Advanced Analytics and Applications
Summer Semester 2022

Pre-Workshop Materials – 04 – Spatial Analytics

1 Dependencies:

Please install geopandas, h3 and shapely.
These should already be part of your AAA environment if you've used the environment files provided in GitHub.

HINT: Use conda whenever possible over pip to ease dependency installation, especially on Windows, spatial computation dependencies are no joke ;-)

2 Introduction to GeoPandas

Read the docs of GeoPandas: https://geopandas.org/docs/user_guide/data_structures.html
Be prepared to answer the following questions:

2.1   Which geometry objects are available?

2.2   Which attributes of these geometry objects are important for us?

2.3   Which fundamental methods are available for GeoDataFrames?

3 Tasks: Visualizing data with GeoPandas and Shapely

We will see solutions for these tasks in the workshop. The tasks can be solved in multiple ways, we want to encourage you to think about possible ways of accomplishing the task.

Task 1: Using color schemes to visualize data

Please visualize the different populations of countries in a meaningful way,
using this data set:

```
1.  world = geopandas.read_file(geopandas.datasets.get_path('naturalearth_lowres'))
```

Task 2: Plotting a heatmap

Please plot a heatmap of cities in the following data set:

```
1.  cities = geopandas.read_file(geopandas.datasets.get_path('naturalearth_cities'))
```

A tutorial on how to plot heatmaps:

https://nbviewer.jupyter.org/gist/perrygeo/c426355e40037c452434

Task 3: Visualizing spatial set operations

Using the following geometries, compute the Intersection, the Difference and the Symmetrical Difference of the geometries and visualize the results.

```
1.  from shapely.geometry import Polygon
2.  polys1 = geopandas.GeoSeries([Polygon([(0,0), (2,0), (2,2), (0,2)]),
3.                                Polygon([(2,2), (4,2), (4,4), (2,4)])])
4.  polys2 = geopandas.GeoSeries([Polygon([(1,1), (3,1), (3,3), (1,3)]),
5.                                Polygon([(3,3), (5,3), (5,5), (3,5)])])
6.  df1 = geopandas.GeoDataFrame({'geometry': polys1, 'df1':[1,2]})
7.  df2 = geopandas.GeoDataFrame({'geometry': polys2, 'df2':[1,2]})
```