
District Segmentation and Clustering

CITIES AND MUNICIPALITIES SEGMENTATION USING
K-MEANS CLUSTERING OF A DISTRICT IN SOUTHERN
GERMANY

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1 Introduciton

The *Rems-Murr-Kreis* is a district in the federal state of Baden-Württemberg in southern Germany. It is located in the northeast of the Stuttgart metropolitan region, which is known for its engineering and automotive industry which is home to the headquarters of Mercedes and Porsche and other world market leaders. The spatial proximity to this economic hub makes the district an attractive location for workers in the region. Here workers can take advantage of both the cultural offerings of a large city (Stuttgart) and the peace and nature of a rural region.

As a result of the popularity of the location and the welfare of the workforce, which benefits from a strong economic sector, rents, land and house prices are relatively high compared to the rest of Germany. However, prices vary greatly between the towns and communities within the district, although they are only a few minutes' drive apart. The aim of this project is to find out which places in the district are overpriced and underpriced in order to support the decision for future investors, shop owners and residents.

2 Business Problem

This section specifies the business problem and names the potential target groups.

2.1 The *Rems-Murr-Kreis*

Figure 1 shows the geographic location of municipalities (blue markers) and cities (red markers) wihtin the disctrict *Rems-Murr-Kreis*. This classification was made by the local administraion and can be freely accessible. The cities are located mainly close the Stuttgart and along two major roads that run through the area. The municipalities are typically located away from these two main roads, but often only a few minutes' drive from the cities.

Obviously this results in differences for commuters, but as mentioned above,

these are very small and do not justify the general price difference between the cities and the more rural communities. The objective of this project is to analyze which municipalities are underpriced and are similar to the cities within the district in terms of popular nearby places and venues. A municipality which is officially classified as a municipality but is in the same cluster as a city is potentially underpriced and can be considered for settlement.

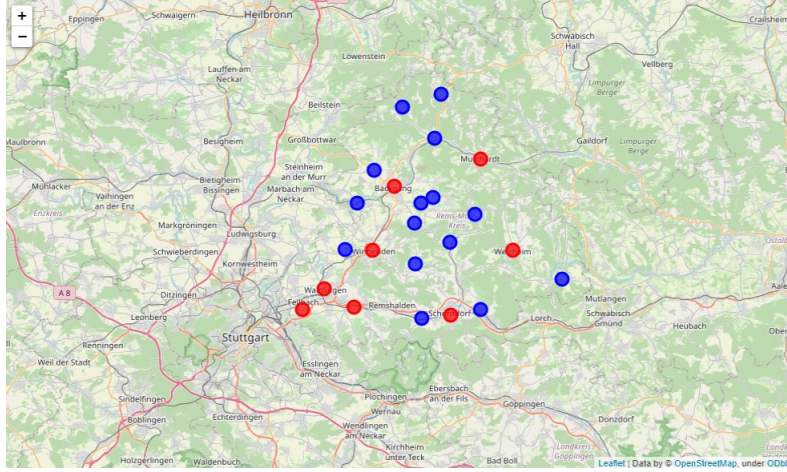


Figure 1: THE REMS-MURR-KREIS: Blue markings indicate municipalities. Red markings indicate cities. Stuttgart is located in the southwest.

2.2 Potential Target Group

This project is addressed to a potentially broad audience taking advantage of underpriced settlements. Specifically, this includes all agents who intend to move near the economically strong city of Stuttgart: future workers, companies, restaurants, profit-oriented investors, shops and shopping centres.

3 Data and Methodology

This section describes the data used as well as the methodology for achieving results.

3.1 Data Set

I webscraped a list of cities and municipalites in the *Rems-Murr-Kreis* and merged it with their respective geographic coordinates, using Python's request and geocoder packages. I searched for the twenty most common venues within 1500 meters of these coordinates using the 'Places API' of the Foursquare developer database, which completes my data set.

3.2 Methodology

Each location has been assigned its most popular venues which are proxies for their local amenities. I use k-means clustering to identify which locations are similar according to the most popular venues within the radius. As we only deal with binary qualitative responses (cities and municipalities) k is set to two. Finally I compare the labels of k-means clustering with the labels of the administration to identify the two clusters.

There are two possible scenarios for the result of the cluster analysis. In the first scenario, the clusters are build among cities and municipalities, separating each category perfectly from each other. The initial classification of local authorities is correct, cities and municipalities have distinctive venues that clearly separate them from one another. In the second scenario clusters form differently from the intial authority clustering (see Figure 1). Exemplary, municipalities are wrongly classified as municipalities and are instead very similar to a city, and vice versa.

In Figure 2 are the final results of the study. The inital clustering (the ones of the local authorities) is indicated in the center of each marking. Again, red represents cities and blue represents municipalities. The outer ring indicates

the classification of the k-means clustering. We can immediately recognize that the results comply with the second scenario.

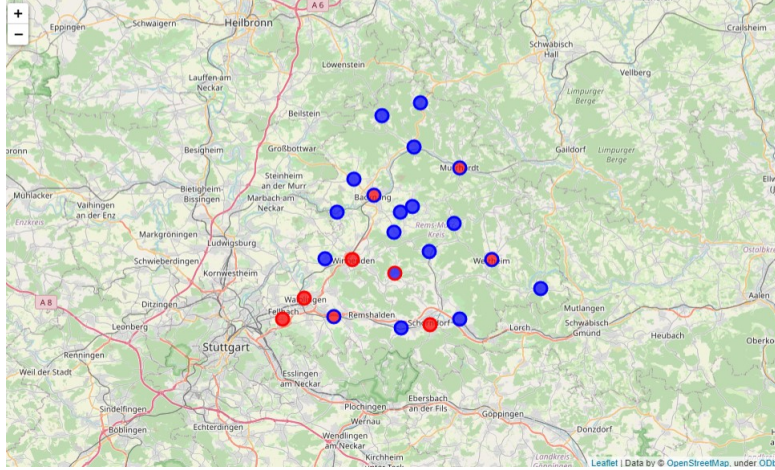


Figure 2: THE REMS-MURR-KREIS: Blue markings indicate municipalities. Red markings indicate cities. Stuttgart is located in the southwest. The center indicates the classification of the local authority. The outer ring represents the classification of the k-means clustering.

4 Results

The results show that four cities (Fellbach, Schorndorf, Waiblingen, and Winnenden) are rightly classified. This can be seen in Figure 2 by the fact that the color of the center corresponds to that of the outer ring. Their respective venues are similar to each other and constitute a city. On this analysis, city-like rents in these locations are justified. Likewise, almost all municipalities have characteristics that distinguish them from a typical city. They are also correctly classified by the local authorities.

Now to the remarkable results. With Backnang, Murrhardt, Weinstadt, and Welzheim, there are four cities which are classified as cities but are venue-wise more similar to more rural municipalities. Rents in these locations could possibly be oriented to the more expensive city rents and have the potential to

be overpriced. It can be strongly recommended to be aware of this fact when looking for a flat/shop. Conversely, there exists a municipality (Berglen, blue center, red outer ring) which is more similar to a city. Rentals in this location can be cheaper, with the same amenities as a typical city. Berglen could turn out to be a favorable housing opportunity for seekers.

5 Discussion

Results should be taken with caution. There may be other significant characteristics that influence local rents more than the composition of the venues. Among them are long-distance transport connections, proximity to the workplace, preferences of landscape, and the number of local companies. However, some results can be taken away for agents who intend to move into the area. The cities Backnang, Murrhardt, Weinstadt, and Welzheim are actually more municipality like. The rents might be higher compared to other municipalities around them, while amenities are similar. The municipality of Berglen seems to be the perfect starting point for a possible housing search, since the rents can be relatively lower here, whereby the amenities are similar to a city.

6 Conclusion

This report tries to find potentially underpriced or overpriced locations within a district in the federal state of Baden-Württemberg in southern Germany. The results represented graphically after a k-means clustering analysis. There seem to be savings opportunities for housing seekers, as a community in the region has the typical characteristics of a city when it comes to venues. The analysis also shows that some cities have the potential to have over-proportionally high rents, as they are not cities in terms of venues.