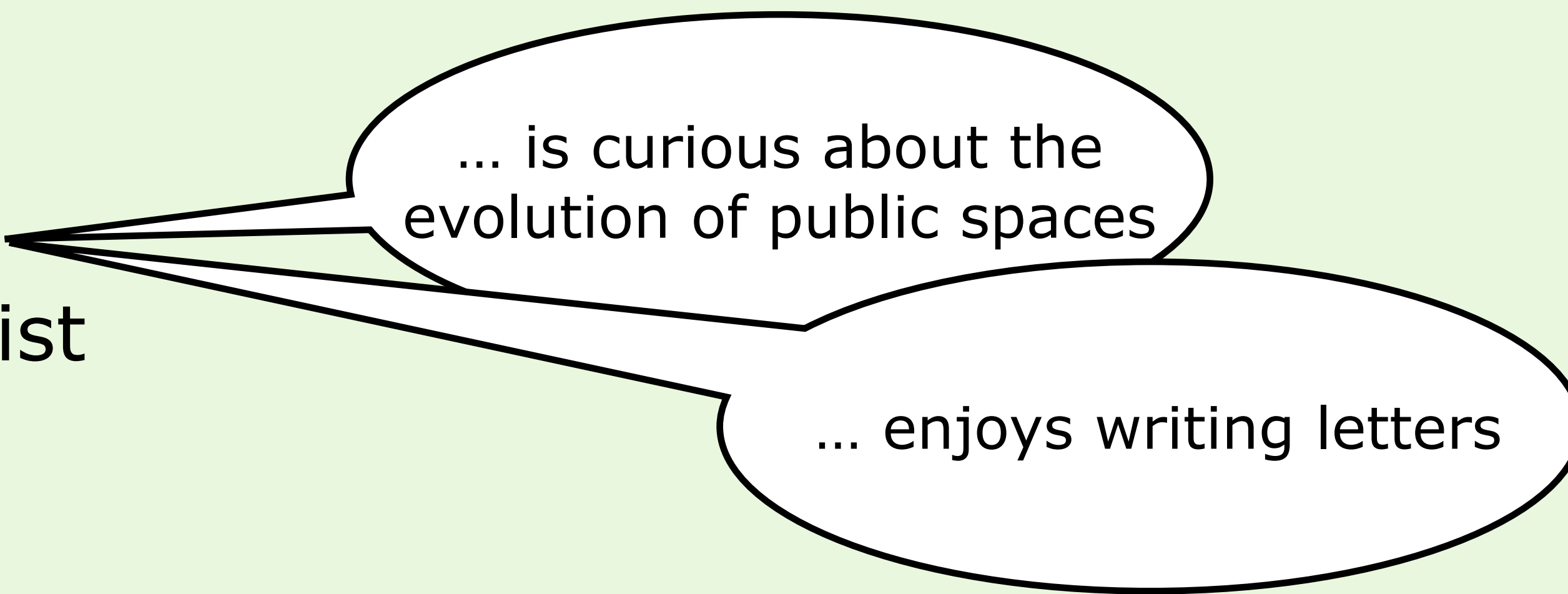


# Where have all the post offices gone?

Discovering neighborhood resources with Python and OpenStreetMap

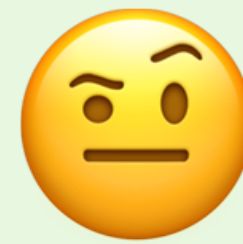
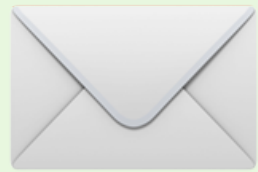
Katie Richardson  
Staff Data Scientist  
@ Blue Yonder



... is curious about the  
evolution of public spaces

... enjoys writing letters

# It all started when ...

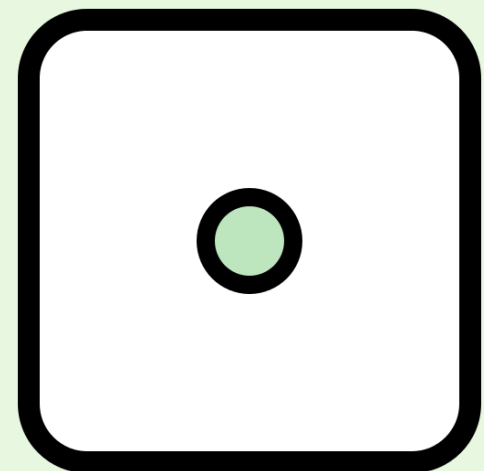


# OpenStreetMap

- Database
- Open and free to use
- Community-driven
- Supported by OpenStreetMap Foundation

# OSM Elements

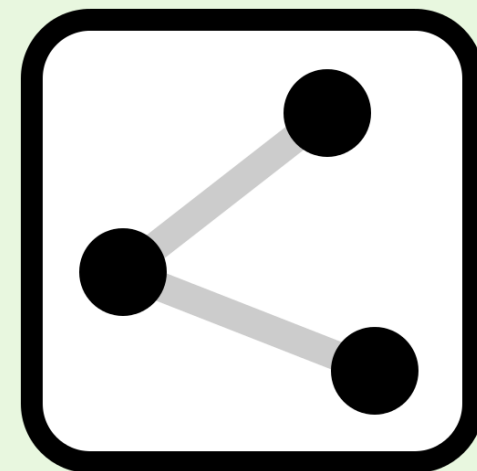
## Node



Single point

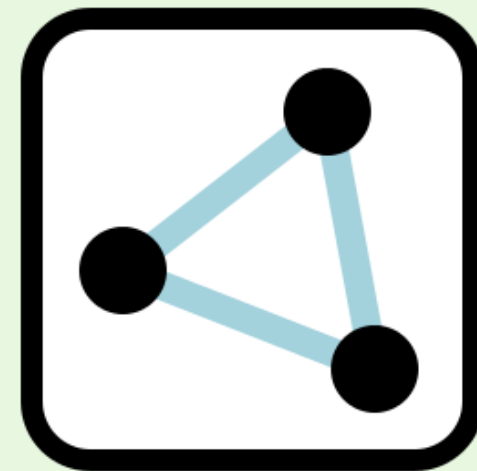
Has  
coordinates

## Way



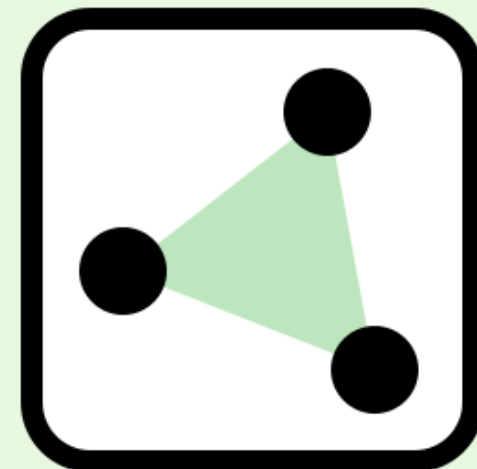
### Open

first  $\neq$  last



### Closed

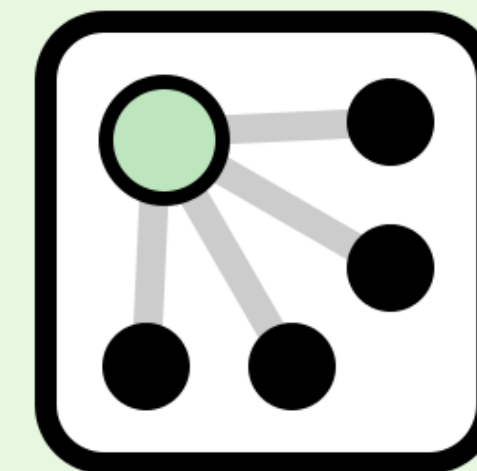
first = last



### Area

Enclosed,  
filled

## Relation

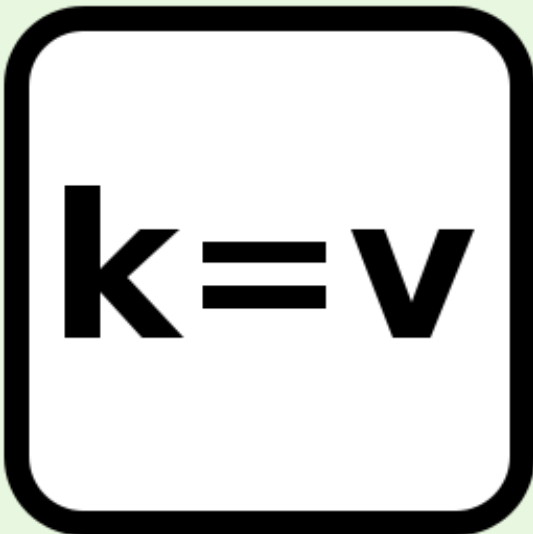


Collection of  
elements

Describes  
logical /  
geographical  
relationships

# OSM Tags

## Tags



Describe features of elements

Meaning & usage are documented in wiki pages

Tag: boundary=administrative

Country ( <a href="#">admin_level=2</a> )	<a href="#">admin_level=*</a>			
	8	9	10	11
<b><i>new levels:</i></b>  <b>Germany</b> <i>see also <a href="#">Grenzen in Deutschland</a> and <a href="#">Diskussionsseite / discussion page</a></i>	<i>Towns, Municipalities / City-districts</i>  Stadt, Gemeinde  LAU 2 (aka NUTS 5)	<i>Parts of a municipality with parish councils /self_government</i>  Stadtbezirk / Gemeindeteil mit Selbstverwaltung	<i>Parts of a municipality without ...</i>  Stadtteil / Gemeindeteil ohne Selbstverwaltung	<i>Neighbourhoods statistical or historical</i>  Stadtviertel etc.

<https://wiki.openstreetmap.org/wiki/Tag:boundary=administrative>



# How are post offices tagged?

- Overpass API

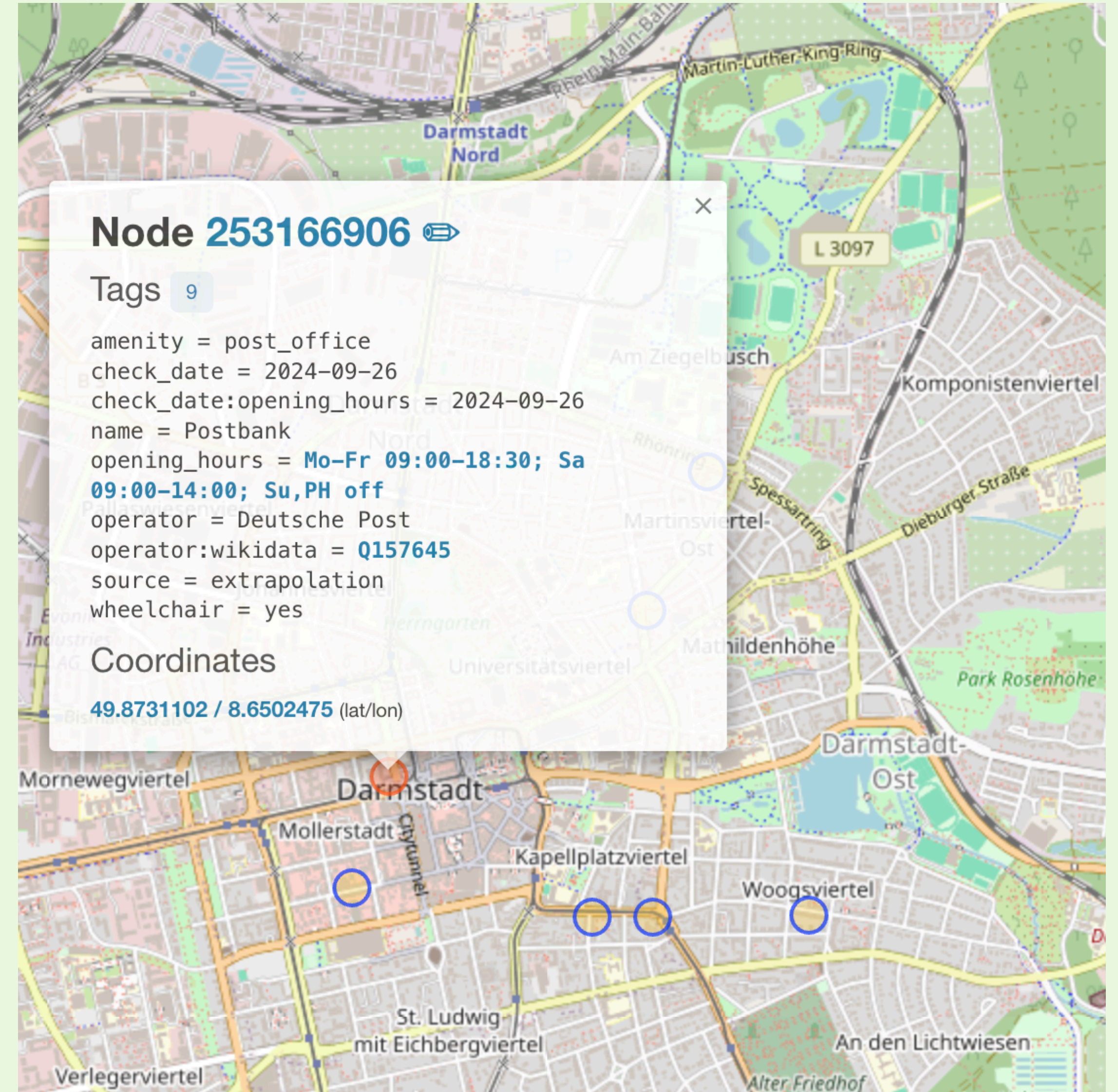
Query up-to-date database copy

- Overpass Turbo

 Query Wizard

🔍 "post office" in Darmstadt

```
[out:json][timeout:25];
{{geocodeArea:Darmstadt}}->.searchArea;
nwr["amenity"="post_office"]
(area.searchArea);
out geom;
```





# Getting the data

## Geofabrik

- Data extracts for sub regions
- Latest & older data files
- Multiple data formats



What are .osm.pbf files?

```
# latest
```

```
https://download.geofabrik.de/europe/germany/hessen-latest.osm.pbf
```

```
# 01-01-2018
```

```
https://download.geofabrik.de/europe/germany/hessen-180101.osm.pbf
```

# Organizing the project

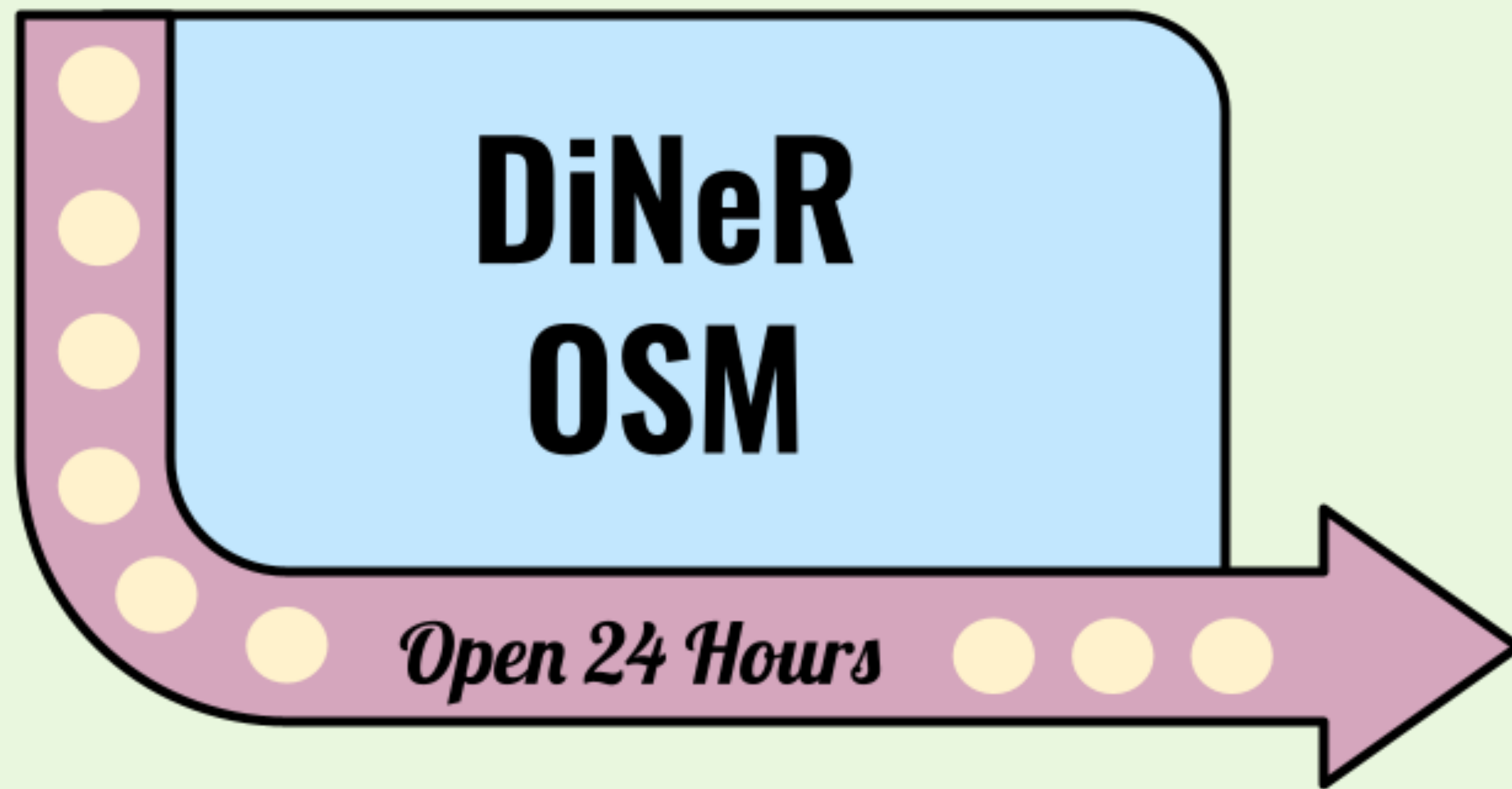
**Goal:** Use geospatial data to learn about the distribution of neighborhood resources and how it has changed over time.





# ... and I want a catchy name

## **DI**scovering **NE**ighborhood **R**esources with **O**pen**S**treet**M**ap



```
[server]
url = "https://download.geofabrik.de"

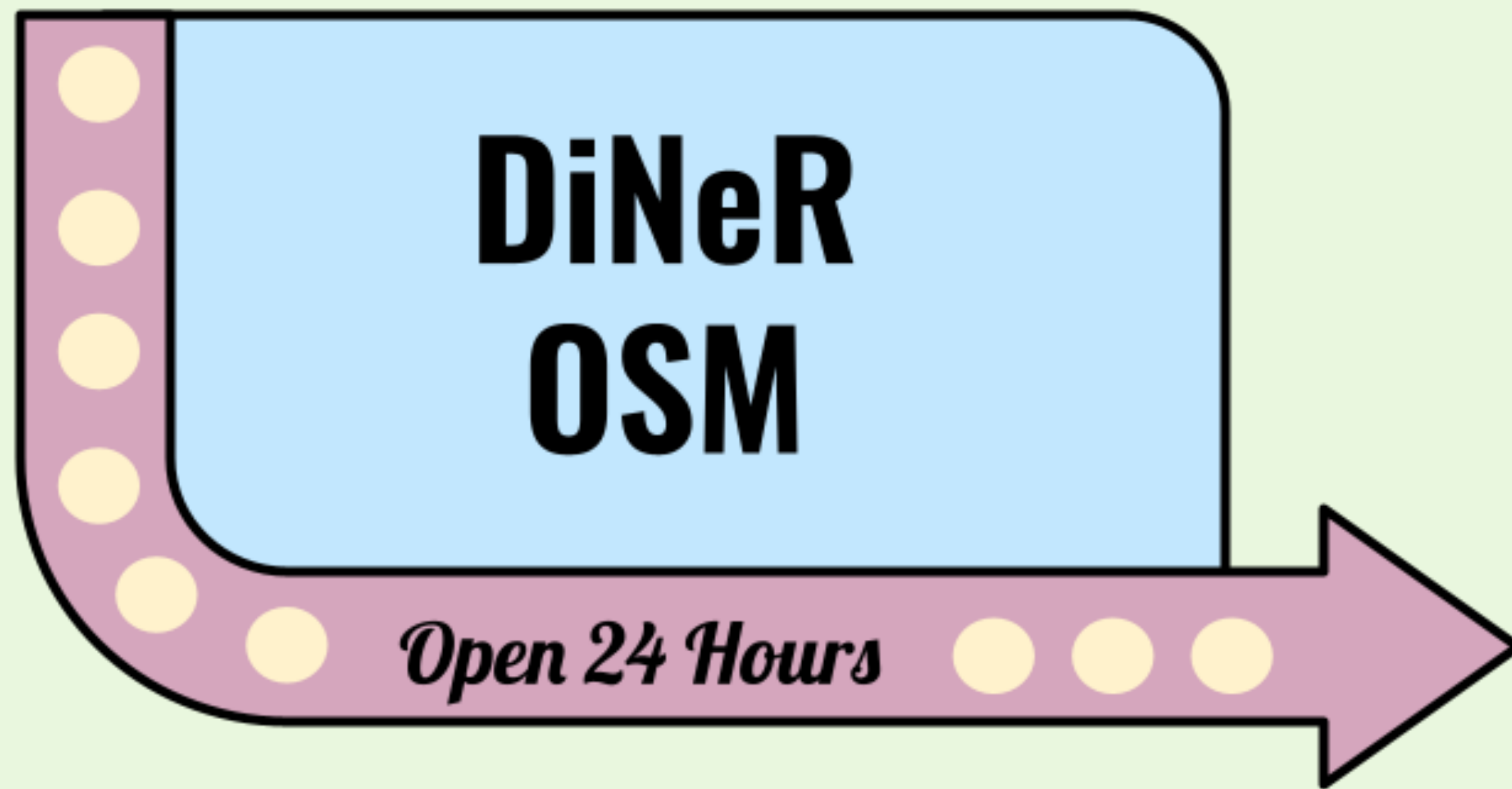
[regions]
darmstadt = "europe/germany/hessen"

[versions]
2019 = "190101.osm.pbf"
2023 = "230101.osm.pbf"
latest = "latest.osm.pbf"
```

```
diner-osm -region darmstadt -versions latest 2023 2019
```

# ... and I want a catchy name

## **DI**sccovering **NE**ighborhood **R**esources with **O**pen**S**treet**M**ap



```
[darmstadt.areas]  
admin_level = "9"
```

```
[darmstadt.places]  
entity = "node"  
keys = ["name"]  
tags.amenity = "post_office"  
tags.operator = "Deutsche Post"
```

```
diner-osm --region darmstadt --versions latest 2023 2019
```

# Get neighborhoods

## pyosmium

- Read file
- Filter the data
- Enhance with geometries
- Add attributes

```
fp_areas = (  
    osmium.FileProcessor("hessen-latest.osm.pbf")  
    .with_areas()  
    .with_filter(EntityFilter(AREA))  
    .with_filter(TagFilter(("boundary", "administrative")))  
    .with_filter(TagFilter(("admin_level", "9")))  
    .with_filter(GeoInterfaceFilter(tags=tags_to_keep))  
    .with_filter(EnrichAttributes())  
)
```




# Get post offices

## pyosmium

- Read file
- Filter the data
- Enhance with geometries
- Add attributes

```
fp_nodes = (  
    osmium.FileProcessor("hessen-latest.osm.pbf")  
    .with_locations()  
    .with_filter(EntityFilter(NODE))  
    .with_filter(KeyFilter(("name")))  
    .with_filter(TagFilter(("amenity", "post_office")))  
    .with_filter(TagFilter(("operator", "Deutsche Post")))  
    .with_filter(GeoInterfaceFilter(tags=tags_to_keep))  
    .with_filter(EnrichAttributes())  
)
```



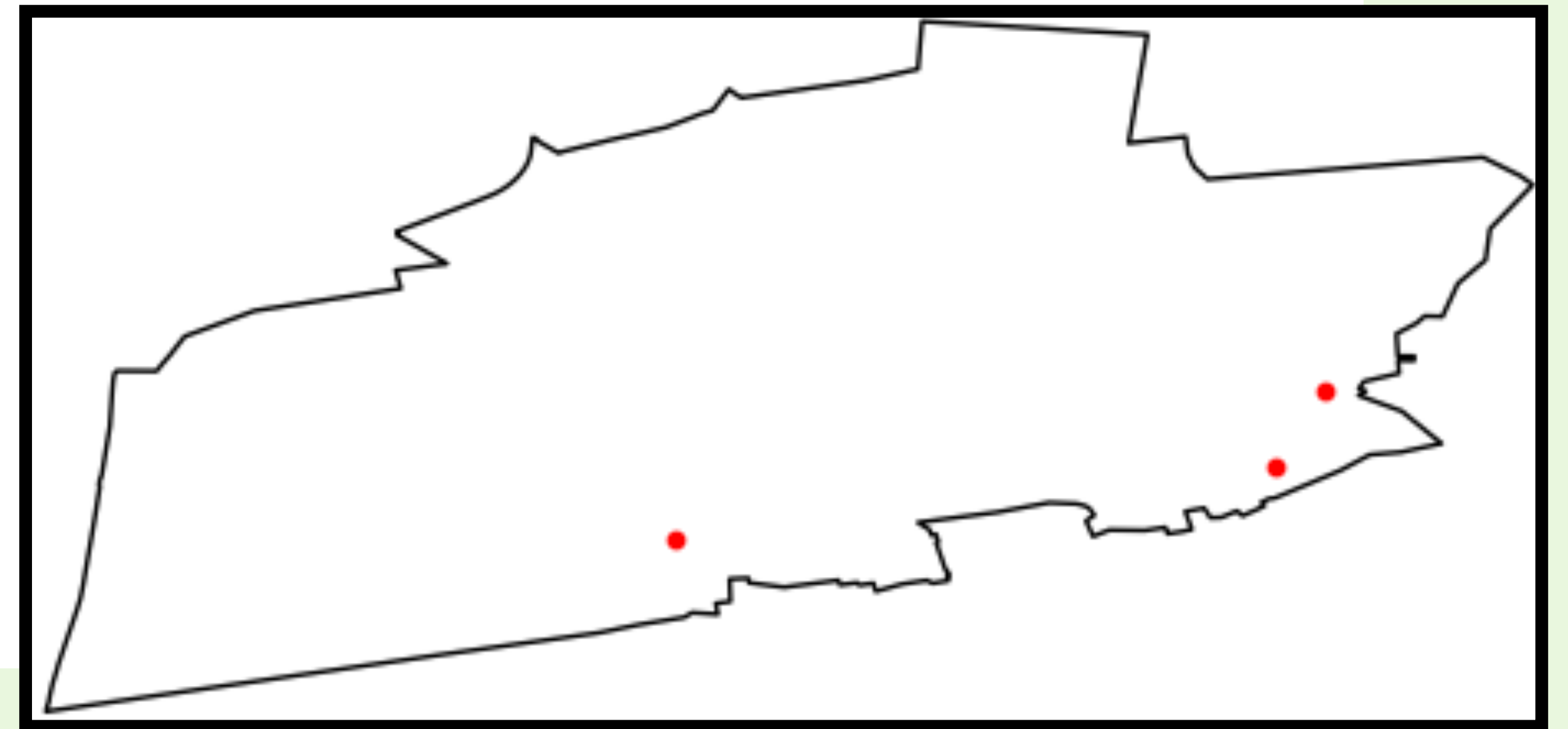
# In which neighborhood are post offices located?

## GeoPandas

- From feature iterable
- Spatial joins

```
gdf_areas = GeoDataFrame.from_features(fp_areas)
gdf_nodes = GeoDataFrame.from_features(fp_nodes)
```

```
gdf = gdf_areas.sjoin(
    df=gdf_nodes,
    how="left",
    predicate="contains",
    lsuffix="area",
    rsuffix="node",
)
```



# Narrow scope & calculate area

## GeoPandas

- Clip by geometry / query
- Get areas of neighborhoods

```
# bbox clip mask
gdf.clip([9.5, 10.4, 53.3, 53.75])

# GeoDataFrame clip mask
gdf.clip(cities_gdf.query("name == 'Darmstadt'"))

gdf["sqkm"] = gdf.set_crs(epsg=4326) \
               .to_crs(epsg=25833) \
               .geometry.area / 1_000_000
```



# Narrow scope & calculate area

## GeoPandas

- Clip by geometry / query
- Get areas of neighborhoods

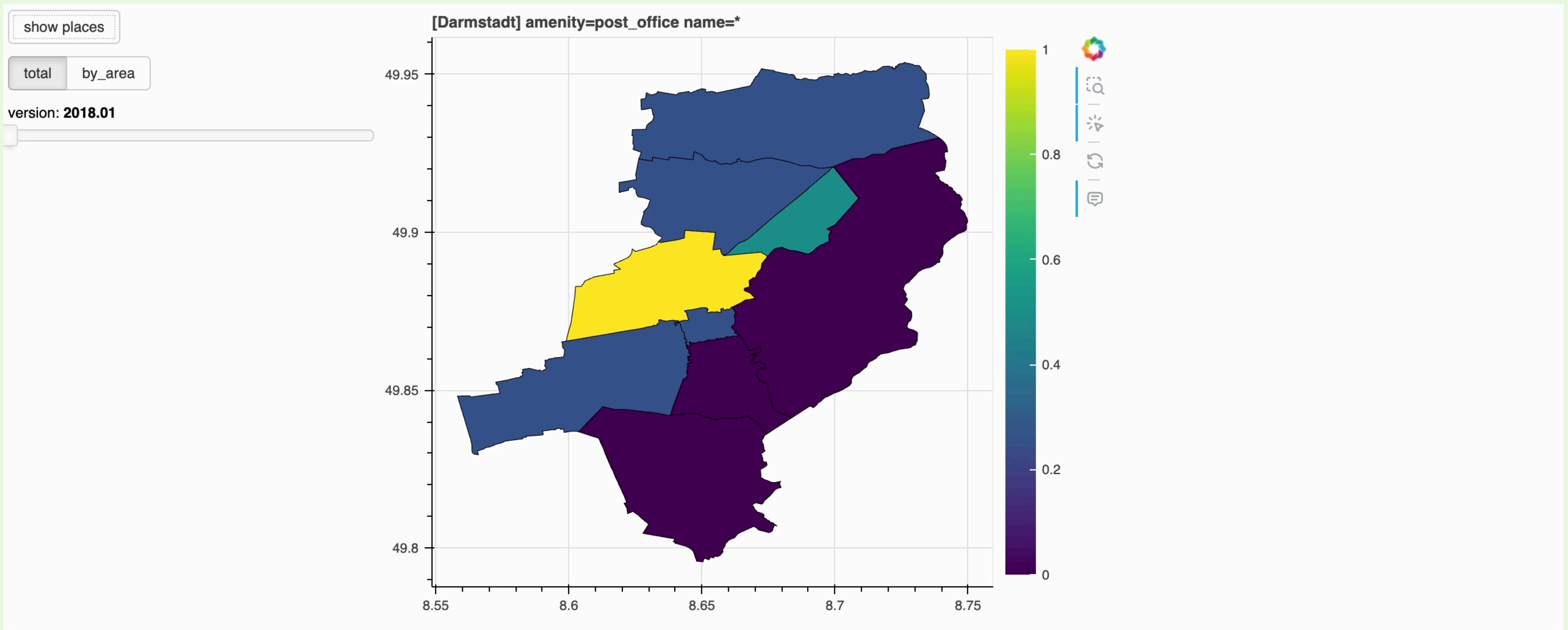
geometry	name	wikidata	id	osm_url	count
POLYGON ((8.64126 49.87164, 8.64261 49.87202, ...	Darmstadt- Mitte	Q1166438	r6604794	<a href="https://www.osm.org/relation/6604794">https://www.osm.org/relation/6604794</a>	2
POLYGON ((8.63439 49.89673, 8.64077 49.89762, ...	Darmstadt- Nord	Q1166439	r6604800	<a href="https://www.osm.org/relation/6604800">https://www.osm.org/relation/6604800</a>	1
POLYGON ((8.6189 49.91331, 8.6189 49.91333, 8....	Arheilgen	Q1166422	r6606314	<a href="https://www.osm.org/relation/6606314">https://www.osm.org/relation/6606314</a>	1

# Interactive Visualisations

## **Bokeh**

- Tools, widgets
- Custom JS callbacks
- GeoJSONDataSource

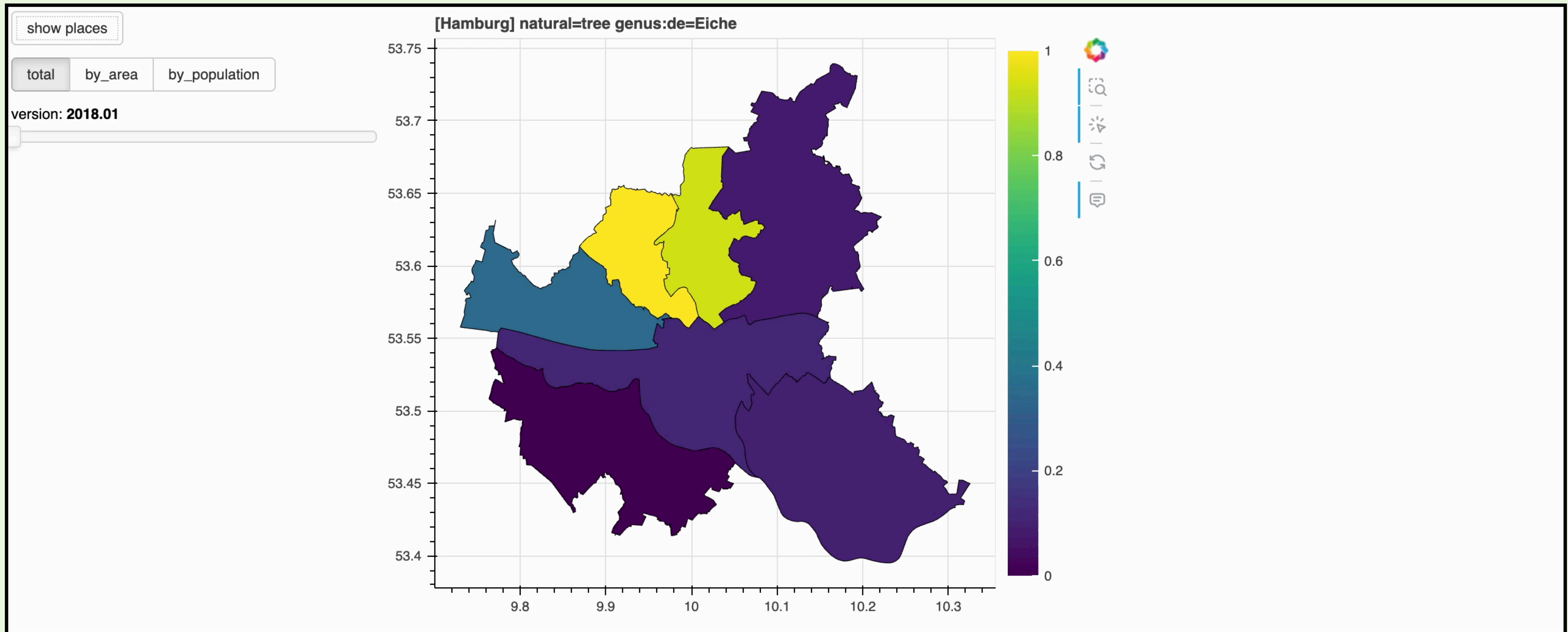
```
areas_data = GeoJSONDataSource(geojson=gdf.to_json())  
  
plot = figure()  
  
areas = plot.patches(source=areas_data)  
  
show(plot)
```



# Post offices in Darmstadt

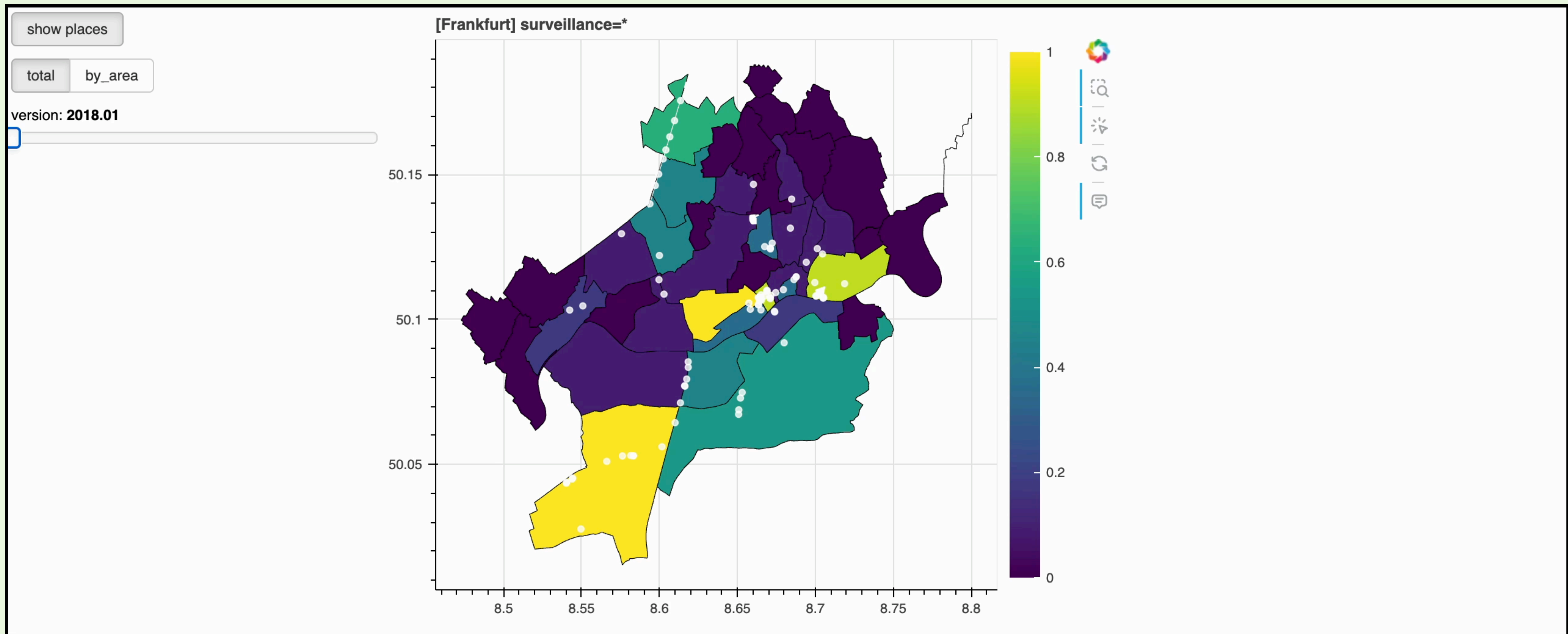
Map data from OpenStreetMap





# Oak trees in Hamburg

Map data from OpenStreetMap



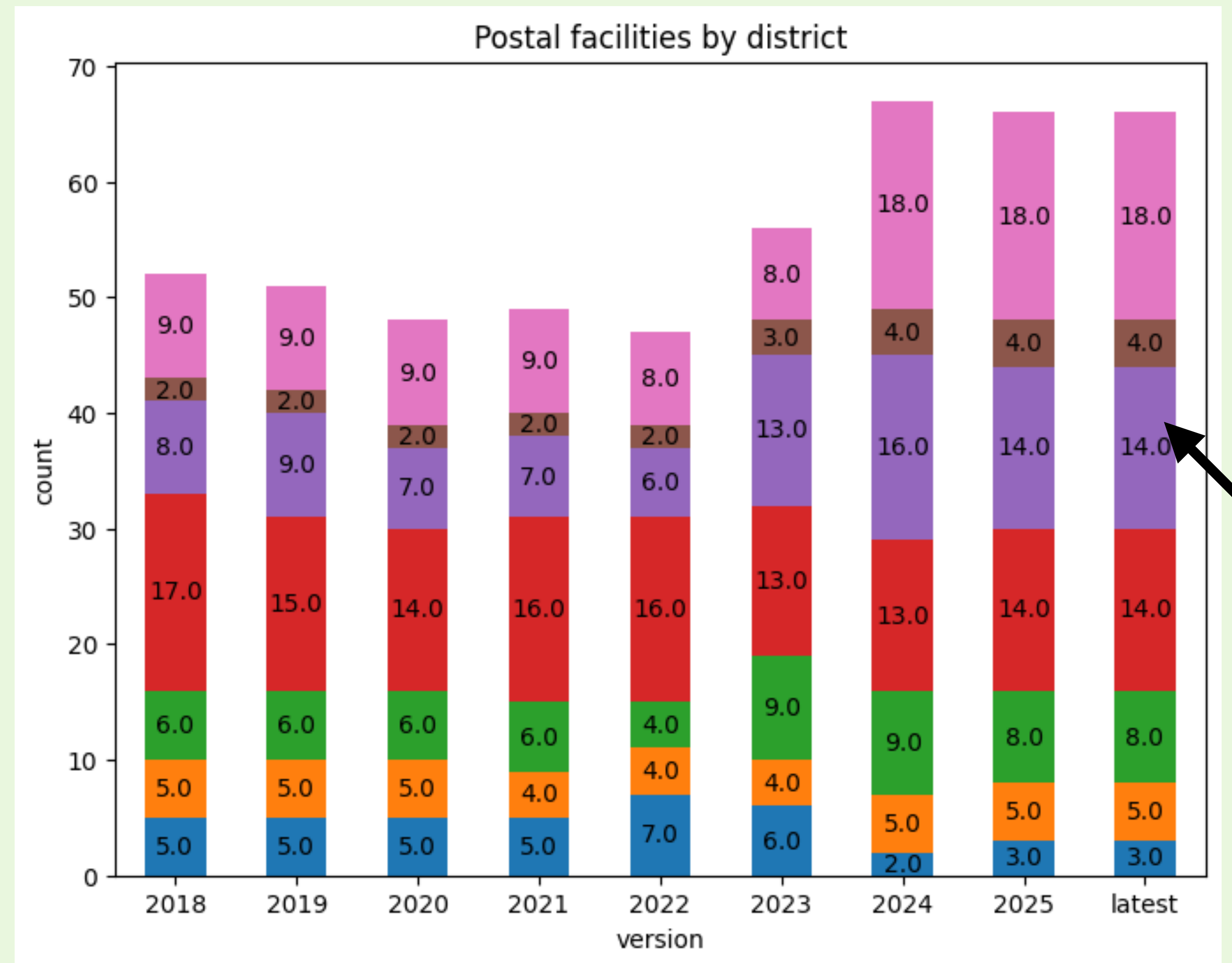
# Surveillance in Frankfurt

Map data from OpenStreetMap

# So where did the post offices go?

Was my experience reflected in the data?

Was I asking the correct question?

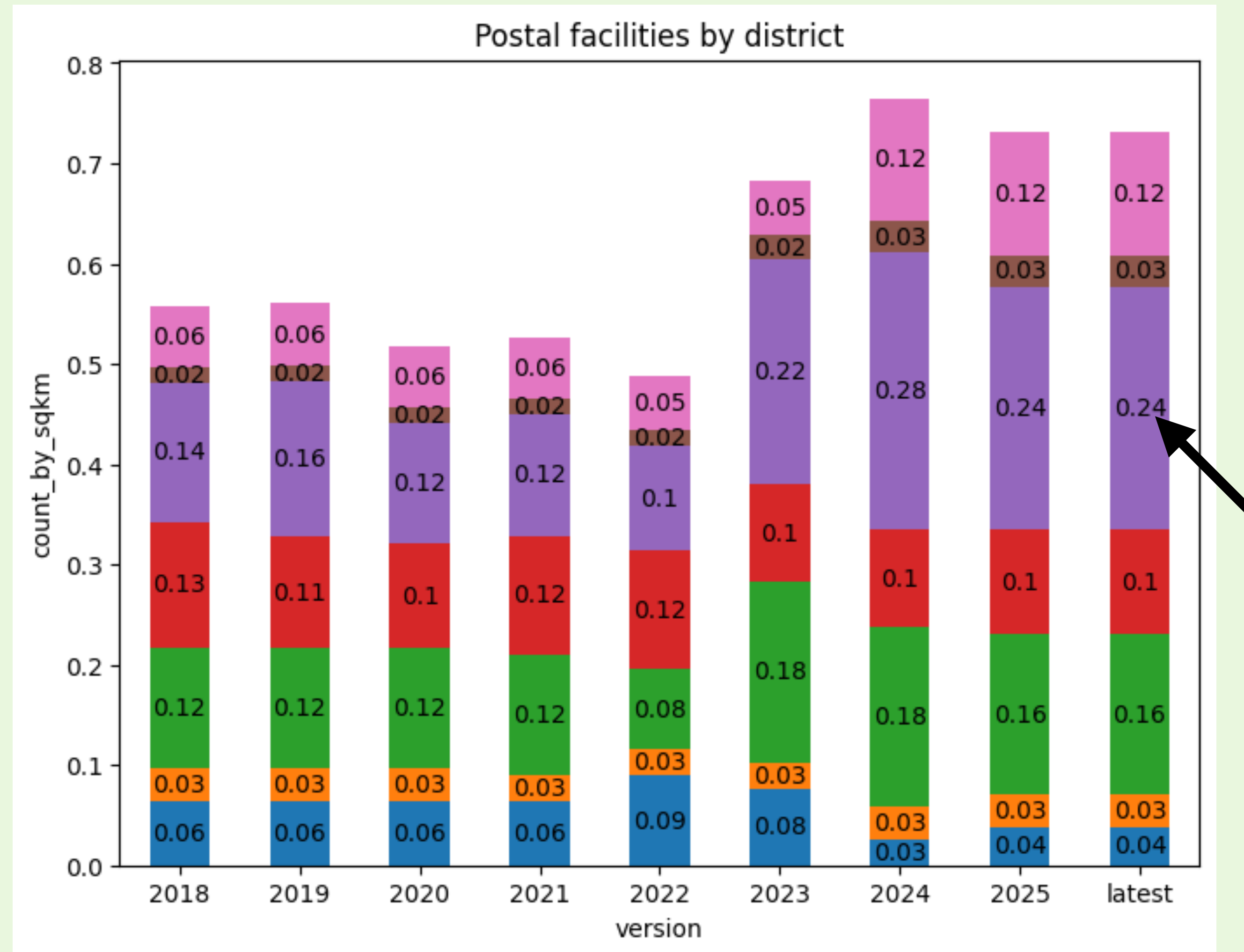




# So where did the post offices go?

Was my experience reflected in the data?

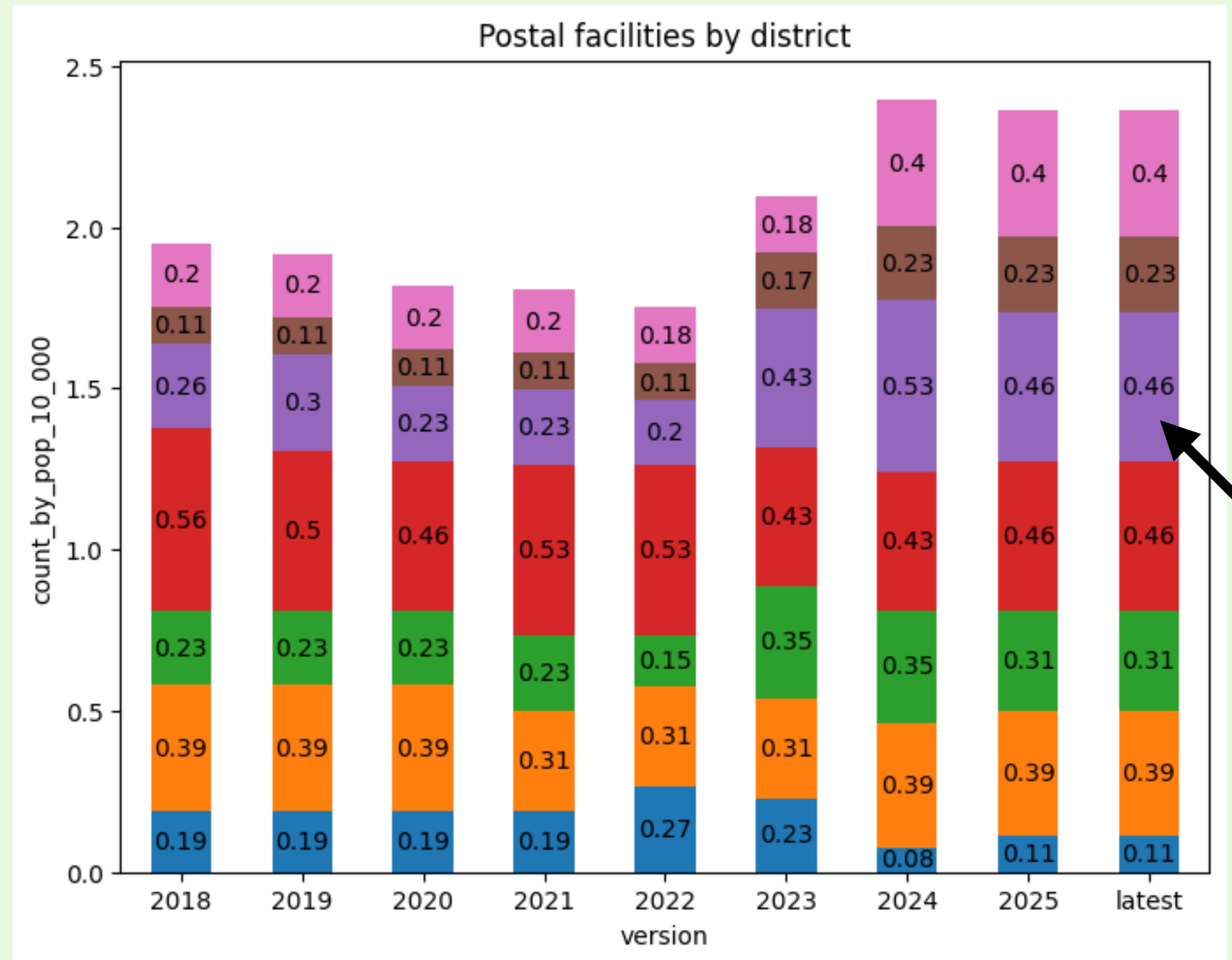
Was I asking the correct question?



# So where did the post offices go?

Was my experience reflected in the data?

Was I asking the correct question?



# Go discover your neighborhood!



KatieBSC / diner-osm

**DiNeR  
OSM**

*Open 24 Hours*

