Where have all the post offices gone?

Discovering neighborhood resources with Python and OpenStreetMap

Katie Richardson
Staff Data Scientist
@ Blue Yonder

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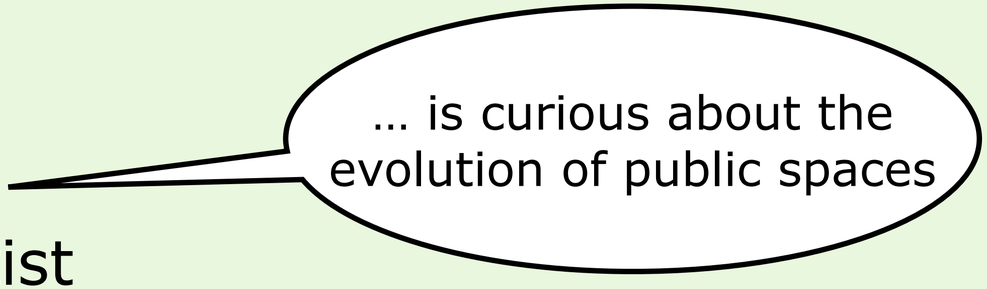

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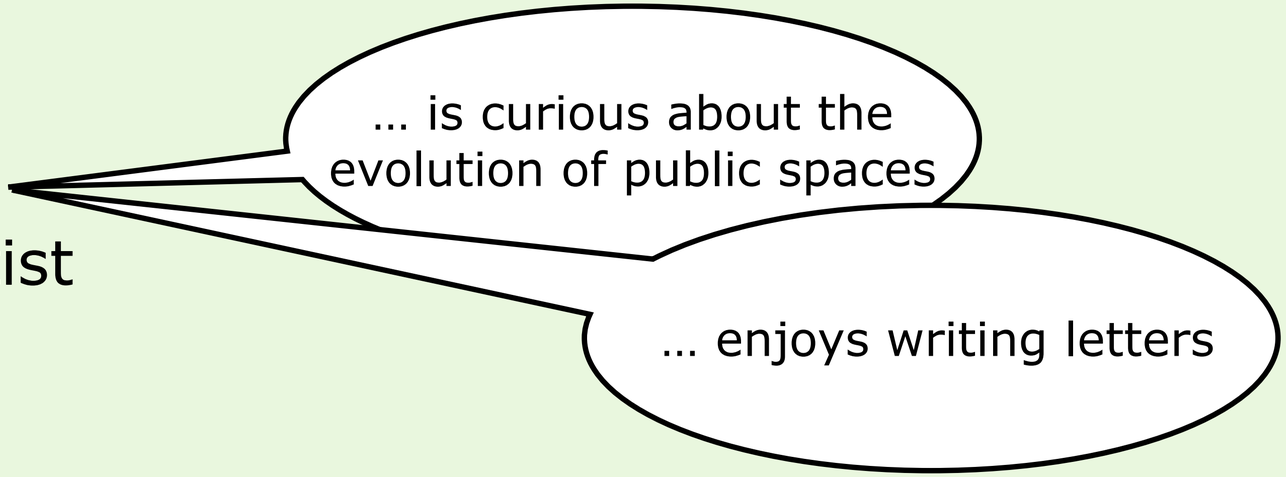

It all started when …

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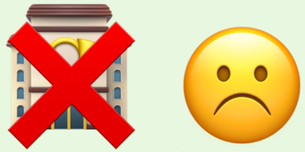

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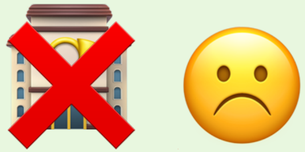

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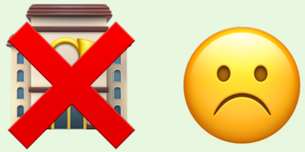


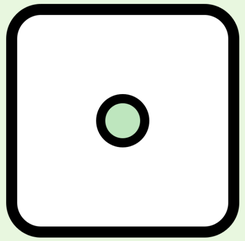
OpenStreetMap

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

OSM Elements

OSM Elements

Node



Single point

Has coordinates

OSM Elements

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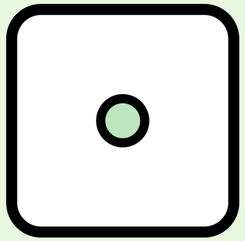

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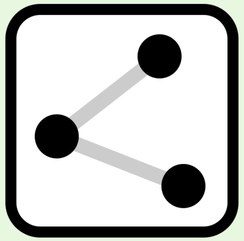

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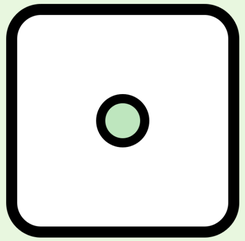

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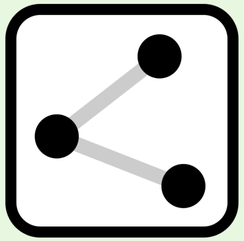

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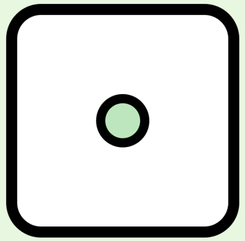
first != last

OSM Elements

Node



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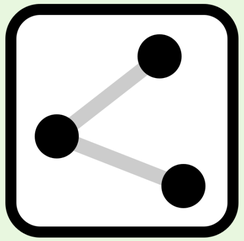

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Closed

first = last

OSM Elements

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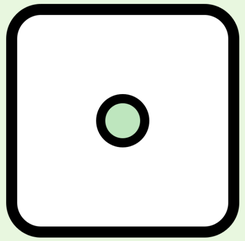

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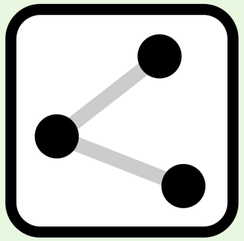

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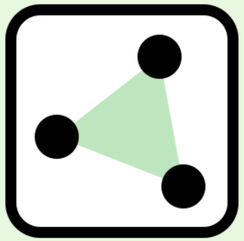
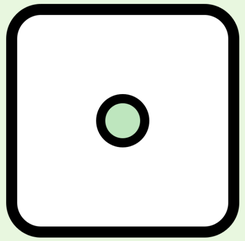


Area

Enclosed, filled

OSM Elements

Node



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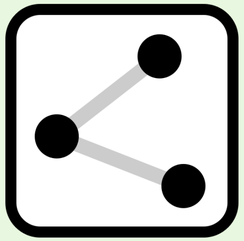

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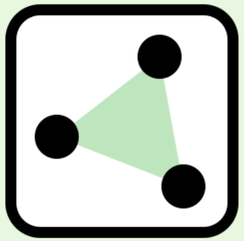


Area

Enclosed, filled

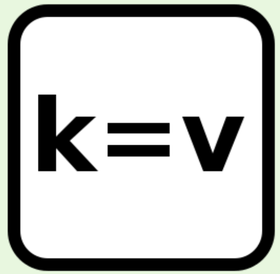
Relation

Collection of elements

Describes logical / geographical relationships

OSM Tags

Tags

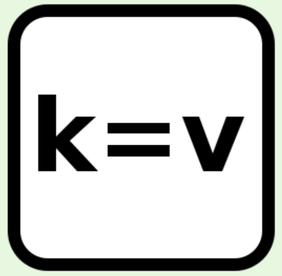


Describe features of elements

Meaning & usage are documented in wiki pages

OSM Tags

Tags



Describe features of elements

Meaning & usage are documented in wiki pages

Tag:boundary=administrative

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

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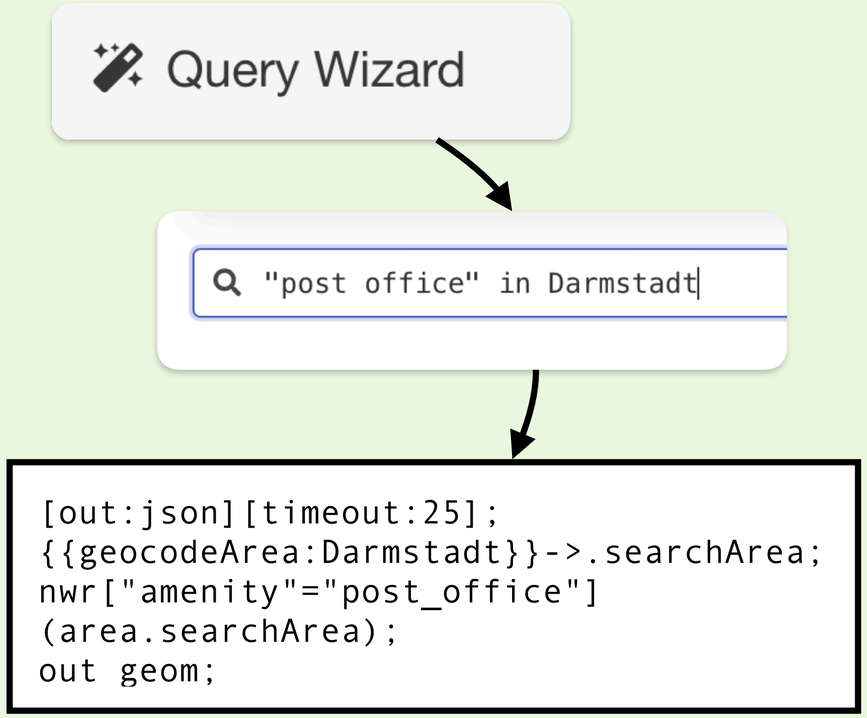


How are post offices tagged?

- Overpass API

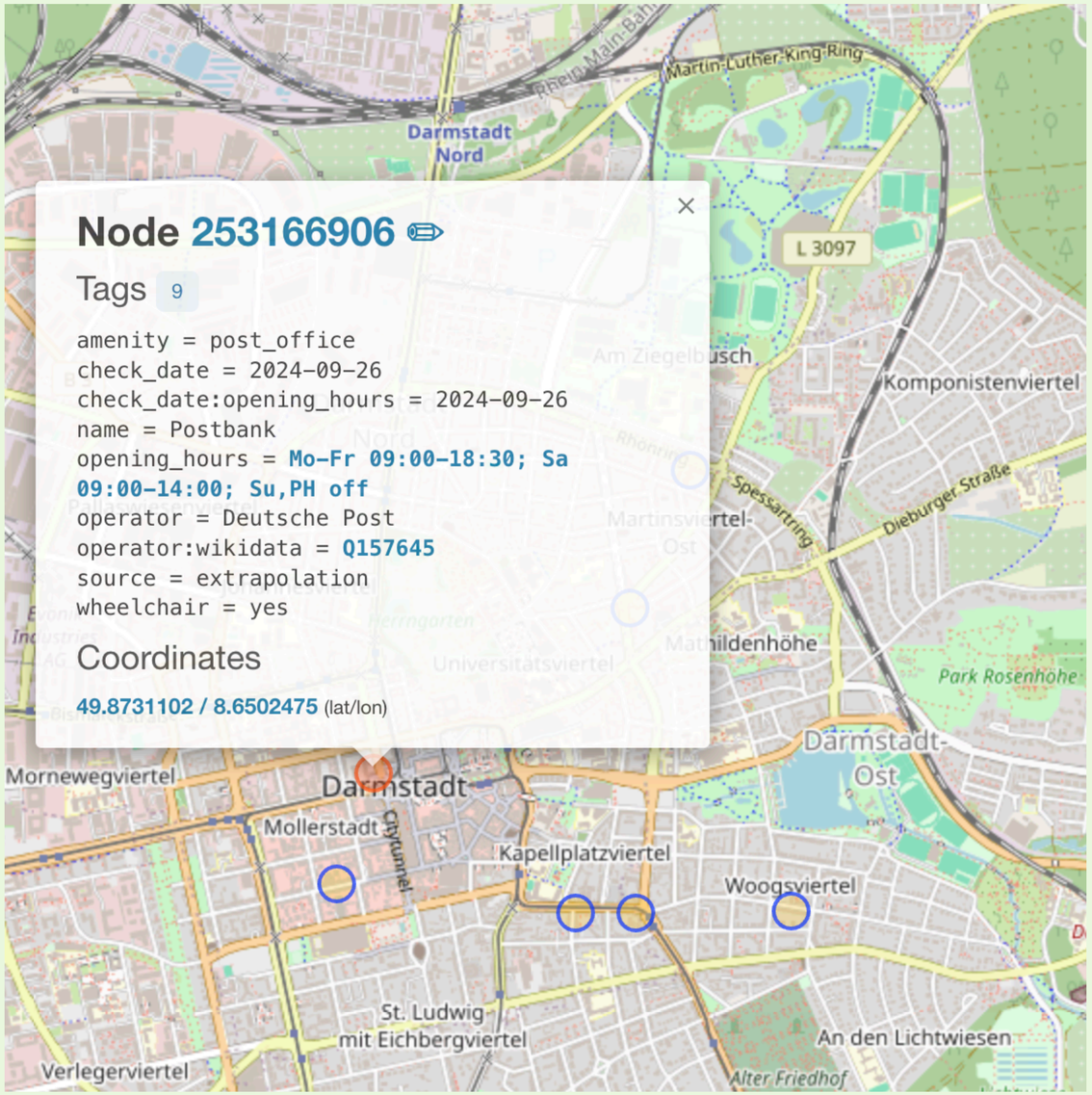
  Query up-to-date database copy

- 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

Getting the data

Geofabrik

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

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Geofabrik

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

# 01-01-2018
https://download.geofabrik.de/europe/germany/hessen-180101.osm.pbf
```

Getting the data

Geofabrik

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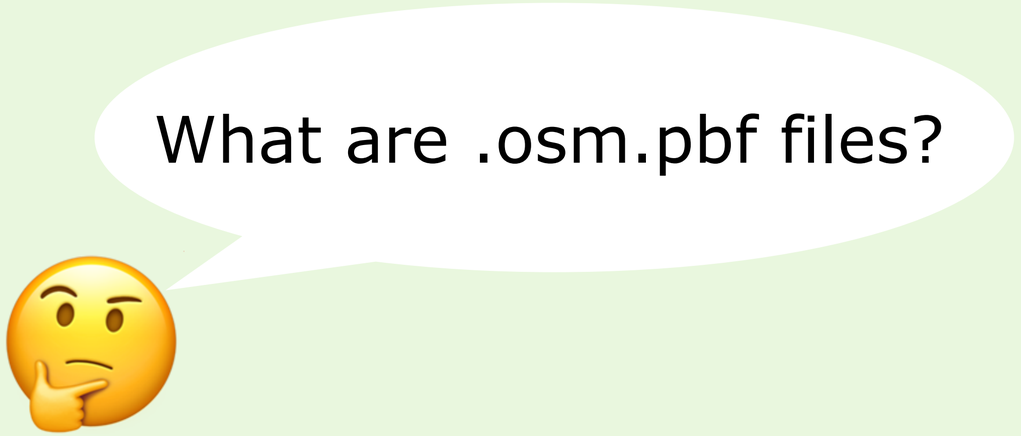


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Organizing the project

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

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… and I want a catchy name

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DIscovering **NE**ighborhood **R**esources with **O**pen**S**treet**M**ap

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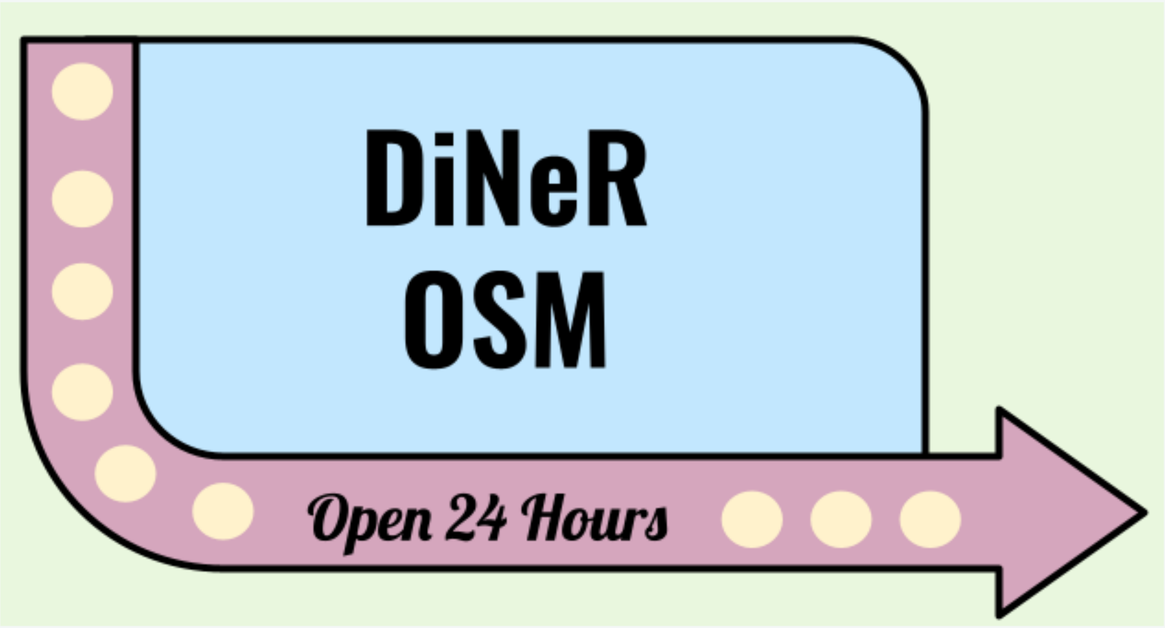

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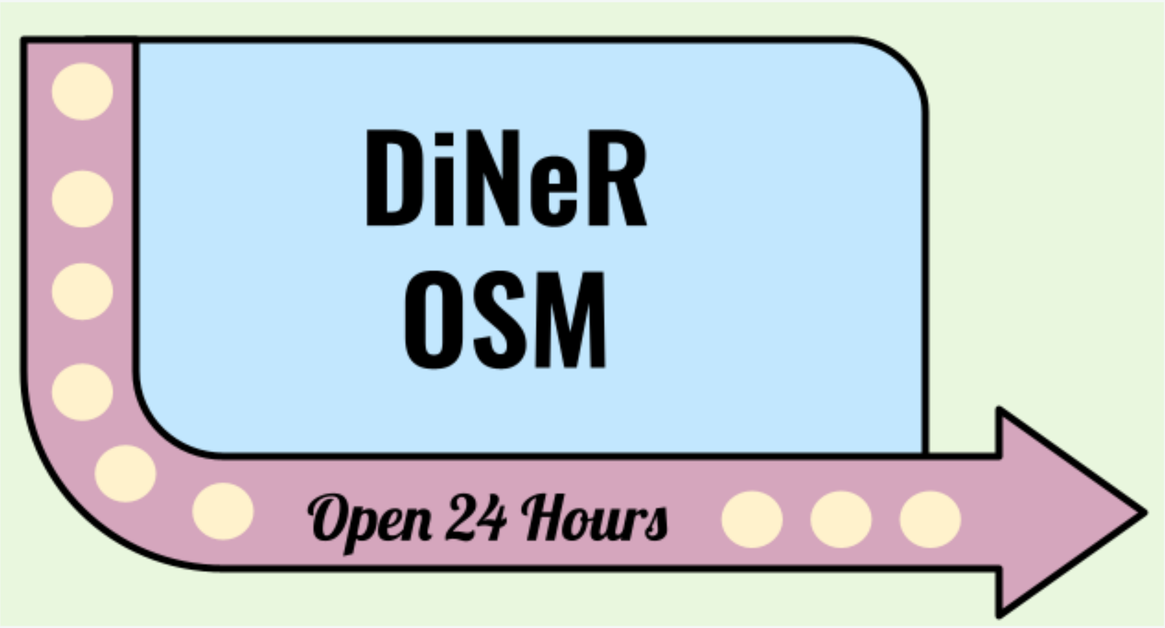


```
diner-osm –region darmstadt –versions latest 2023 2019
```

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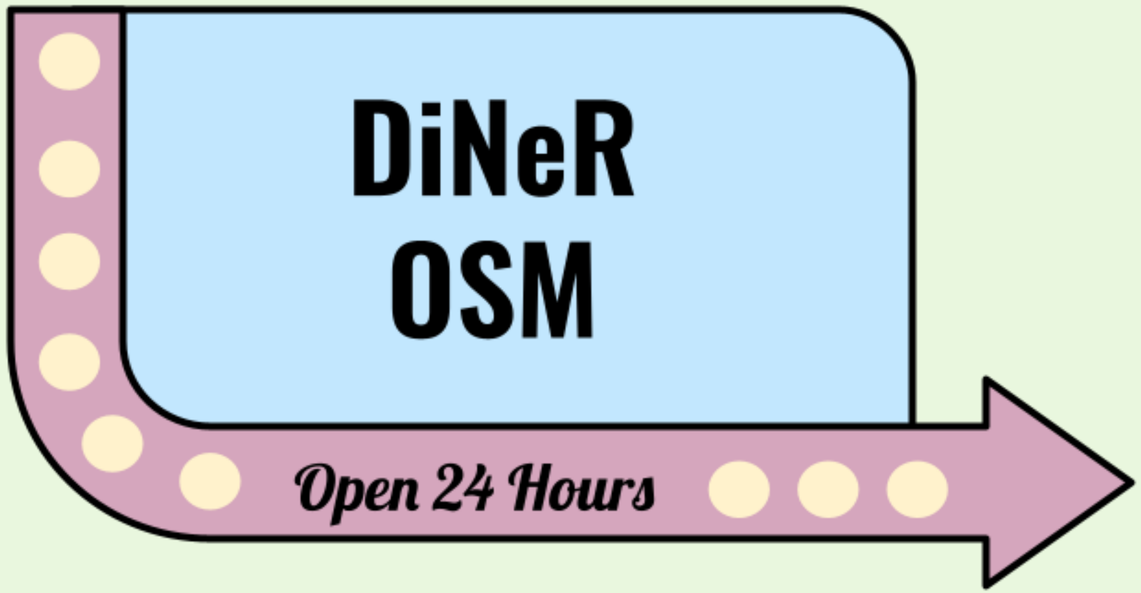


```
[server]
url = "https://download.geofabrik.de"

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

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

```
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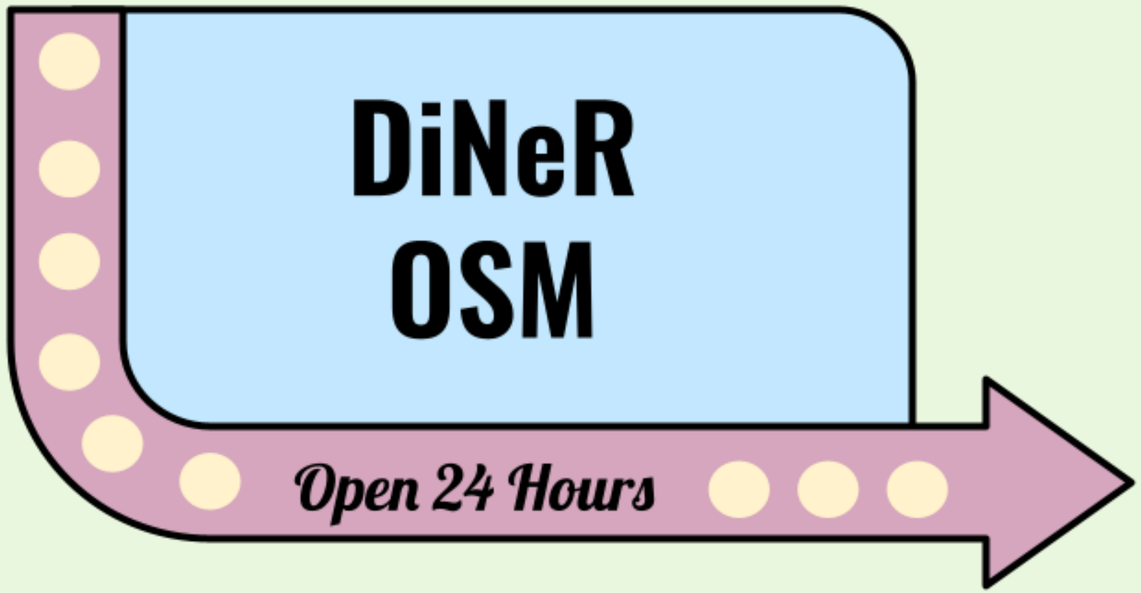


```
[darmstadt.areas]
admin_level = "9"


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

```
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Get neighborhoods

pyosmium

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

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```
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
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```
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")))
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)
```

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",
)
```

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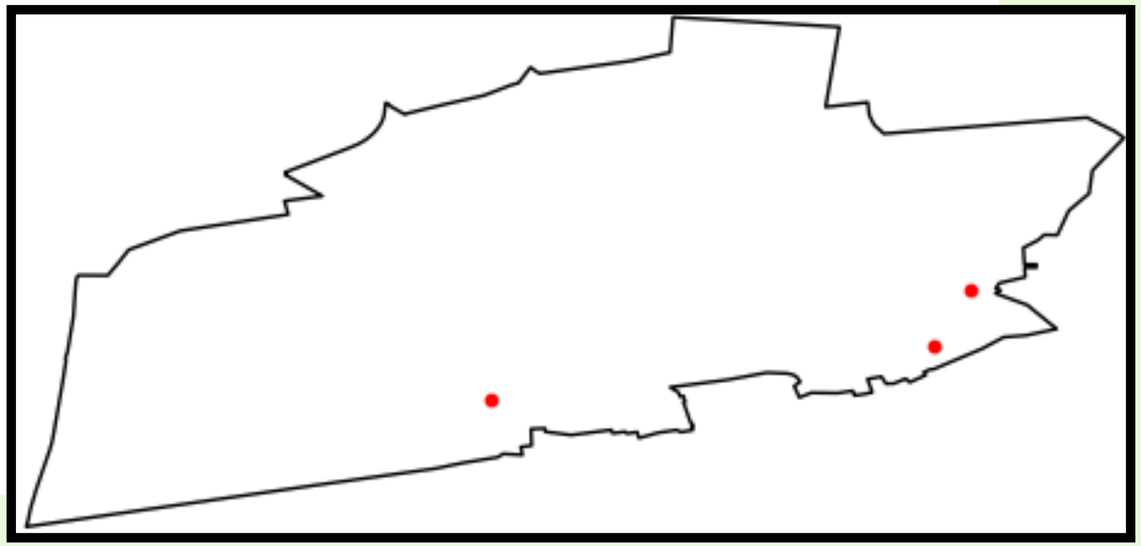

Narrow scope & calculate area

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

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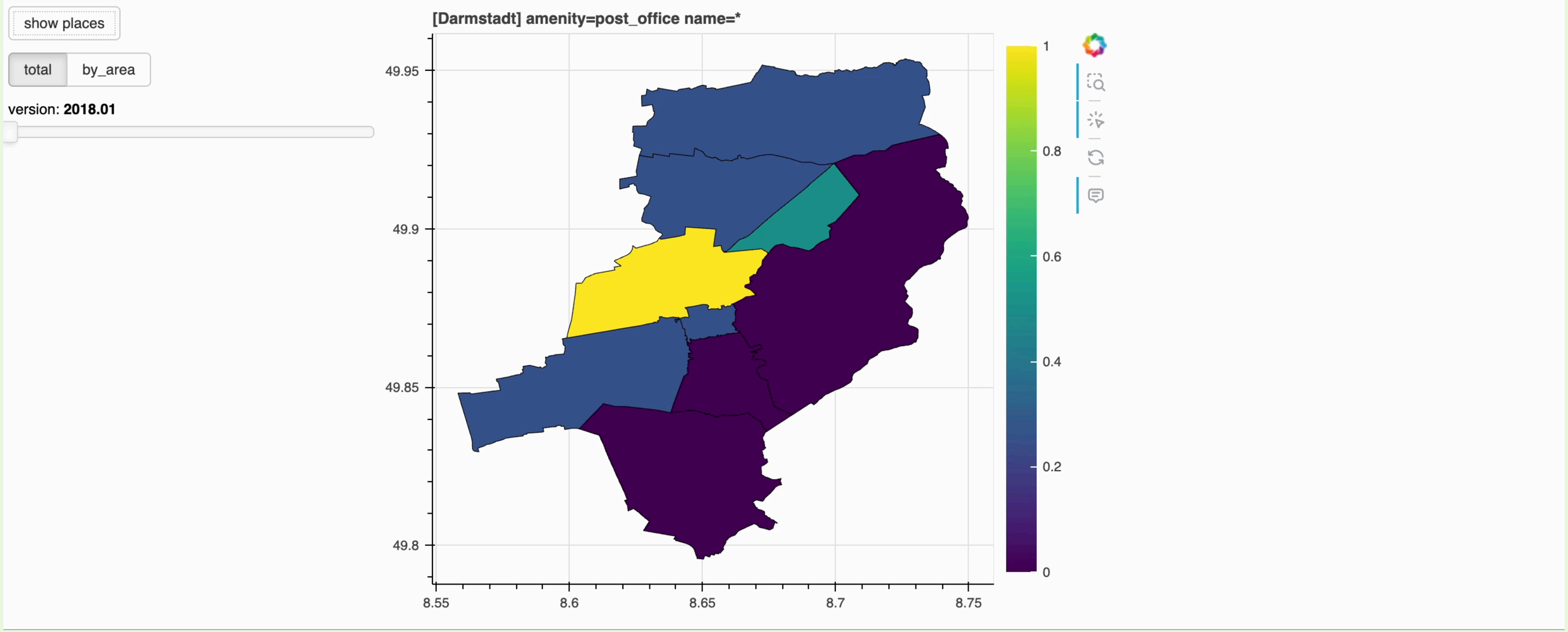
geometry	name	wikidata	id	osm_url	count
POLYGON ((8.64126 49.87164, 8.64261 49.87202, ...	Darmstadt-Mitte	Q1166438	r6604794	https://www.osm.org/relation/6604794	2
POLYGON ((8.63439 49.89673, 8.64077 49.89762, ...	Darmstadt-Nord	Q1166439	r6604800	https://www.osm.org/relation/6604800	1
POLYGON ((8.6189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

Interactive Visualisations

Bokeh

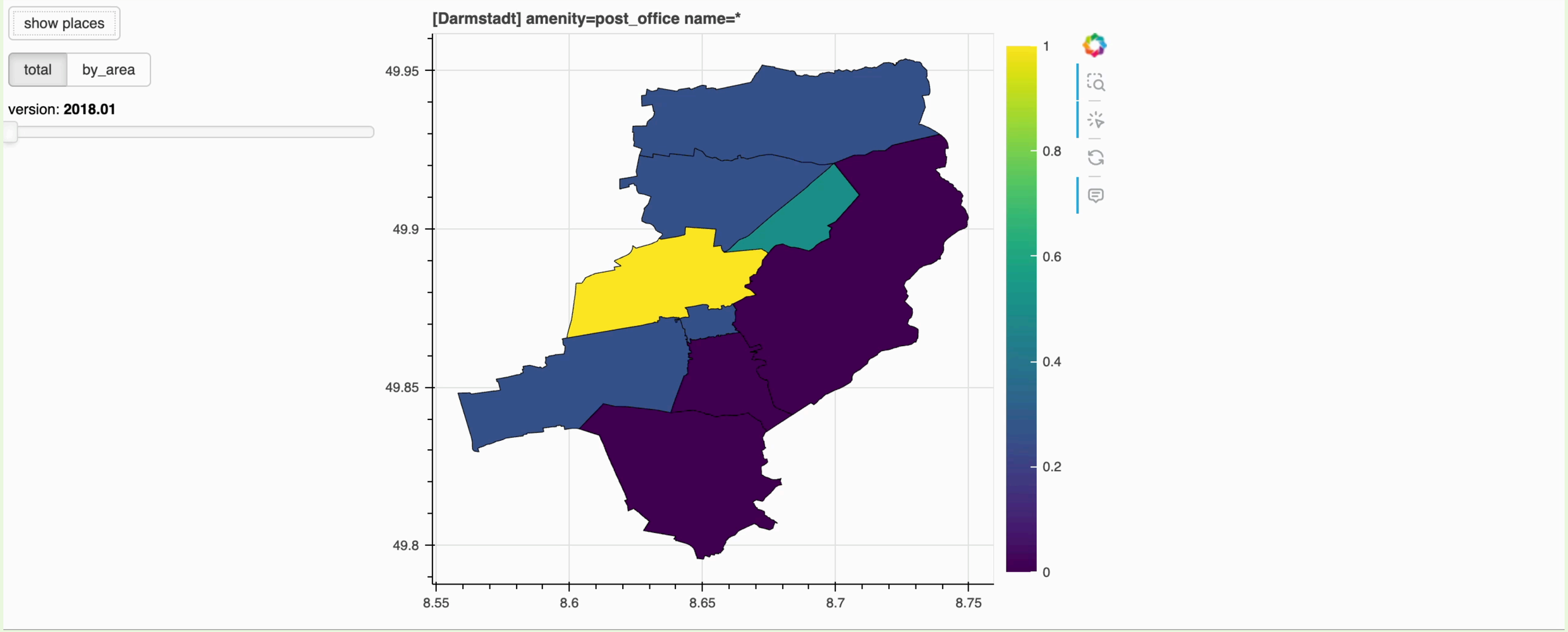
- GeoJSONDataSource
- Tools, widgets
- Custom JS callbacks

```
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



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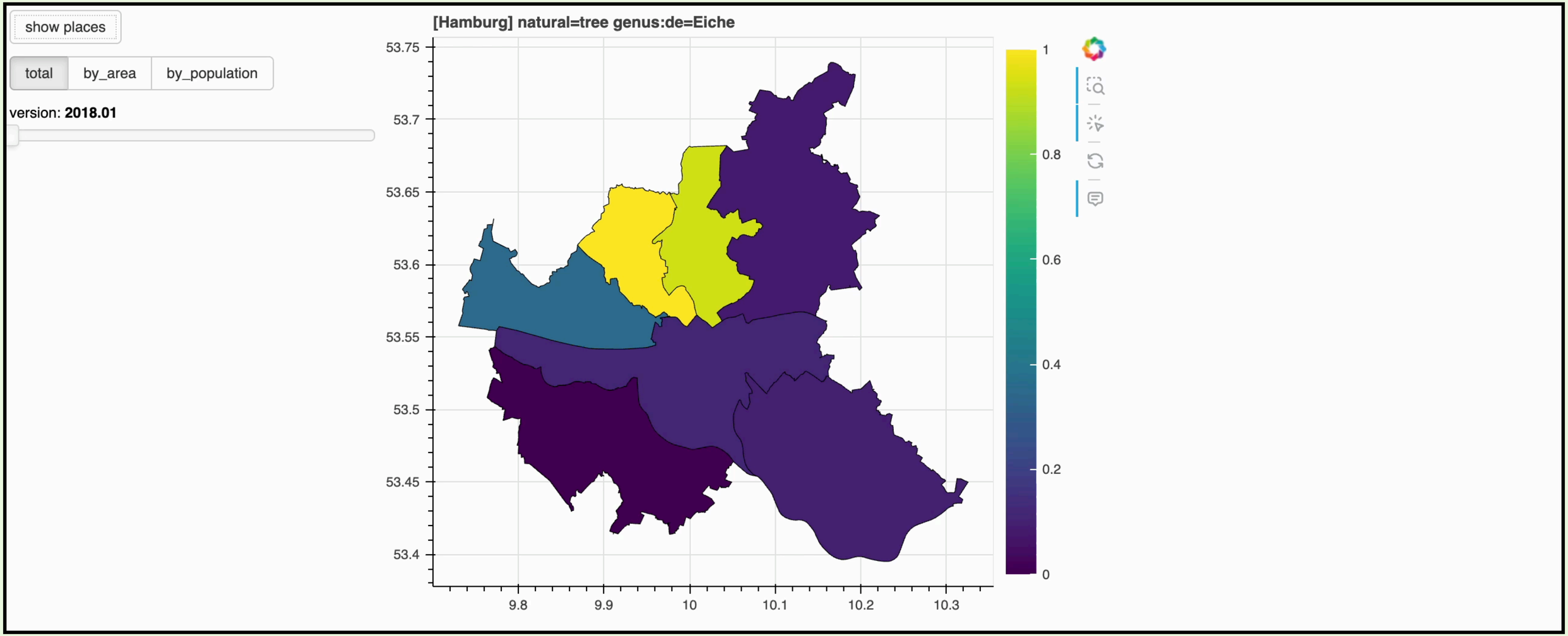

Oak trees in Hamburg

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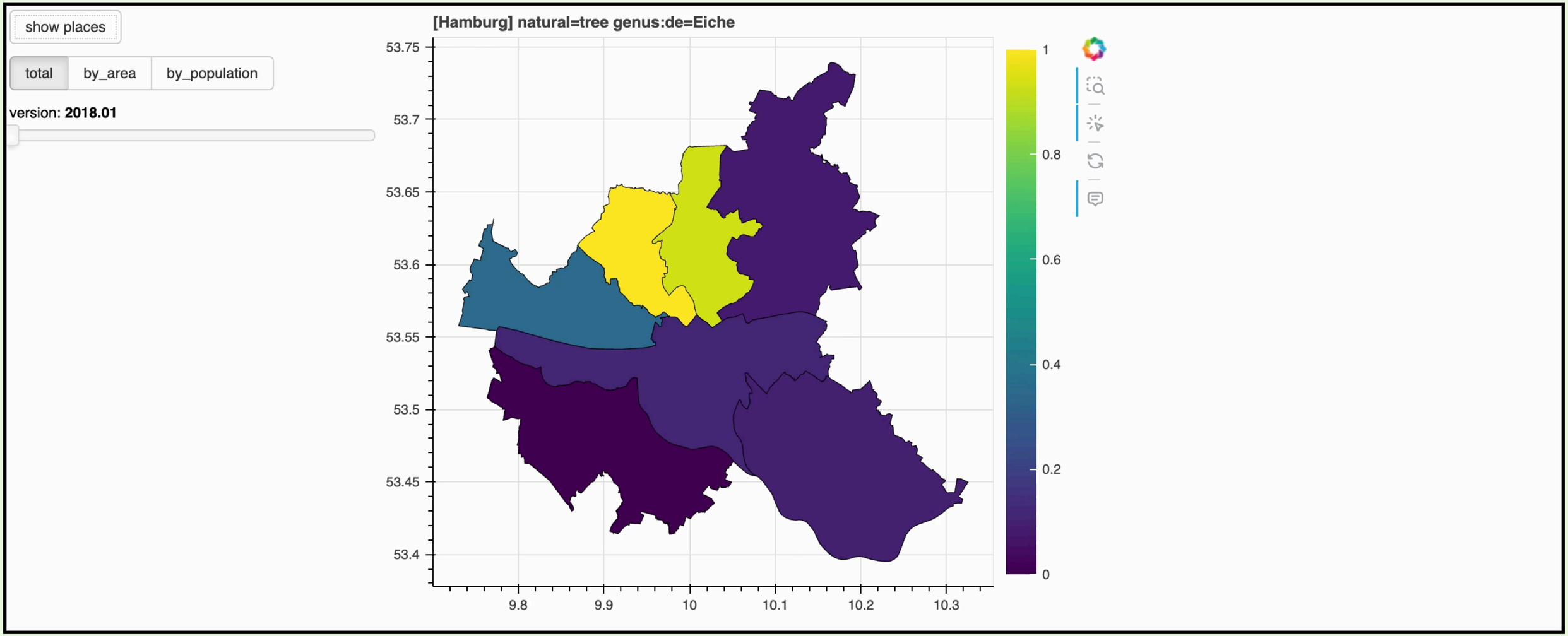

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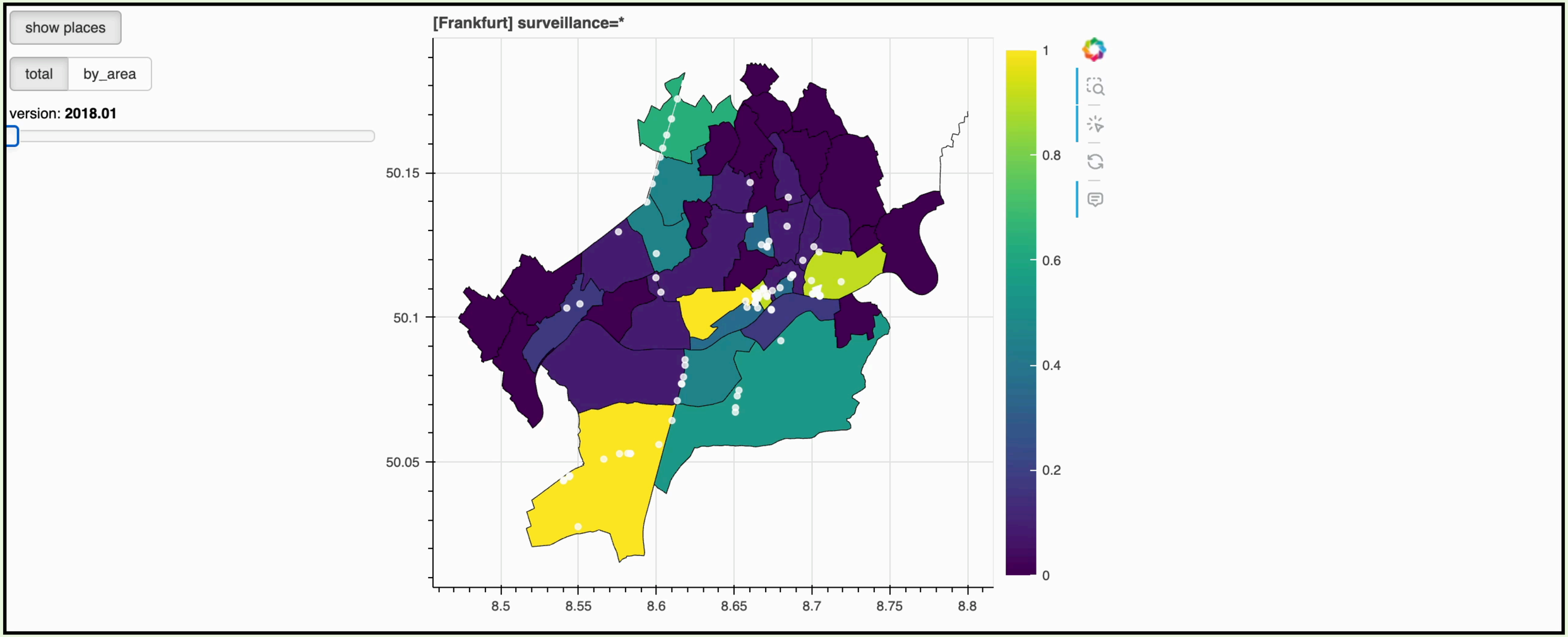
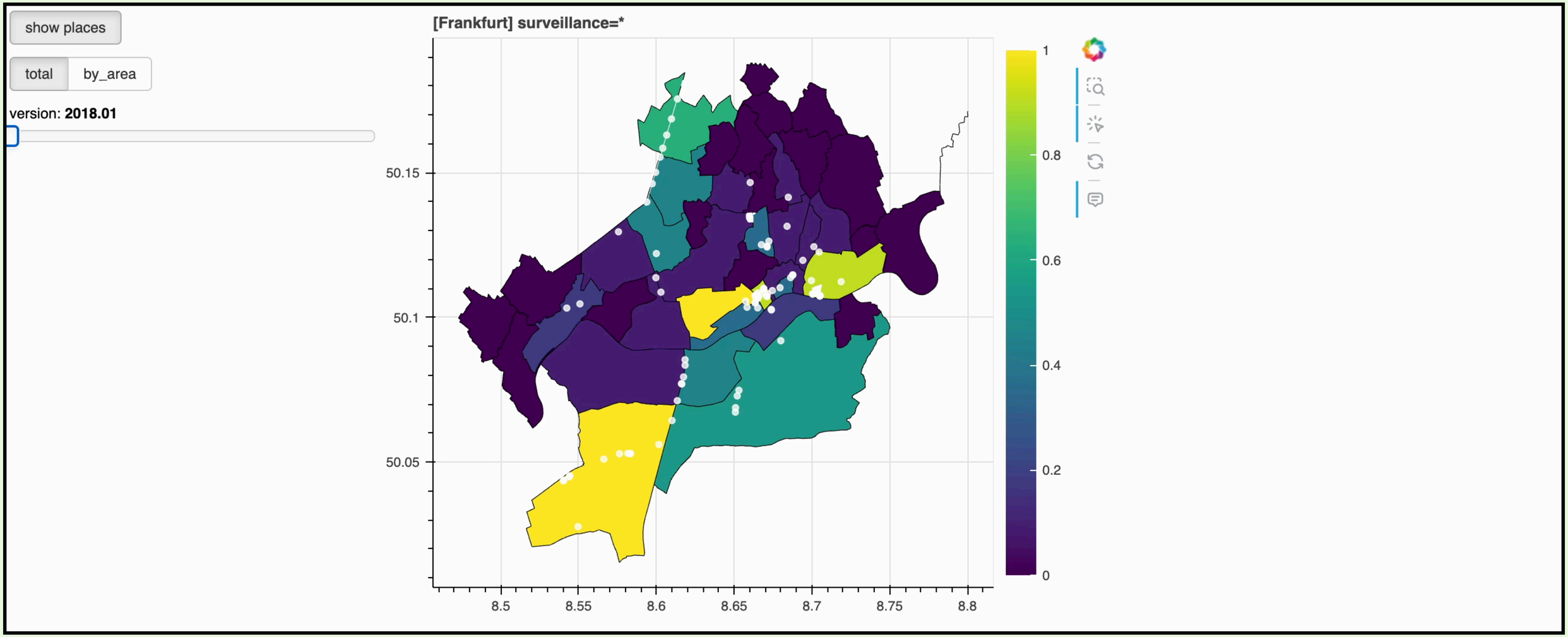


Surveillance in Frankfurt

Map data from OpenStreetMap



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So where did the post offices go?

Was my experience reflected in the data?

Was I asking the correct question?

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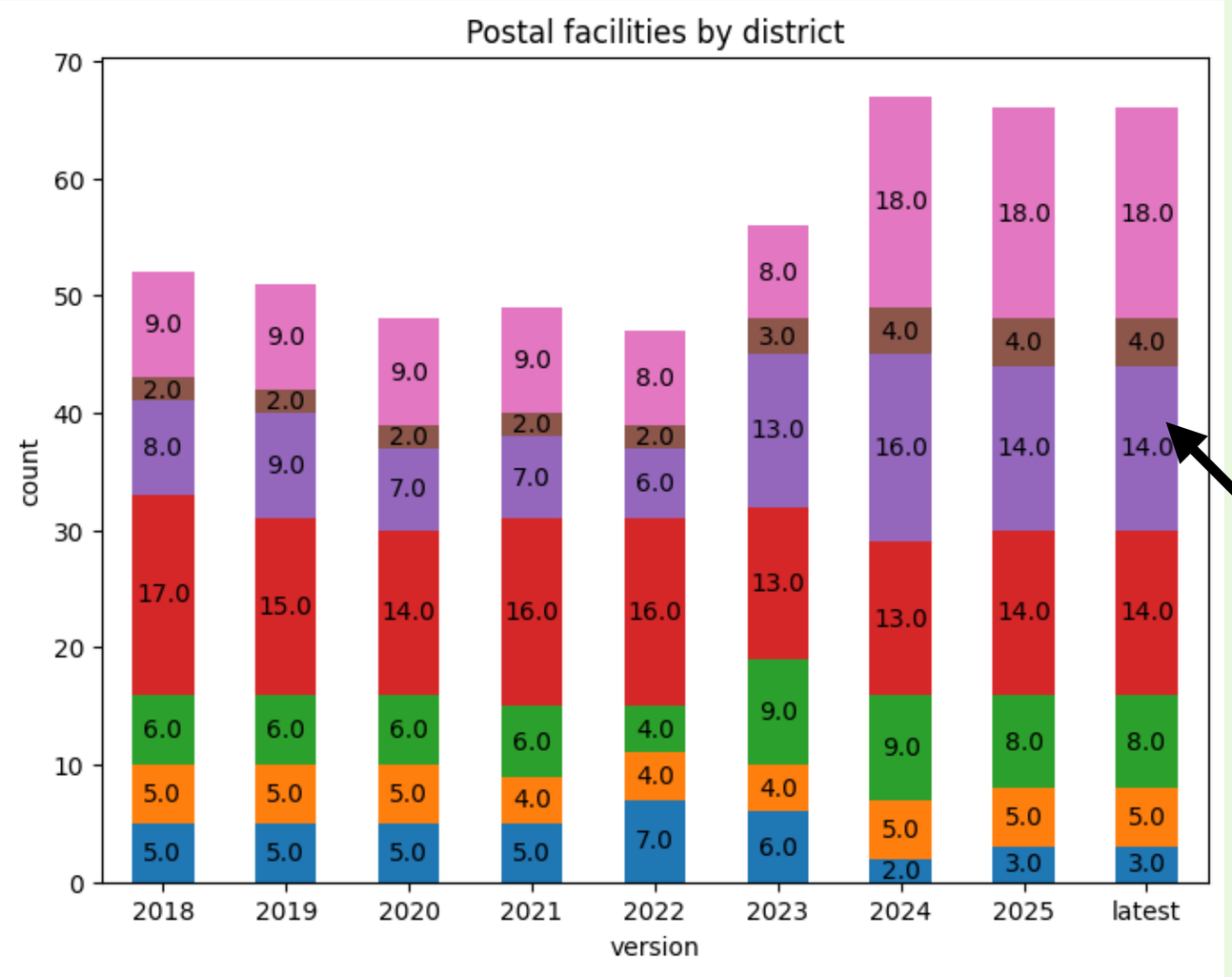

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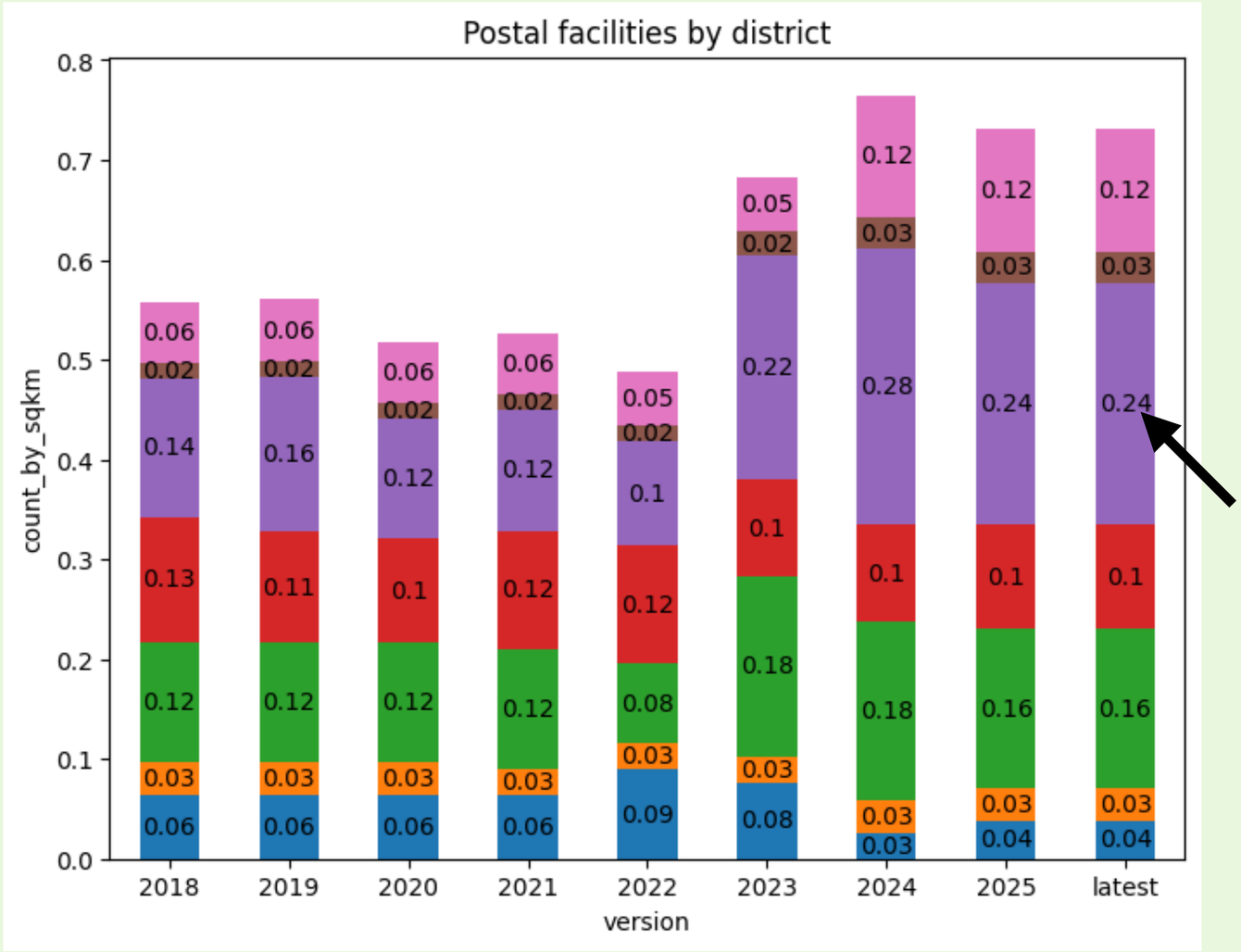

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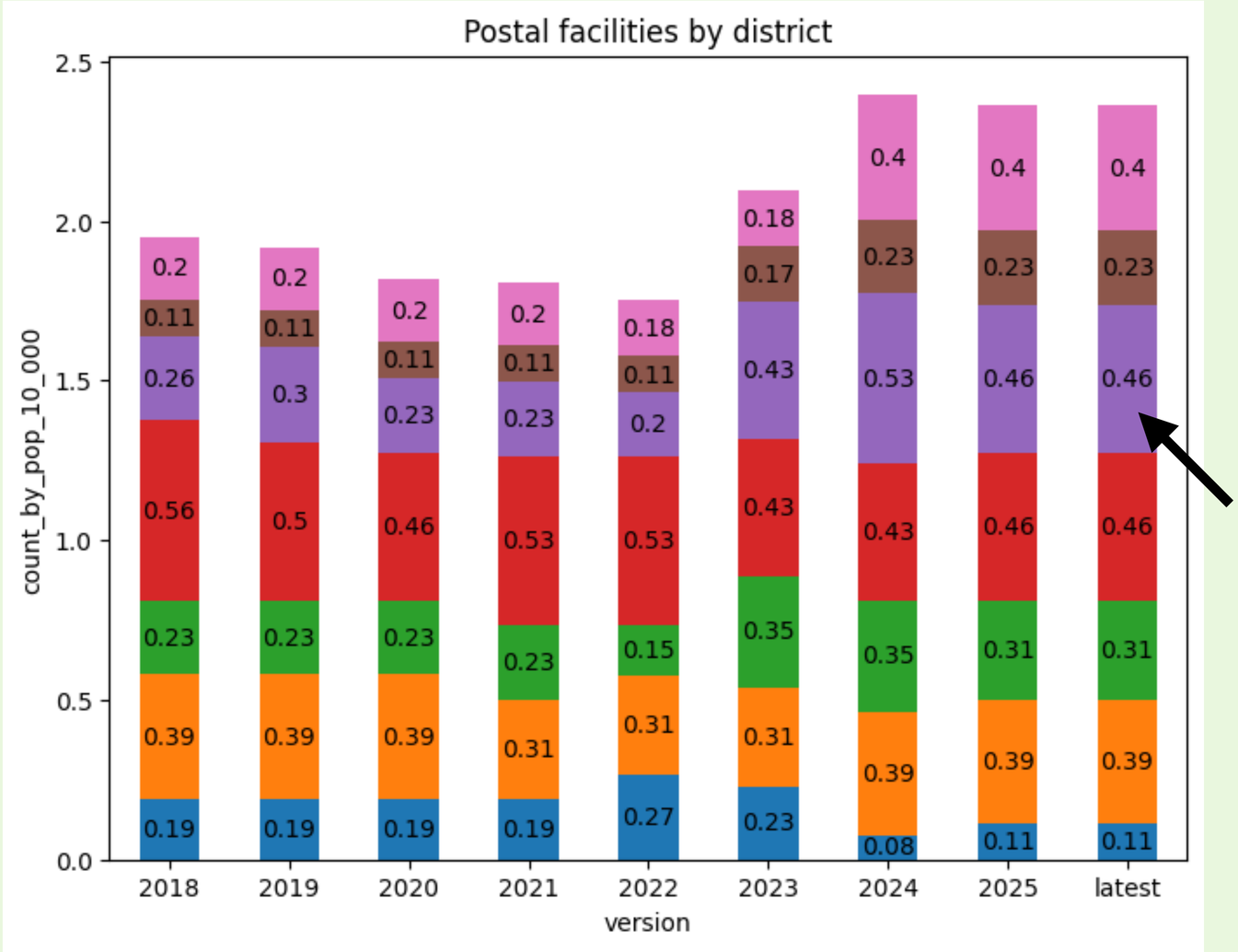

Go discover your neighborhood!

KatieBSC / diner-osm