

# TARGET AREAS TO OPEN NEW GYMS IN FRANKFURT, GERMANY

CAPSTONE PROJECT FOR IBM DATA SCIENCE PROFESSIONAL CERTIFICATE

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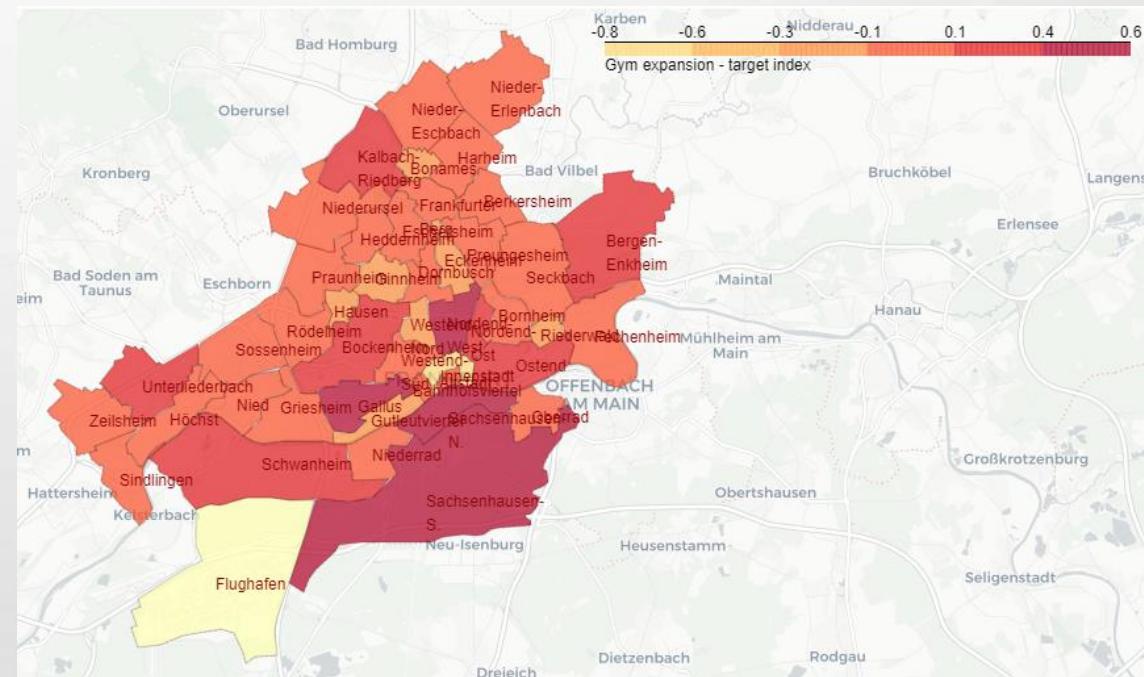
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# MANAGEMENT SUMMARY

- Frankfurt am Main is one of Germany's largest cities, a major financial centre in Europe, and hub for commerce, culture, education, tourism and transportation
    - Frankfurt's 46 boroughs differ significantly in terms of inhabitants, size, population density, employment and income, and available sports and recreations offers available
  - For several years, The Fitness market in Germany has been growing
    - There are 125 gyms in the city of Frankfurt, primarily general purpose gyms and only a few specialized gyms
  - Based on extensive research, to open a new gym or expand gym franchises, it is recommend to focus on the following boroughs:
    - (1) Gallus, (2) Nordend-West, (3) Sachsenhausen Süd, (4) Sachsenhausen Nord, (5) Ostend



# DATA SOURCES

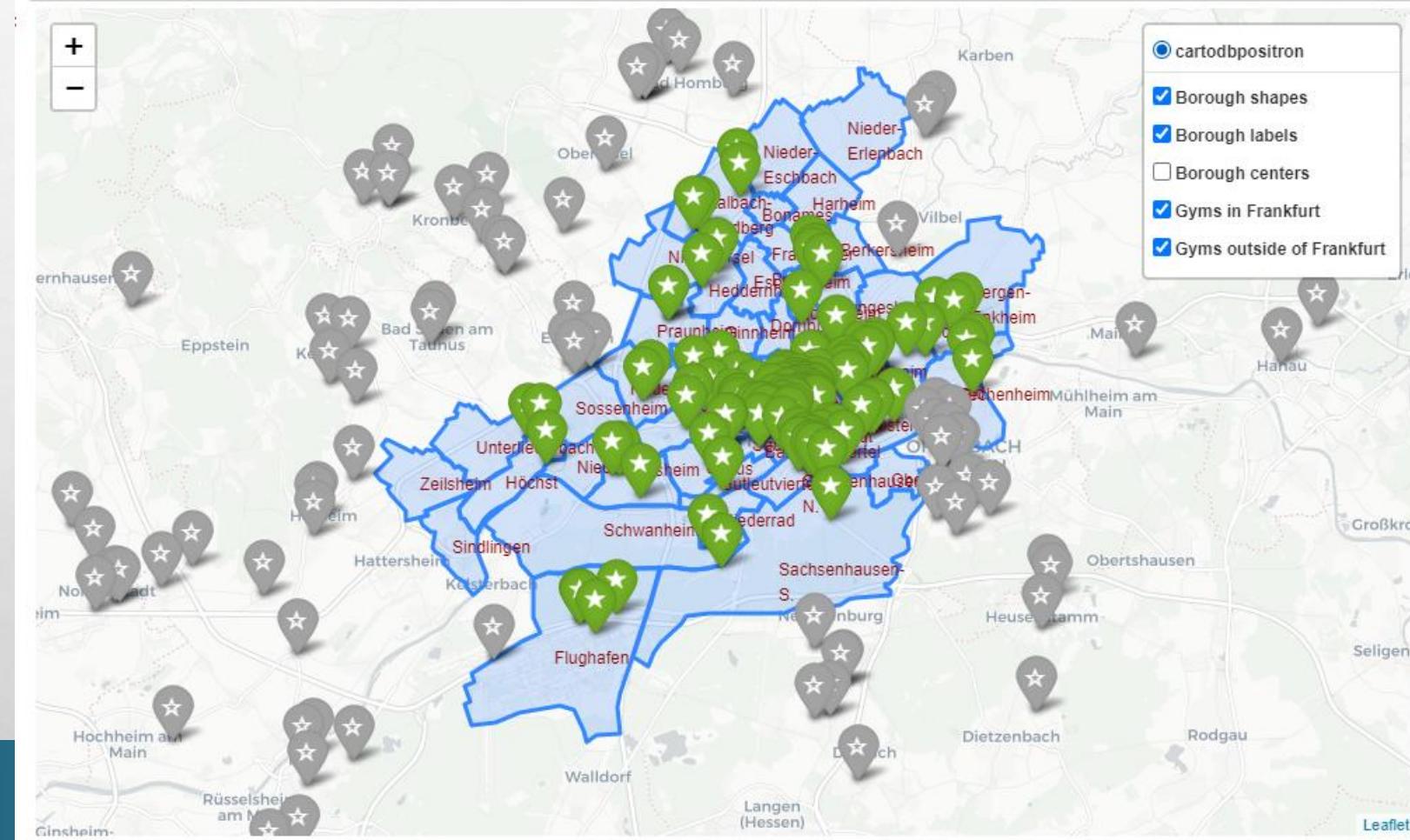
- Gym location data: Foursquare API, data retrieved Jan 2021
- Frankfurt borough geoshapes: [Esri DE Open Data: Städte & Gemeinden](#)
- Frankfurt official statistics for each borough (data based on end of 2019): [Stadtteilprofile Frankfurt am Main](#)

# METHODOLOGY

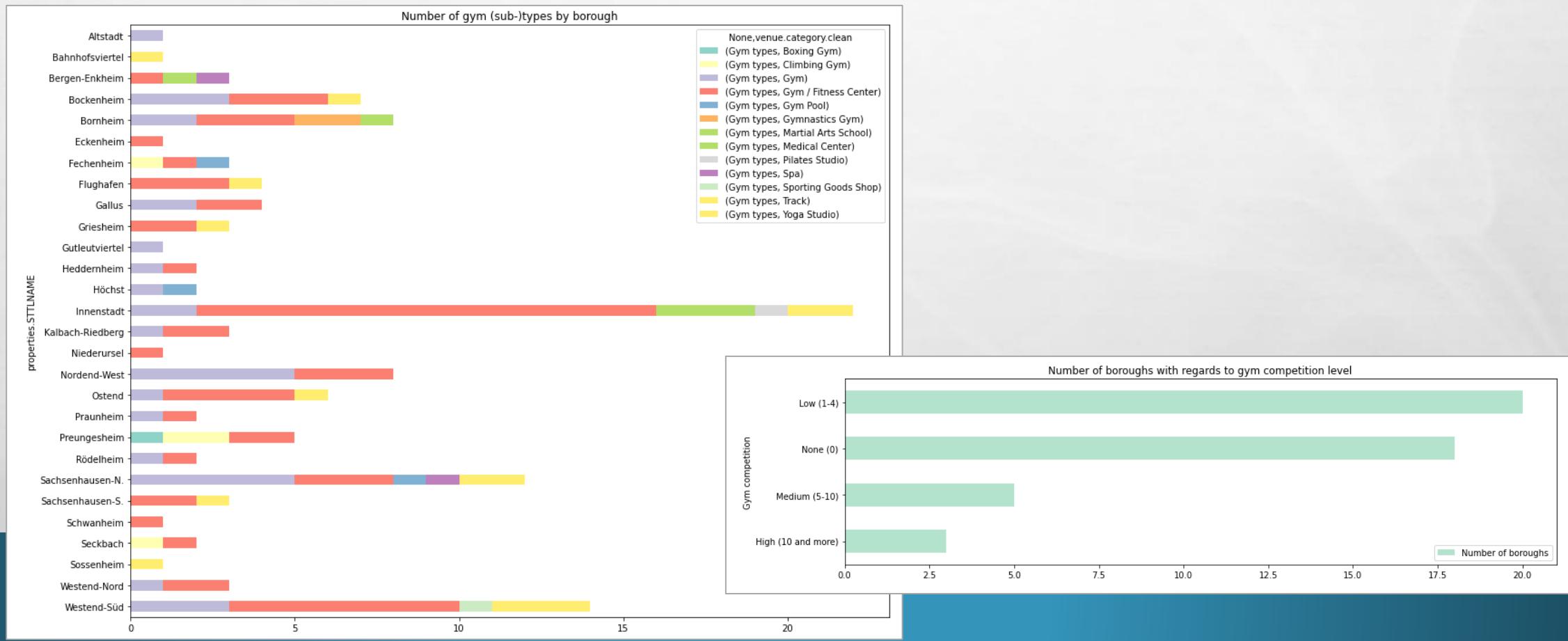
- Various data imports & data preprocessing steps (e.g. computing of classes, e.g. gym competition type)
- **Data exploration and visualizations**
  - Inspections based on: Grouping, counts, frequencies etc.
  - Bar charts
  - Various Choropleth maps
- Decision tree analysis to support feature selection for cluster analysis
- **Cluster analysis** of similar boroughs
  - KMeans algorithm
  - Grid searches used to determine number of clusters, scaling method (=> MaxAbsScaler), initialization (=„random“) state for reproducible results)
  - Line plots to assess clustering results using the following metrics:
    - SKLearn Kmeans default score
    - Silhouette coefficients
    - Sum of squared distances of samples to their closest cluster center
- Creation of a **gym expansion target** index as
  - + Amount of total income of employed inhabitants for each borough
  - 50% of the ratio of sports, leisure and recreation areas
  - 50% of the number of gyms in the borough
- Statistics tables for (1) recommend top boroughs and (2) clusters of similar boroughs

# **KEY RESULTS: FRANKFURT BOROUGHHS AND THEIR GYMS**

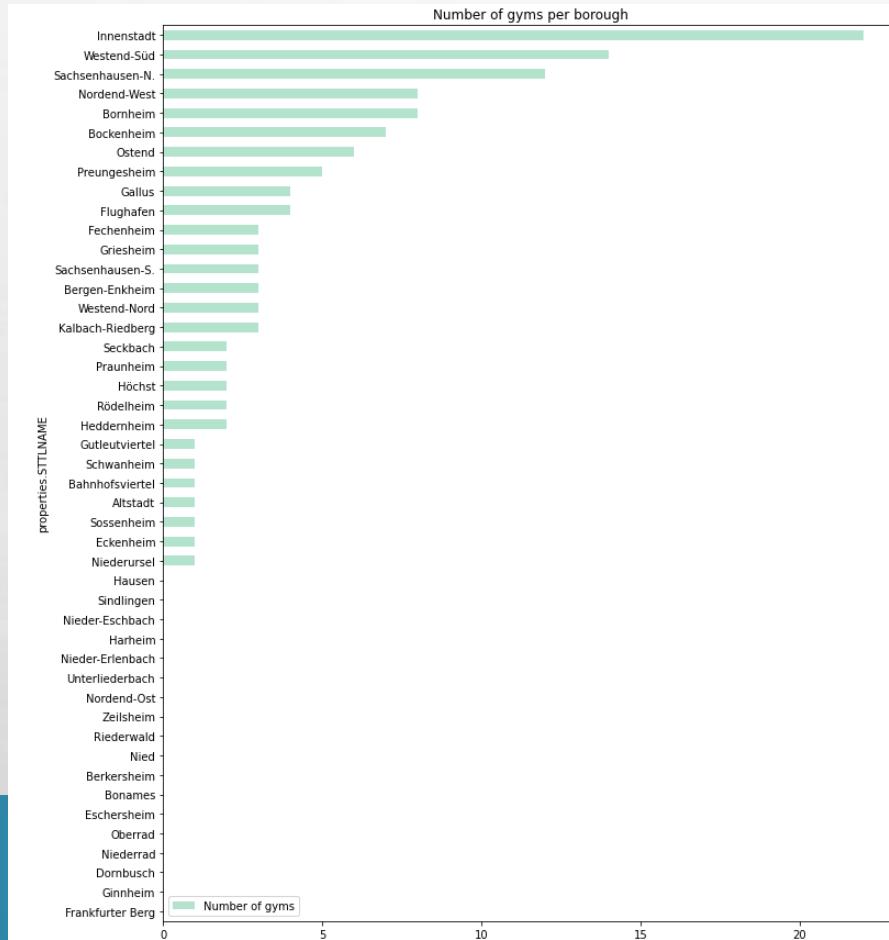
# 125 GYMS IN FRANKFURT + 81 IN THE SURROUNDING REGION



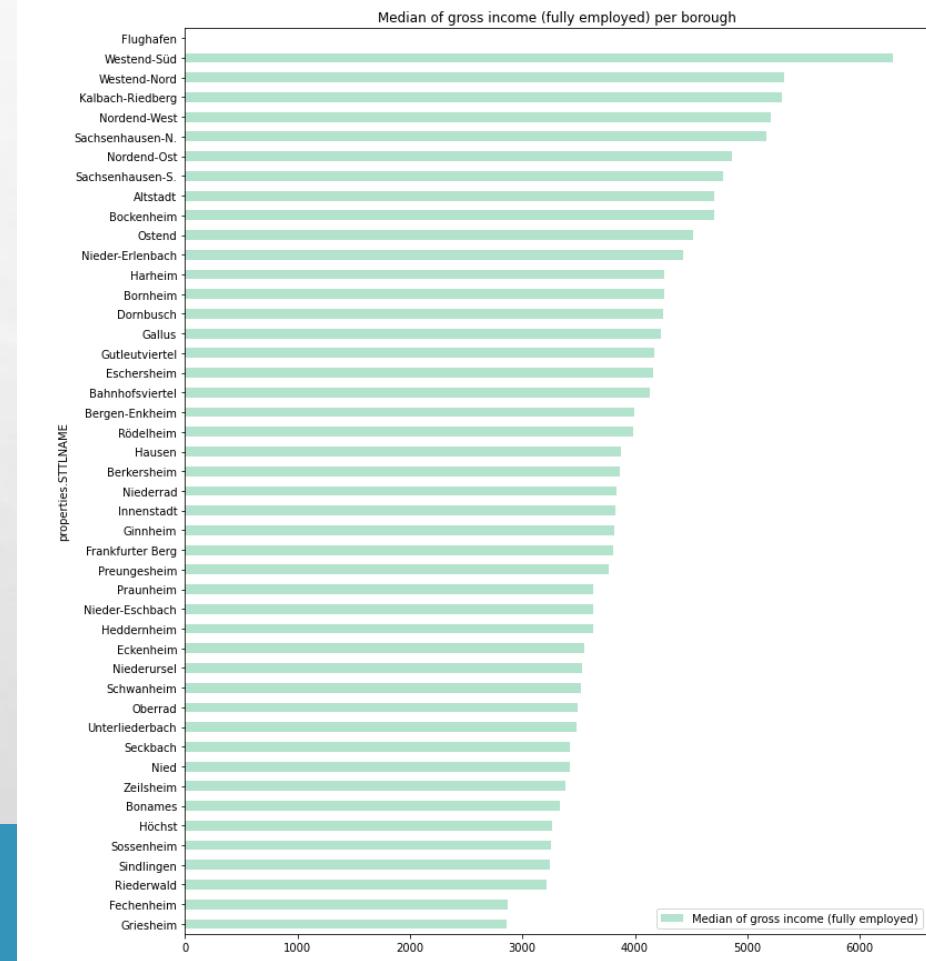
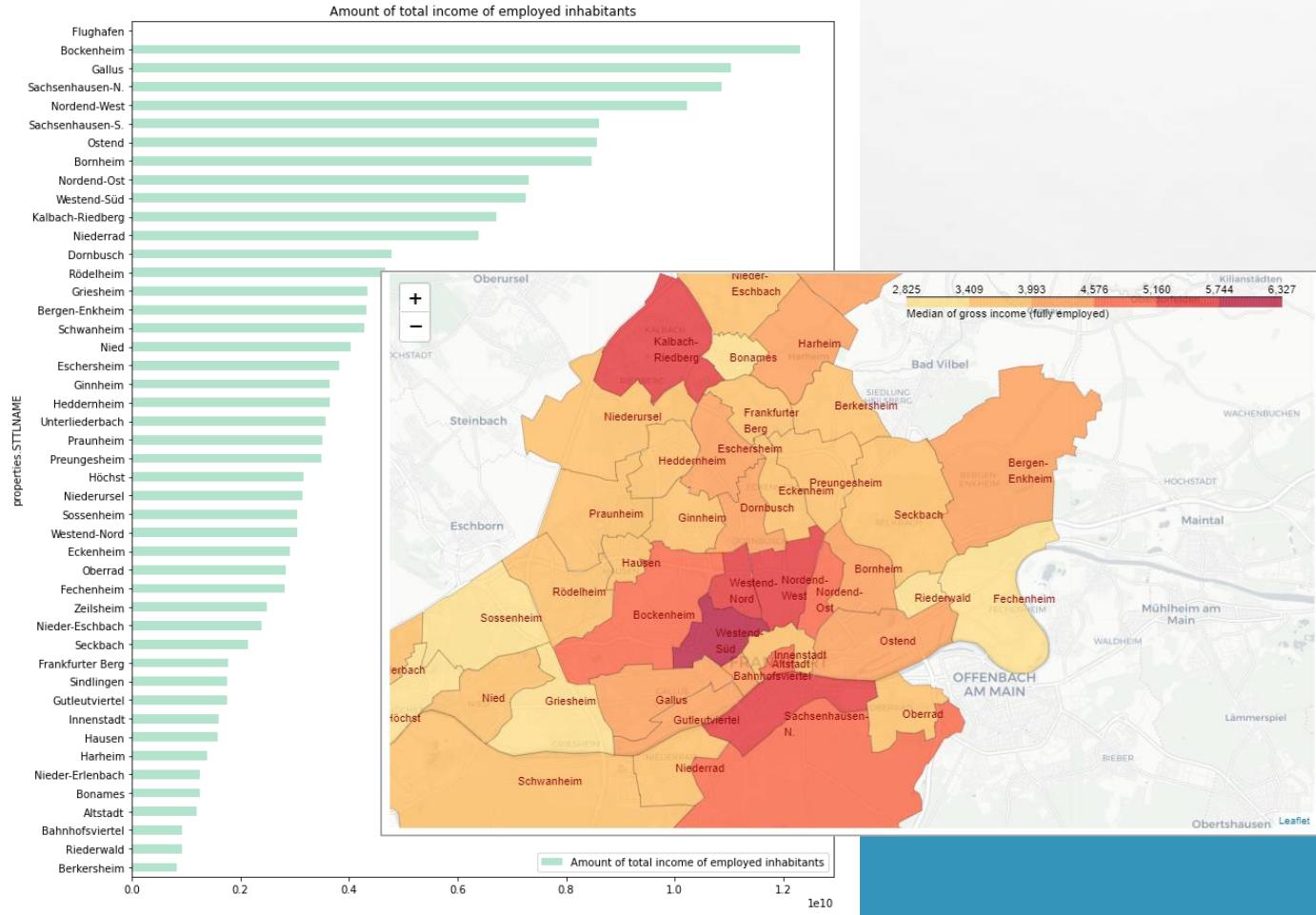
# (1) GYM COMPETITION DIFFERS A LOT IN BOROUGHS, BUT MOST GYMS ARE GENERAL PURPOSE



## (2) GYM COMPETITION DIFFERS A LOT IN BOROUGH, BUT MOST GYMS ARE GENERAL PURPOSE



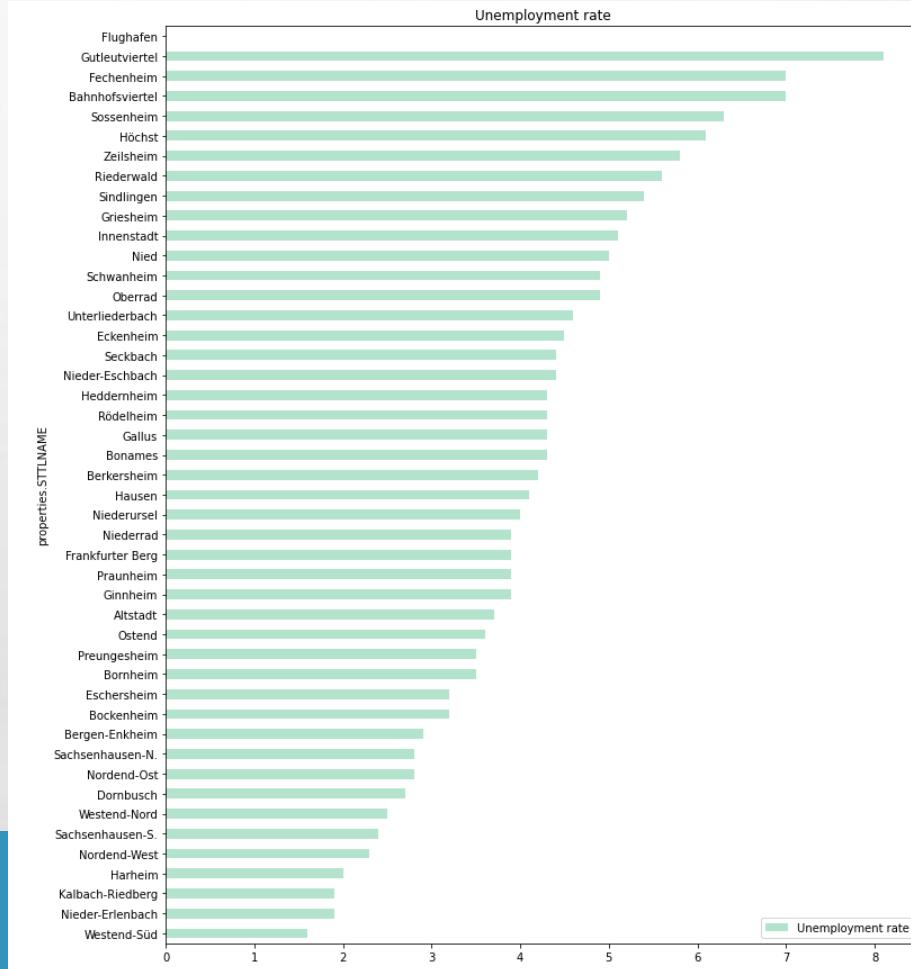
# GROSS INCOME VARIES EXTREMELY



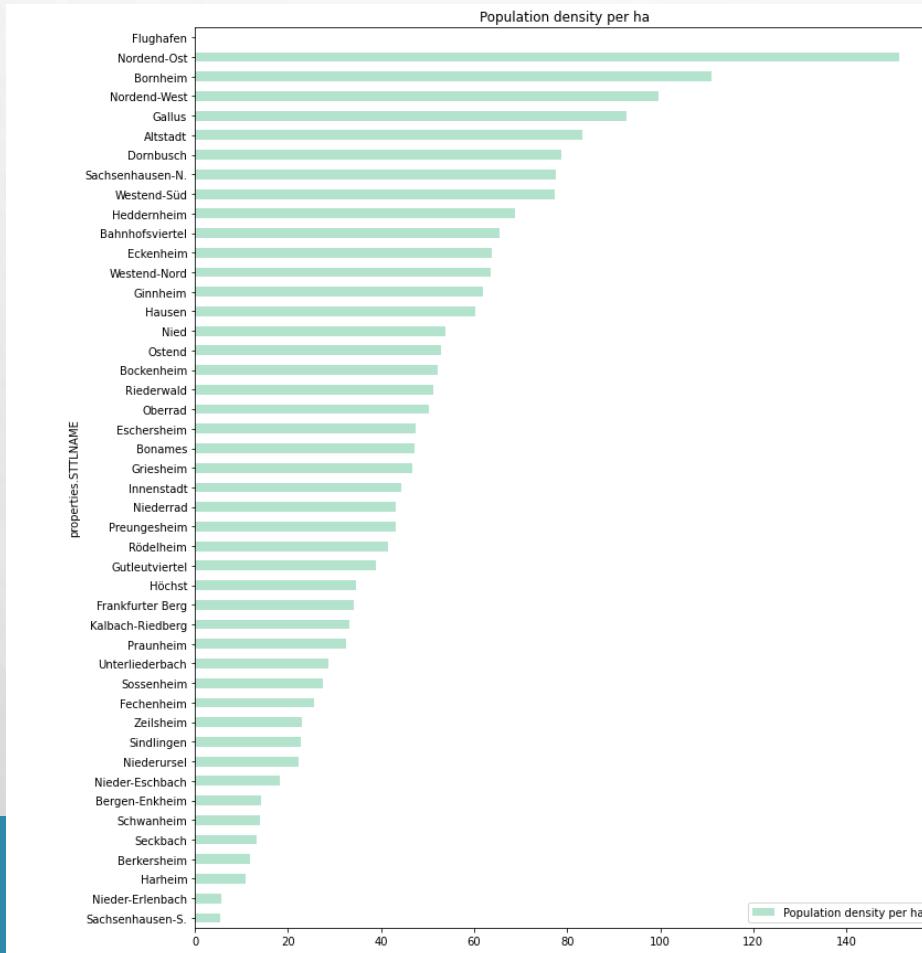
# AVERAGE AGE CENTERS AROUND 40



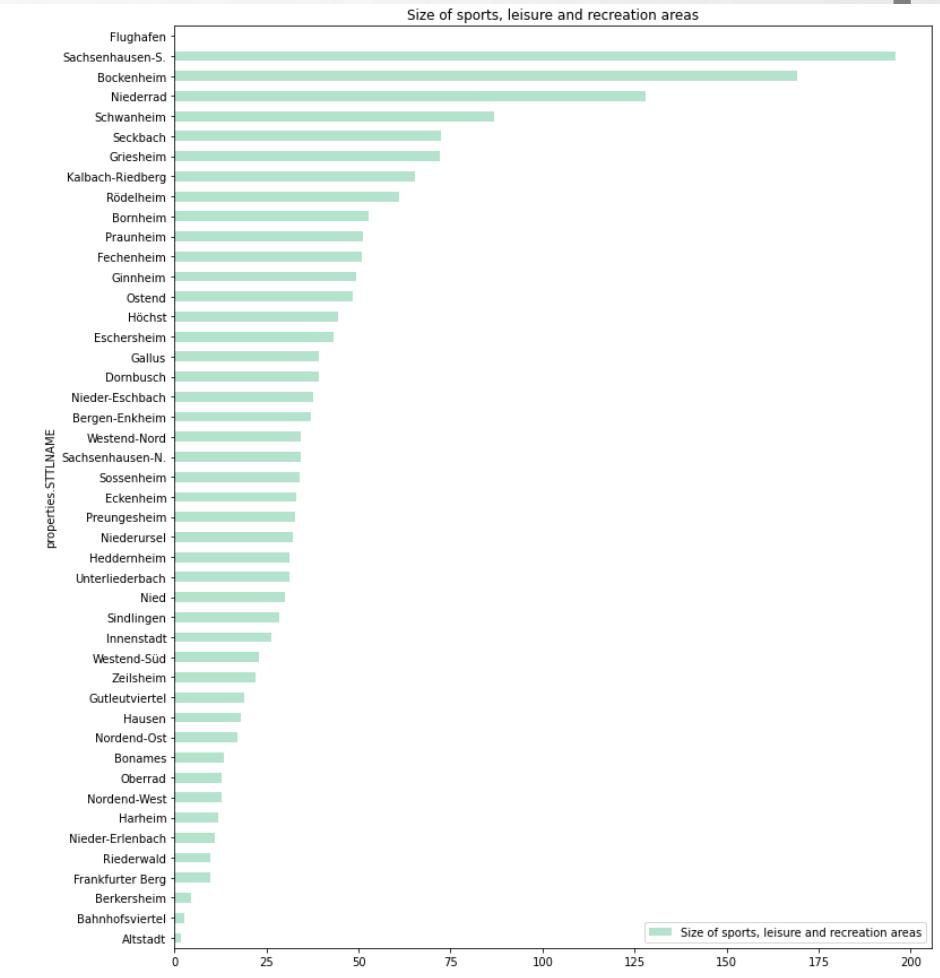
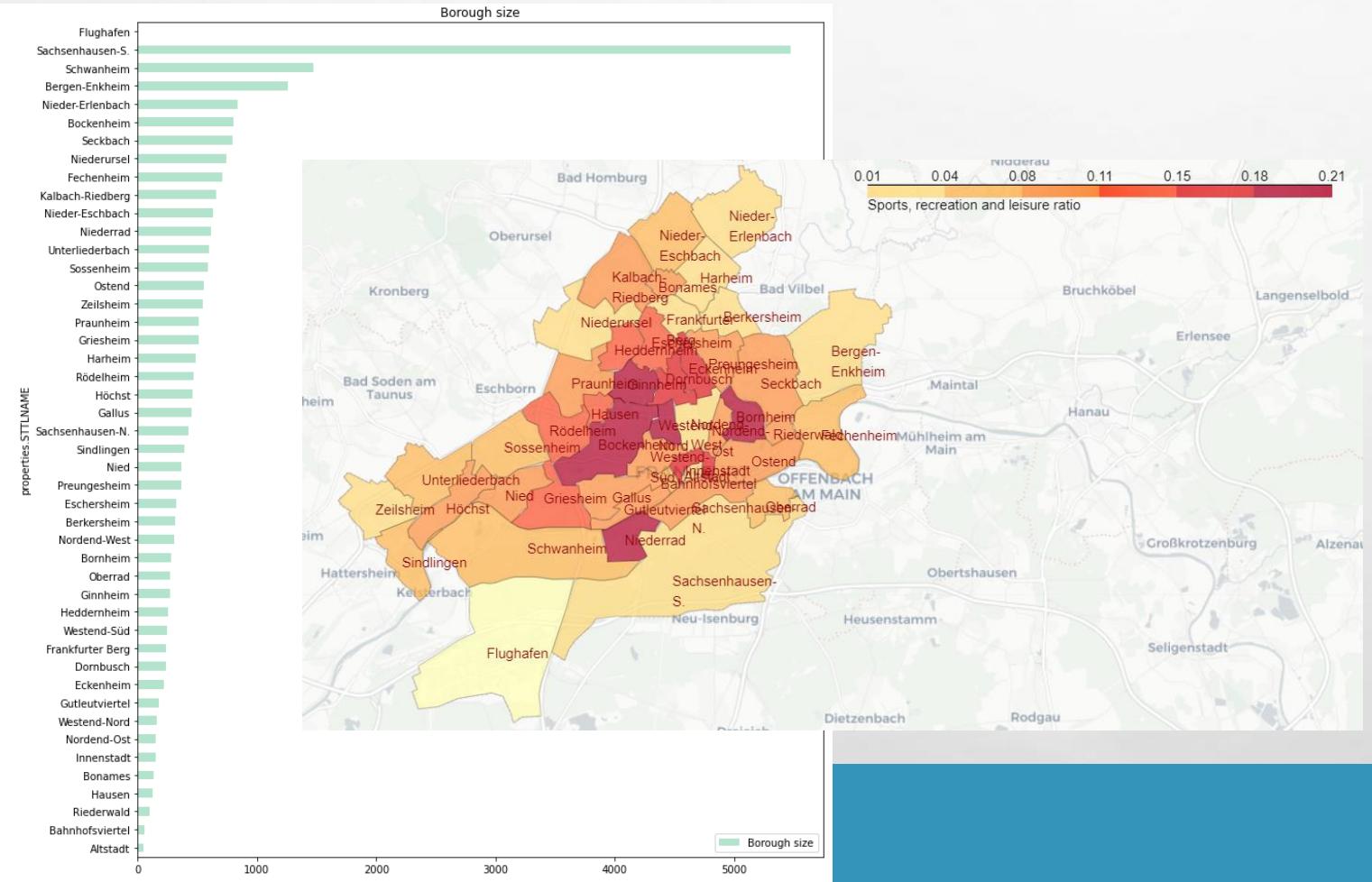
# UNEMPLOYMENT RATES VARY BY MORE THAN 6%



# POPULATION DENSITY IS WIDELY SPREAD

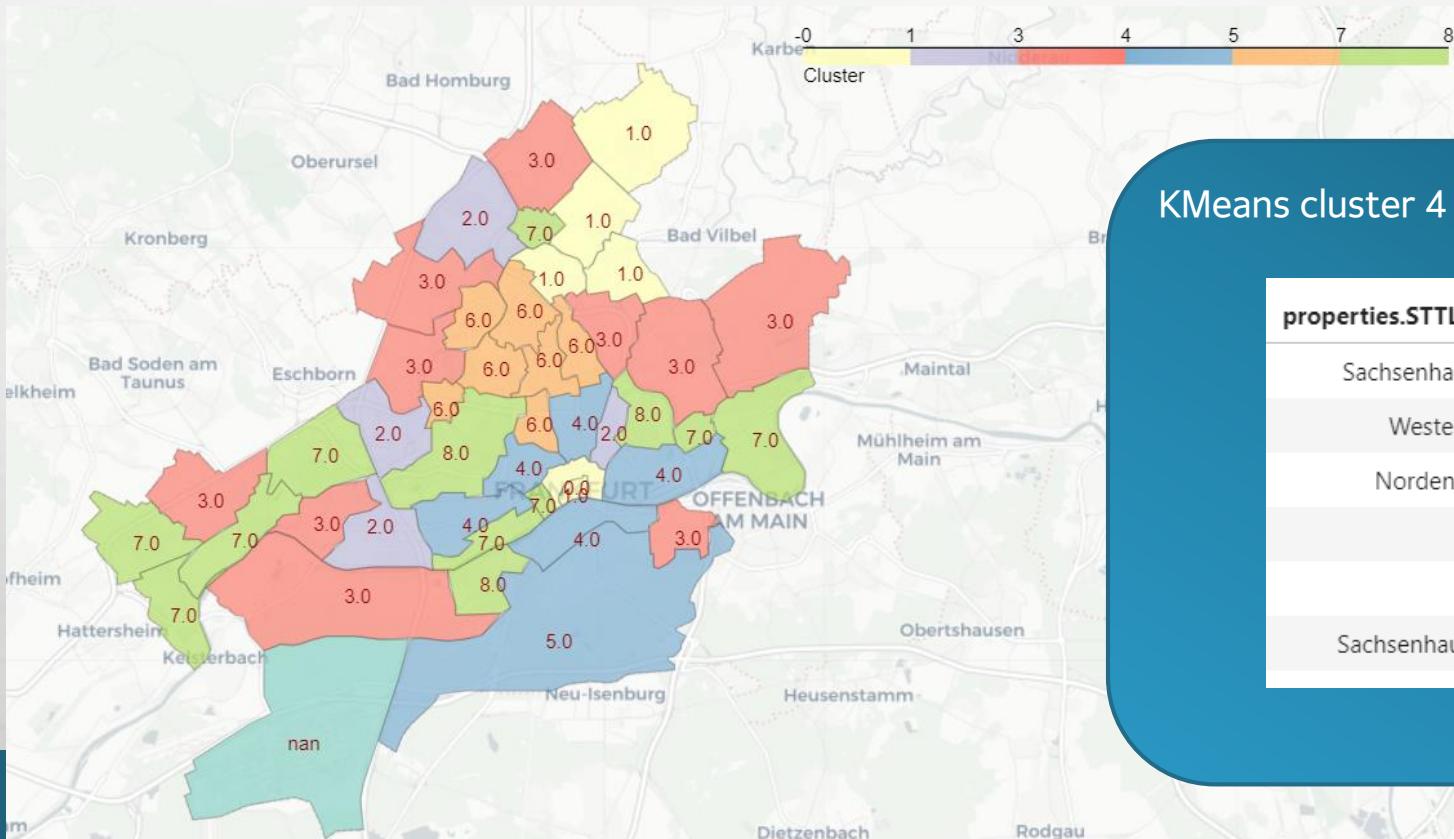


# TOTAL AND SPORTS & RECREATION AREAS SIGNIFICANTLY DIFFER



# **KEY RESULTS: TARGET BOROUGHS TO OPEN NEW GYMS**

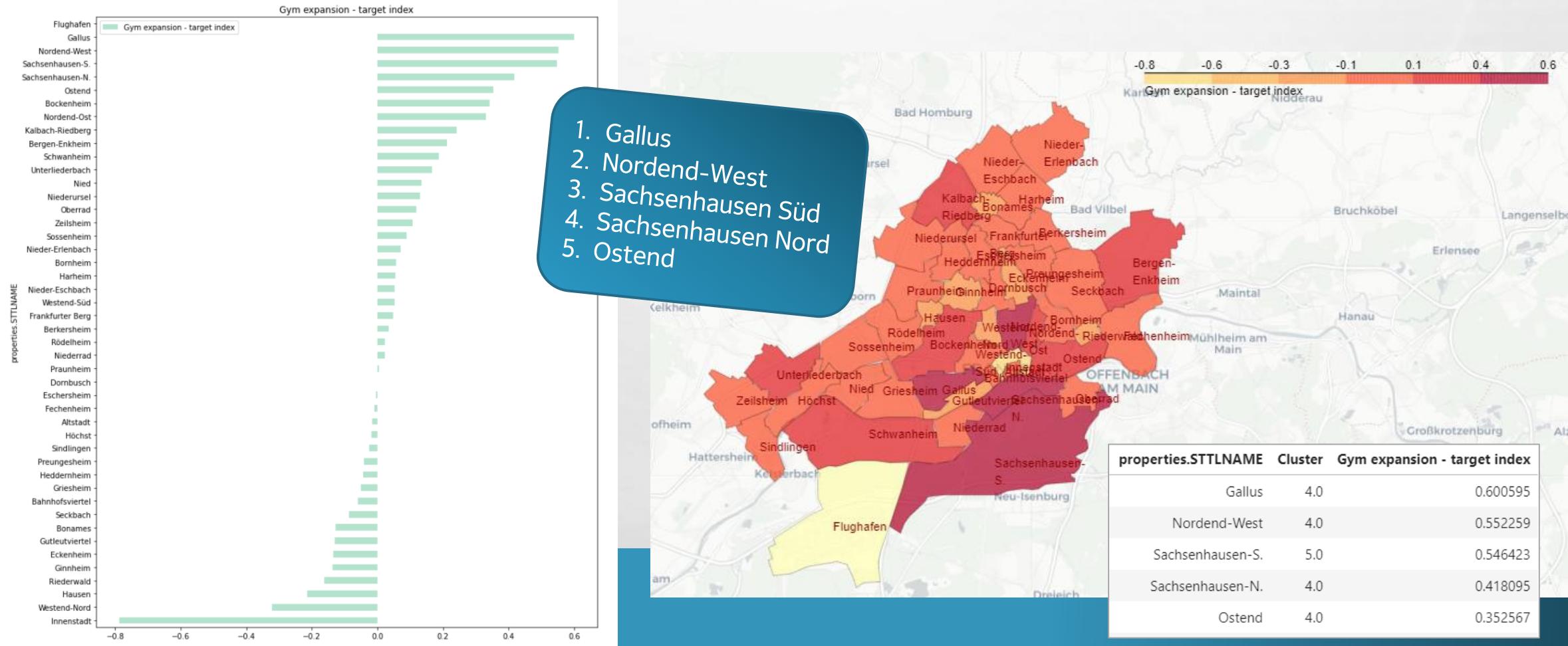
# KMEANS: CLUSTERS 4 AND 5 ARE SIMILAR AND FAVORABLE



KMeans cluster 4 & 5:

| properties.STLNAME | Cluster | Gym expansion - target index |
|--------------------|---------|------------------------------|
| Sachsenhausen-S.   | 5.0     | 0.546423                     |
| Westend-Süd        | 4.0     | 0.051835                     |
| Nordend-West       | 4.0     | 0.552259                     |
| Ostend             | 4.0     | 0.352567                     |
| Gallus             | 4.0     | 0.600595                     |
| Sachsenhausen-N.   | 4.0     | 0.418095                     |

# INDEX: TOP5 BOROUGHHS FOR NEW GYMS



# STATS FOR THE TOP5 BOROUGHHS TO OPEN NEW GYMS

|  | 0                  | 1                  | 2                 | 3                  | 4                 |
|--|--------------------|--------------------|-------------------|--------------------|-------------------|
| properties.STTNAME                             | Gallus             | Nordend-West       | Sachsenhausen-S.  | Sachsenhausen-N.   | Ostend            |
| Gym expansion - target index                   | 0.600595           | 0.552259           | 0.546423          | 0.418095           | 0.352567          |
| centroid.latitude                              | 50.102319          | 50.130401          | 50.070682         | 50.098492          | 50.11622          |
| centroid.longitude                             | 8.638973           | 8.685188           | 8.674516          | 8.685992           | 8.721066          |
| Number of gyms                                 | 4.0                | 8.0                | 3.0               | 12.0               | 6.0               |
| Gym competition                                | Low (1-4)          | Medium (5-10)      | Low (1-4)         | High (10 and more) | Medium (5-10)     |
| Borough size                                   | 451.730563         | 310.017541         | 5471.102593       | 423.463536         | 556.403464        |
| Size of sports, leisure and recreation areas   | 39.183601          | 12.689284          | 195.848676        | 34.230558          | 48.466343         |
| Sports, recreation and leisure ratio           | 0.086741           | 0.040931           | 0.035797          | 0.080835           | 0.087106          |
| Population density per ha                      | 92.645934          | 99.662103          | 5.328176          | 77.496637          | 52.977744         |
| Inhabitants                                    | 41851.0            | 30897.0            | 29151.0           | 32817.0            | 29477.0           |
| female   | 19824.0            | 15845.0            | 15001.0           | 16845.0            | 15108.0           |
| male   | 22027.0            | 15052.0            | 14150.0           | 15972.0            | 14369.0           |
| Average age                                    | 36.7               | 40.5               | 43.5              | 40.3               | 41.9              |
| Households                                     | 23069.0            | 18568.0            | 16506.0           | 19097.0            | 17619.0           |
| People per household                           | 1.85               | 1.69               | 1.79              | 1.75               | 1.67              |
| Employment rate                                | 62.3               | 63.6               | 61.7              | 64.0               | 64.3              |
| Unemployment rate                              | 4.3                | 2.3                | 2.4               | 2.8                | 3.6               |
| Median of gross income (fully employed)        | 4235.34252         | 5206.382353        | 4787.166667       | 5171.768657        | 4516.125          |
| Amount of total income of employed inhabitants | 11042881823.000393 | 10230797477.541176 | 8610277912.350002 | 10862203648.477613 | 8559732808.987499 |
| Cluster  | 4.0                | 4.0                | 5.0               | 4.0                | 4.0               |

|                                   | 0      | 1            | 2                | 3                | 4      |
|-----------------------------------|--------|--------------|------------------|------------------|--------|
| properties.STTNAME                | Gallus | Nordend-West | Sachsenhausen-S. | Sachsenhausen-N. | Ostend |
| (Gym types, Boxing Gym)           | NaN    | NaN          | NaN              | NaN              | NaN    |
| (Gym types, Climbing Gym)         | NaN    | NaN          | NaN              | NaN              | NaN    |
| (Gym types, Gym)                  | 2.0    | 5.0          | NaN              | 5.0              | 1.0    |
| (Gym types, Gym / Fitness Center) | 2.0    | 3.0          | 2.0              | 3.0              | 4.0    |
| (Gym types, Gym Pool)             | NaN    | NaN          | NaN              | 1.0              | NaN    |
| (Gym types, Gymnastics Gym)       | NaN    | NaN          | NaN              | NaN              | NaN    |
| (Gym types, Martial Arts School)  | NaN    | NaN          | NaN              | NaN              | NaN    |
| (Gym types, Medical Center)       | NaN    | NaN          | NaN              | NaN              | NaN    |
| (Gym types, Pilates Studio)       | NaN    | NaN          | NaN              | NaN              | NaN    |
| (Gym types, Spa)                  | NaN    | NaN          | NaN              | 1.0              | NaN    |
| (Gym types, Sporting Goods Shop)  | NaN    | NaN          | NaN              | NaN              | NaN    |
| (Gym types, Track)                | NaN    | NaN          | 1.0              | NaN              | NaN    |
| (Gym types, Yoga Studio)          | NaN    | NaN          | NaN              | 2.0              | 1.0    |

# FURTHER INFORMATION

CODE, TABLES AND INTERACTIVE MAPS:

[https://nbviewer.jupyter.org/github/ROLANDTESCHKE/COURSERA\\_CAPSTONE/blob/main/TARGET%20AREAS%20FOR%20OPENING%20A%20GYM%20IN%20FRANKFURT.ipynb](https://nbviewer.jupyter.org/github/ROLANDTESCHKE/COURSERA_CAPSTONE/blob/main/TARGET%20AREAS%20FOR%20OPENING%20A%20GYM%20IN%20FRANKFURT.ipynb)

FULL REPORT:

[https://github.com/ROLANDTESCHKE/COURSERA\\_CAPSTONE/raw/main/REPORT%20-%20TARGET%20AREAS%20FOR%20OPENING%20A%20GYM%20IN%20FRANKFURT.pdf](https://github.com/ROLANDTESCHKE/COURSERA_CAPSTONE/raw/main/REPORT%20-%20TARGET%20AREAS%20FOR%20OPENING%20A%20GYM%20IN%20FRANKFURT.pdf)