Hadern	9.23	44993	4875	11.481842	48.118064	14.57
8	Laim	5.29	50082	9457	11.503835	48.144352	15.21
9	Ludwigsvorstadt-Isarvorstadt	4.39	45736	10418	11.573366	48.130340	17.84
10	Maxvorstadt	4.29	46058	10736	11.562418	48.151092	19.98
11	Milbertshofen-Am Hart	13.37	66992	5011	11.575043	48.182385	14.73
12	Moosach	11.09	47754	4306	11.506122	48.180166	15.11
13	Neuhausen-Nymphenburg	12.92	84604	6548	11.531517	48.154222	16.44
14	Obergiesing	5.71	47007	8232	11.596084	48.111130	15.78

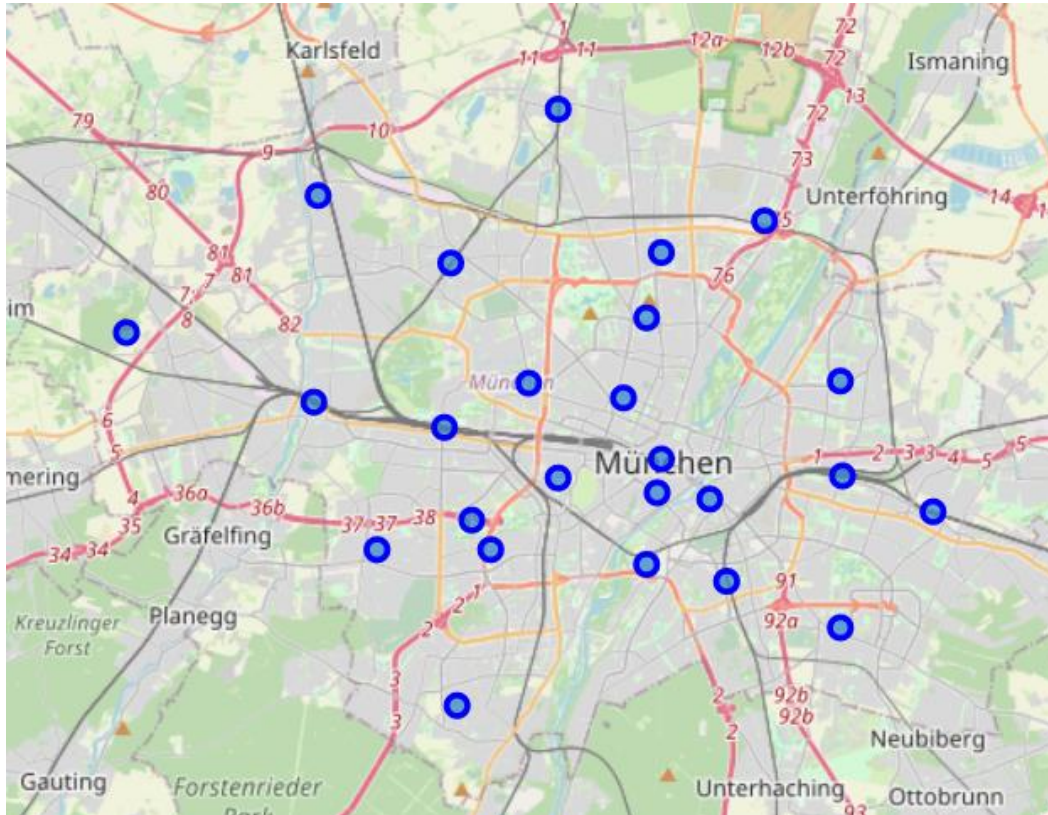
# Data preparation – Table 2

- Using the Foursquare API we get a table with the top 100 venues for each borough (first 5 rows shown):

	Neighborhood	Neighborhood Latitude	Neighborhood Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
0	Allach-Untermenzing	48.195157	11.462973	Bäckerei Schuhmair	48.197175	11.459016	Bakery
1	Allach-Untermenzing	48.195157	11.462973	Sport Bittl	48.191447	11.466553	Sporting Goods Shop
2	Allach-Untermenzing	48.195157	11.462973	Trattoria Olive	48.189905	11.466970	Trattoria/Osteria
3	Allach-Untermenzing	48.195157	11.462973	Zur Allacher Mühle	48.198411	11.457869	Bavarian Restaurant
4	Allach-Untermenzing	48.195157	11.462973	Würmtalhof	48.188834	11.460680	German Restaurant

# Methodology – Exploratory data analysis

- Visualization of the 25 existing boroughs in Munich on a Folium map



# Top 10 venues

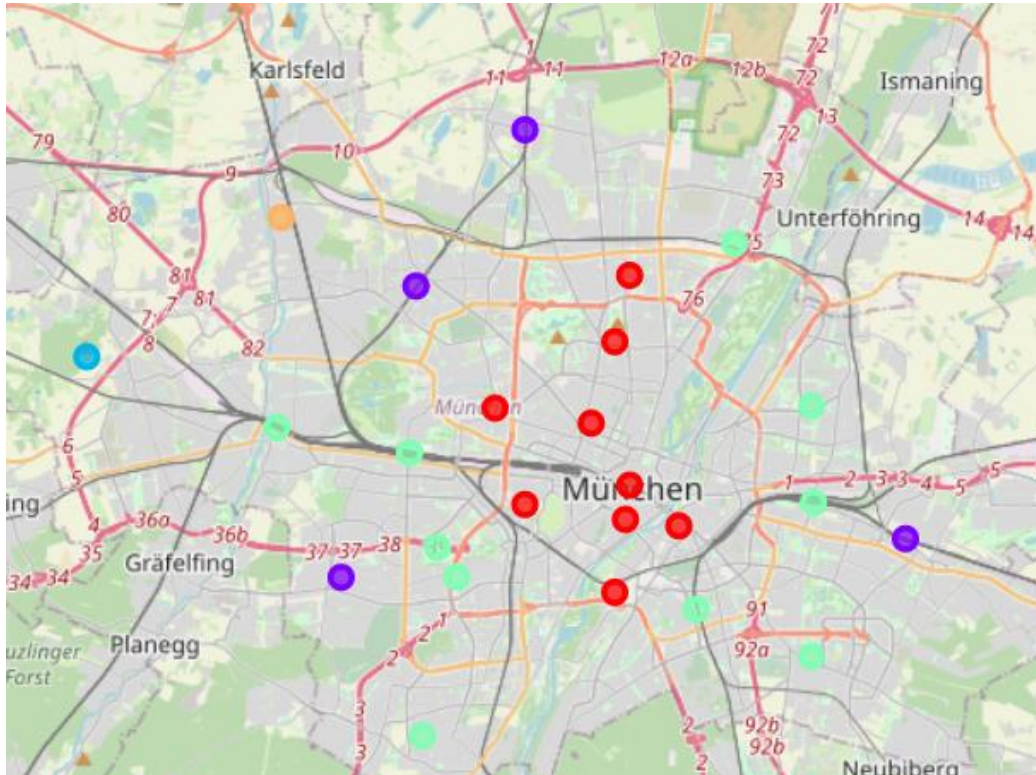
- Using one hot encoding to determine the 10 most common venues for each borough:

	Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
0	Allach-Untermenzing	Hotel	Drugstore	Bavarian Restaurant	Supermarket	Bakery	Shopping Mall	Trattoria/Osteria	Italian Restaurant	Light Rail Station	German Restaurant
1	Altstadt-Lehel	Plaza	Café	Bavarian Restaurant	German Restaurant	Hotel	Coffee Shop	Restaurant	Gourmet Shop	Department Store	Cocktail Bar
2	Au-Haidhausen	Café	Plaza	German Restaurant	Hotel	Coffee Shop	Bavarian Restaurant	Pub	Beer Garden	Cocktail Bar	Beach
3	Aubing-Lochhausen-Langwied	Soccer Field	Bus Stop	Bakery	Bistro	Supermarket	Light Rail Station	German Restaurant	Hotel	Post Office	Pharmacy
4	Berg am Laim	Hotel	Italian Restaurant	Supermarket	Bakery	Drugstore	Tram Station	German Restaurant	Asian Restaurant	Gym	Gastropub
5	Bogenhausen	Italian Restaurant	Bus Stop	Supermarket	Drugstore	Hotel	Bakery	Asian Restaurant	Beer Garden	German Restaurant	Plaza
6	Feldmoching-Hasenberg	Supermarket	Plaza	Drugstore	Bakery	Italian Restaurant	Gastropub	German Restaurant	Greek Restaurant	Intersection	Café
7	Hadern	Supermarket	Bus Stop	Bakery	Bank	German Restaurant	Drugstore	Ice Cream Shop	Sushi Restaurant	Residential Building (Apartment / Condo)	Sandwich Place
8	Laim	Supermarket	Greek Restaurant	Plaza	Italian Restaurant	Drugstore	Pizza Place	Bakery	Hotel	Park	Gastropub
9	Ludwigsvorstadt-Isarvorstadt	Café	Coffee Shop	Italian Restaurant	Bavarian Restaurant	German Restaurant	Plaza	Cocktail Bar	Ice Cream Shop	Pizza Place	Bookstore



# Cluster neighbourhoods

- Using k-means (with  $k = 5$ ) to cluster boroughs to find similar ones to Maxvorstadt (0, “red”):

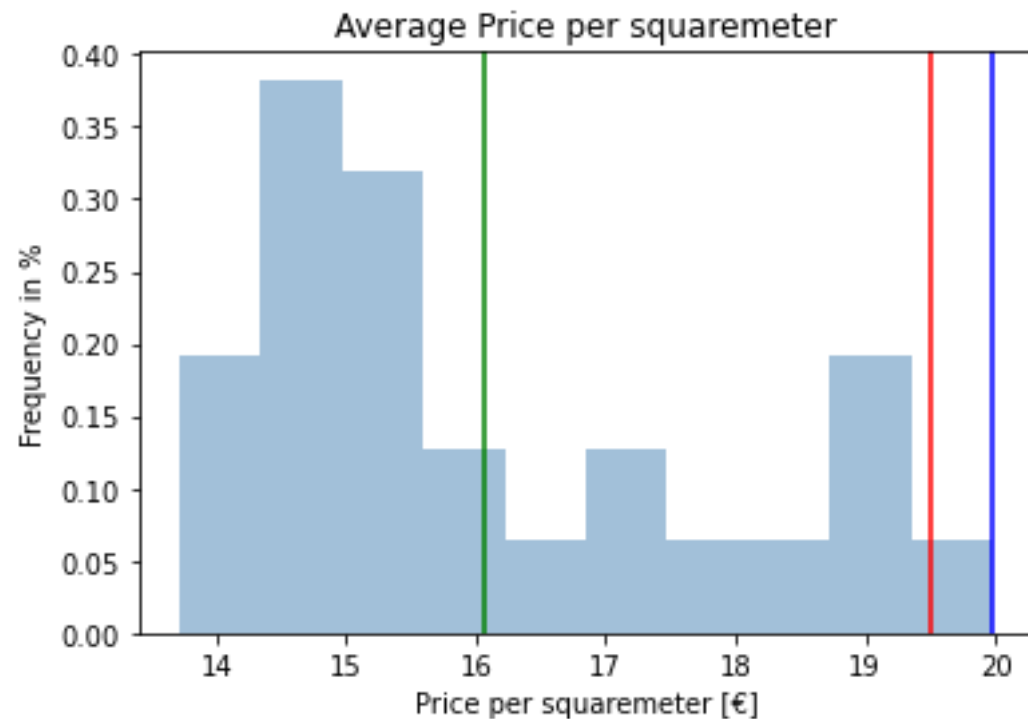


	Borough	Inhabitants per km <sup>2</sup>	Longitude	Latitude	Rent per m <sup>2</sup>	Cluster Labels	1st Most Common Venue
1	Altstadt-Lehel	5973	11.574582	48.137828	18.78	0	Plaza
3	Au-Haidhausen	12887	11.590536	48.128753	13.78	0	Café
9	Ludwigsvorstadt- Isarvorstadt	10418	11.573366	48.130340	17.84	0	Café
10	Maxvorstadt	10736	11.562418	48.151092	19.98	0	Café
11	Milbertshofen-Am Hart	5011	11.575043	48.182385	14.73	0	Hotel
13	Neuhausen- Nymphenburg	6548	11.531517	48.154222	16.44	0	Italian Restaurant
18	Schwabing-West	13628	11.569873	48.168271	19.27	0	Italian Restaurant
19	Schwanthalerhöhe	12610	11.541057	48.133782	18.97	0	Café
24	Untergiesing- Harlaching	5965	11.570189	48.114963	15.50	0	Italian Restaurant

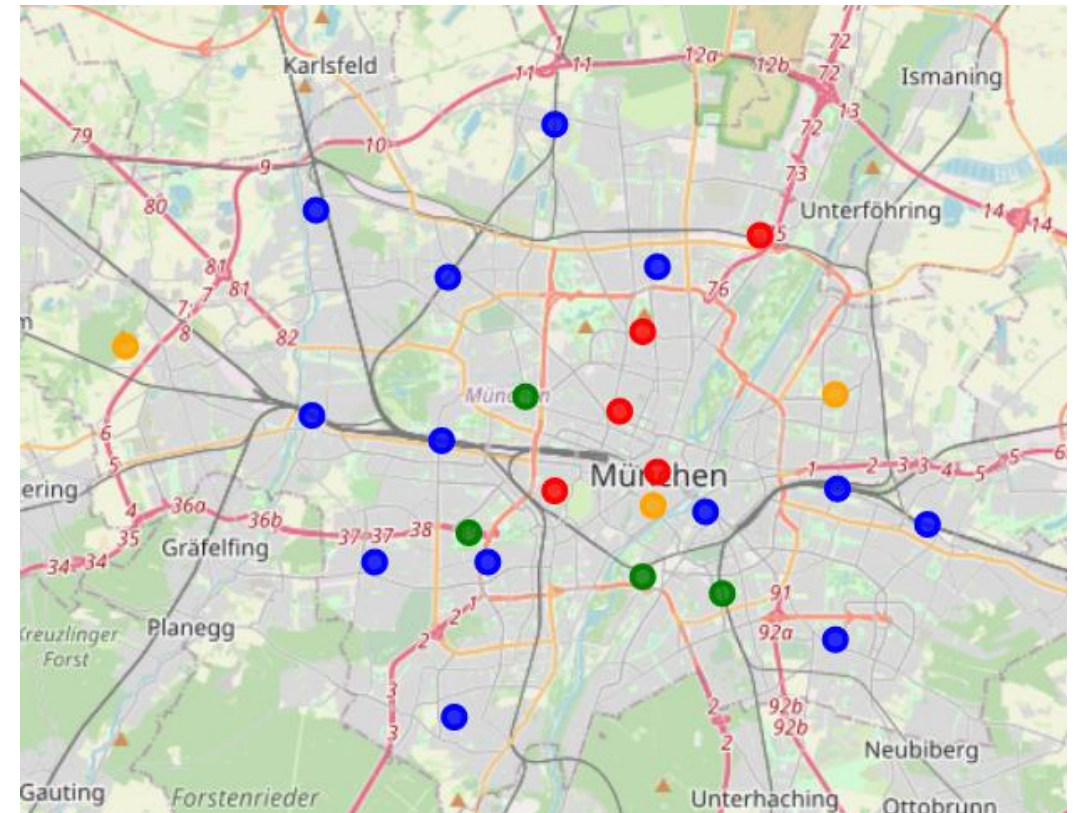


# Compare rental prices

- Anna's current rent (red) is slightly below the average rent in Maxvorstadt (blue), but still far above the average rent for Munich (green)



- Boroughs close to the city center, including Maxvorstadt, are generally more expensive (red) than the ones in the outskirts of Munich (blue)



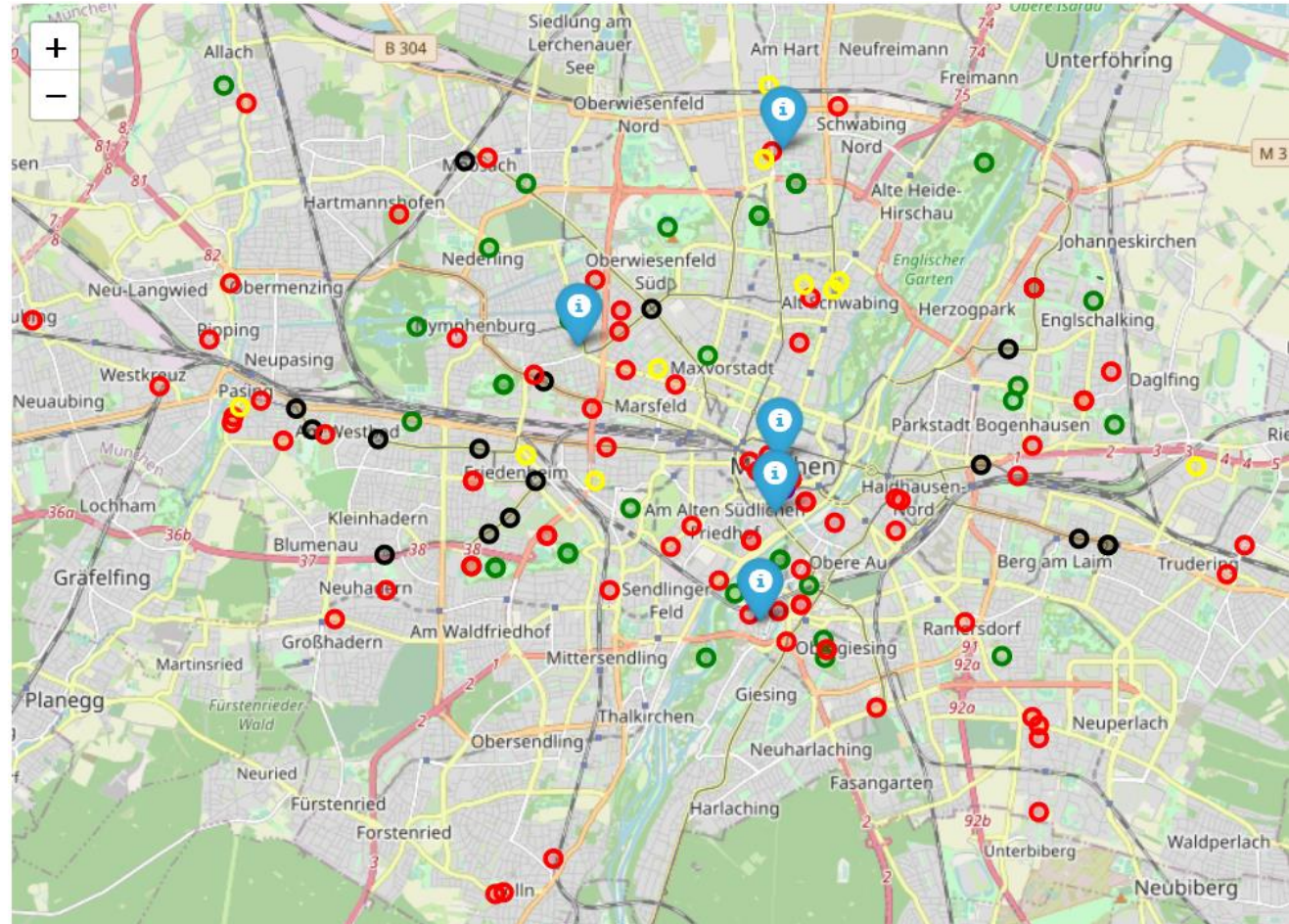
# Results based on rent and inhabitant count

- 5 boroughs remain that are basically fulfilling the criteria defined in the beginning:

	index	Borough	Area in km <sup>2</sup>	Inhabitant Count	Inhabitants per km <sup>2</sup>	Longitude	Latitude	Rent per m <sup>2</sup>	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue
0	1	Altstadt-Lehel	3.16	18876	5973	11.574582	48.137828	18.78	0	Plaza	Café	Bavarian Restaurant	German Restaurant	Hotel
1	9	Ludwigsvorstadt-Isarvorstadt	4.39	45736	10418	11.573366	48.130340	17.84	0	Café	Coffee Shop	Italian Restaurant	Bavarian Restaurant	German Restaurant
2	11	Milbertshofen-Am Hart	13.37	66992	5011	11.575043	48.182385	14.73	0	Hotel	Italian Restaurant	Bakery	Drugstore	Greek Restaurant
3	13	Neuhausen-Nymphenburg	12.92	84604	6548	11.531517	48.154222	16.44	0	Italian Restaurant	Café	Plaza	German Restaurant	Hotel
4	24	Untergiesing-Harlaching	8.06	48075	5965	11.570189	48.114963	15.50	0	Italian Restaurant	Café	German Restaurant	Bar	Greek Restaurant

# Visualize Anna's favourite venues on map

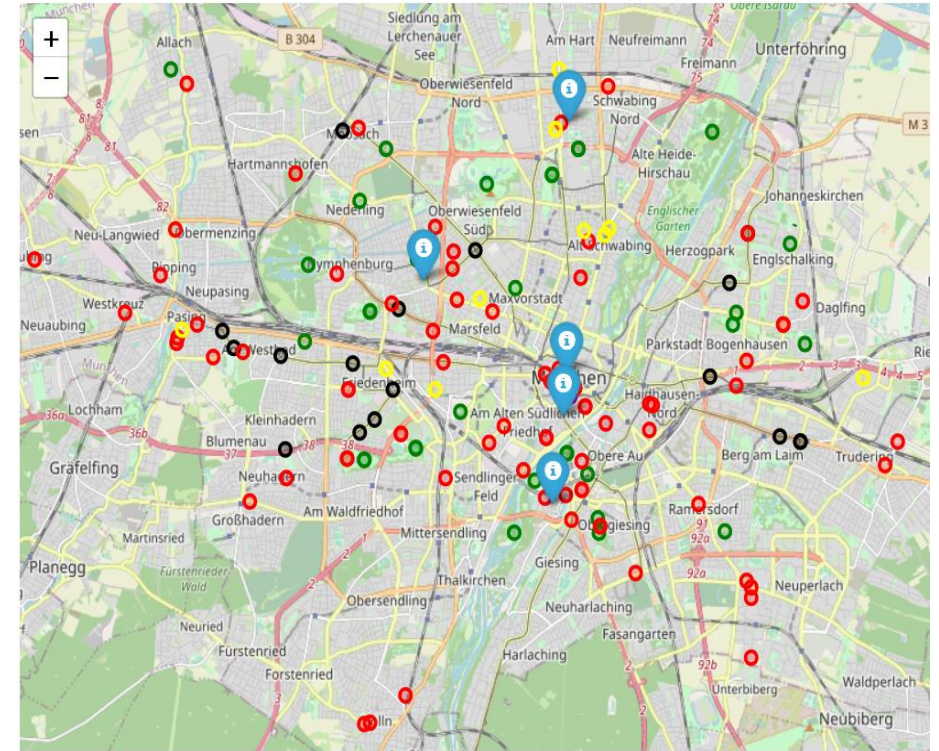
- 5 remaining boroughs (i)
- Park (green)
- Tram Station (black)
- German Restaurant (red)
- Thai Restaurant (yellow)
- Cupcake Shop (purple)





# Results based on venues

- Information about tram stations not reliable → ignore
- Recommendation: **Milbertshofen-Am Hart**
- 2 parks, 2 German and 2 Thai restaurants
- No cupcake shop → possibility to open a new one
- Lowest average rent among the five boroughs



	Borough	Inhabitants per km <sup>2</sup>	Rent per m <sup>2</sup>	# Park	# Tram Station	# German Restaurant	# Thai Restaurant	# Cupcake Shop
0	Altstadt-Lehel	5973	18.78	0	0	5	0	1
1	Ludwigsvorstadt-Isarvorstadt	10418	17.84	1	0	4	0	1
2	Milbertshofen-Am Hart	5011	14.73	2	0	2	2	0
3	Neuhausen-Nymphenburg	6548	16.44	2	2	6	0	0
4	Untergiesing-Harlaching	5965	15.50	4	0	7	0	0

# Conclusions

- The aim of this project was to identify a borough that is similar to Annas current one (Maxvorstadt) and has as many of her favourite venues nearby. In addition, both the rent per m<sup>2</sup> and the inhabitant count per km<sup>2</sup> should be less than in her current borough. The best option was found to be **Milbertshofen-Am Hart**.
- This data analysis is of course very **basic**. There might be additional factors like availability of apartments, noise, proximity to friends and so on, which should be considered. However, the data analysis presented above should be appropriate to get a **first orientation**.

	index	Borough	Area in km <sup>2</sup>	Inhabitant Count	Inhabitants per km <sup>2</sup>	Longitude	Latitude	Rent per m <sup>2</sup>	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue
0	1	Altstadt-Lehel	3.16	18876	5973	11.574582	48.137828	18.78	0	Plaza	Café	Bavarian Restaurant	German Restaurant	Hotel
1	9	Ludwigsvorstadt- Isarvorstadt	4.39	45736	10418	11.573366	48.130340	17.84	0	Café	Coffee Shop	Italian Restaurant	Bavarian Restaurant	German Restaurant
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