VISUALIZING GEOSPATIAL DATA IN PYTHON

Introduction

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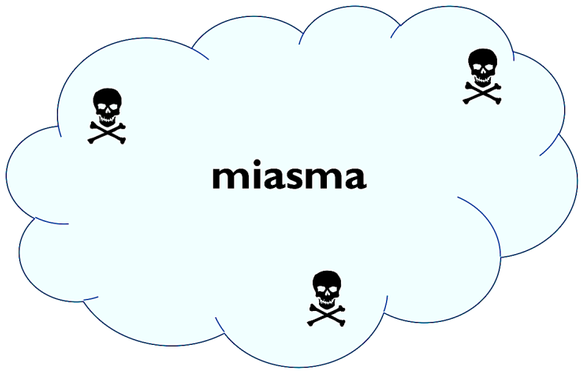
Location

- 1854 cholera outbreak in London
- 600+ deaths



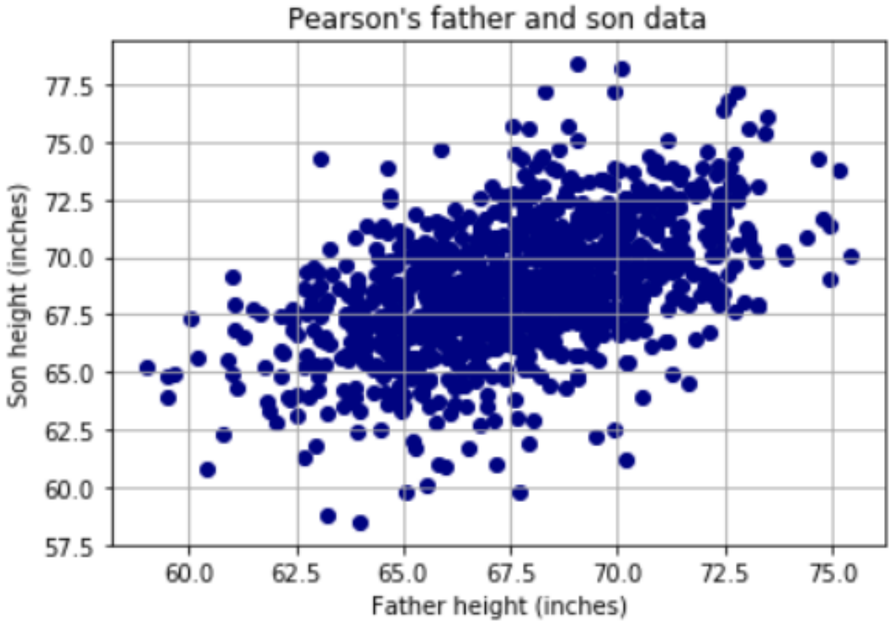
Snow's dot map

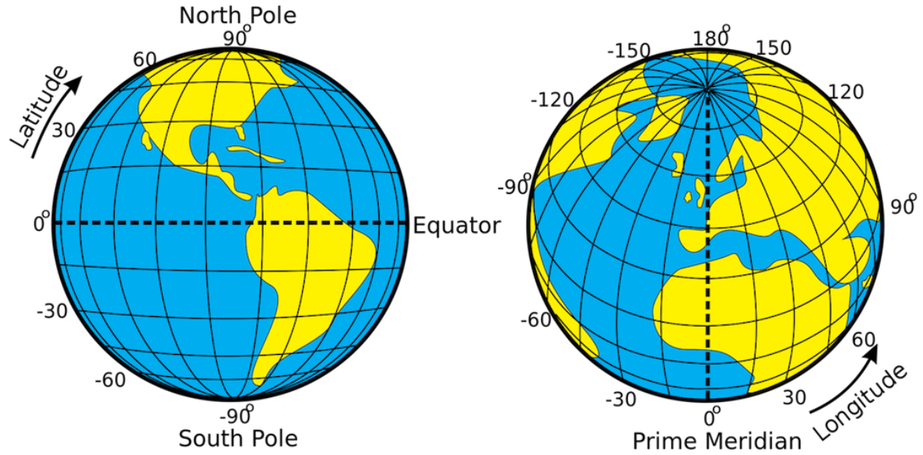
https://myweb.rollins.edu/jsiry/London-Cholera-John_Snow-copy.jpg

What you will learn in this course

- How to plot geospatial points as scatterplots
- How to plot geometries using `geopandas`
- How to construct a `GeoDataFrame` from a `DataFrame`
- How to spatially join datasets
- How to add a street map to your plots
- When and how to create a choropleth

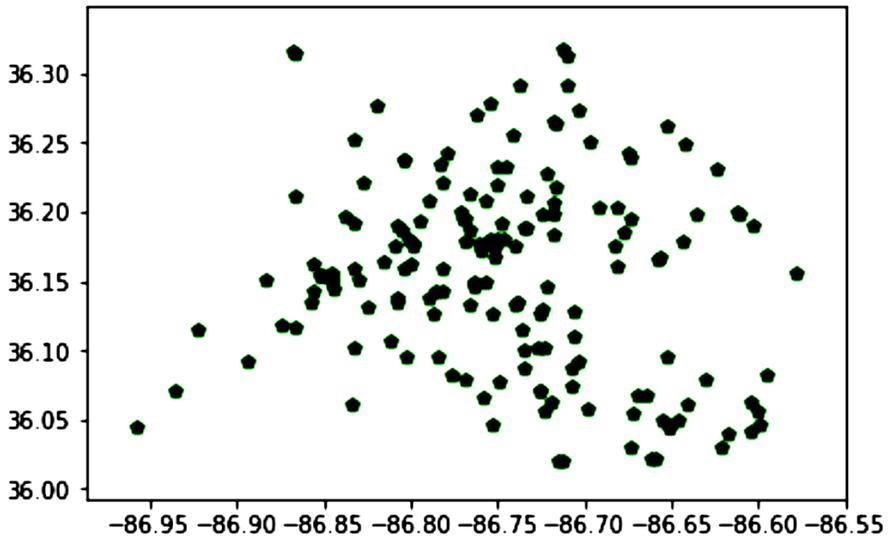
Longitude and latitude



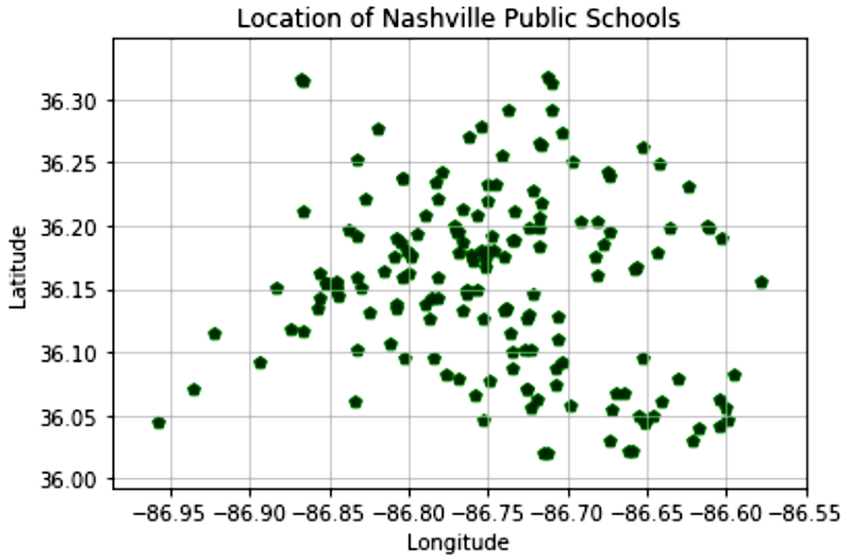


Scatterplot styling

```
plt.scatter(schools.Longitude,
            schools.Latitude,
            c = 'darkgreen',
            marker = 'p')
plt.show()
```




```
plt.scatter(schools.Longitude,
            schools.Latitude,
            c = 'darkgreen',
            marker = 'p')
plt.xlabel('Longitude')
plt.ylabel('Latitude')
plt.title('Nashville Public Schools')
plt.grid()
plt.show()
```



Extracting longitude and latitude

```
bus_stops.head()
```

```
Stop ID    StopName        Location
4431       MCC5_11     (36.16659, -86.781996)
588        CHA7AWN     (36.165, -86.78406)
590        CHA8AWN     (36.164393, -86.785451)
541        CXONGULC    (36.162249, -86.790464)
5231       7AVUNISM    (36.163822, -86.783791)
```

Extracting longitude and latitude

```
bus_stops['lat'] = [loc[0] for loc in bus_stops.Location]
bus_stops['lng'] = [loc[1] for loc in bus_stops.Location]
bus_stops.head()
```

```
Stop ID    StopName  Location                  lat         lng
4431       MCC5_11   (36.16659, -86.781996)    36.16659    -86.781996
588        CHA7AWN   (36.165, -86.78406)       36.165      -86.78406
590        CHA8AWN   (36.164393, -86.785451)   36.164393   -86.785451
541        CXONGULC  (36.162249, -86.790464)   36.162249   -86.790464
5231       7AVUNISM  (36.163822, -86.783791)   36.163822   -86.783791
```

Extracting longitude and latitude with regular expressions

```
bus_stops2.head()
```

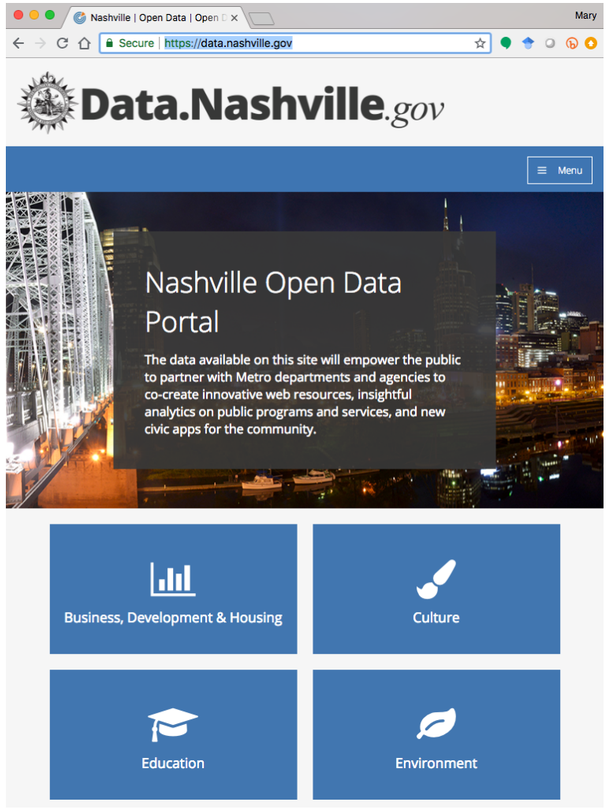
```
Stop ID         Location
4431       MCC - BAY 11\nNashville, TN\n(36.16659, -86.78199)
588        CHARLOTTE AVE\nNashville, TN\n(36.165, -86.78406)
590        CHARLOTTE AV\nNashville, TN\n(36.164393, -86.785451)
541        CHARLOTTE\nNashville, TN\n(36.162249, -86.790464)
5231       Nashville, TN\n(36.163822, -86.783791)
```

Extracting longitude and latitude with regular expressions

```
lat_lng_pattern = re.compile(r'\((.*),\s*(.*)\)', flags=re.MULTILINE)
def extract_lat_lng(address):
    try:
        lat_lng_match = lat_lng_pattern.search(address)
        lat = float(lat_lng_match.group(1))
        lng = float(lat_lng_match.group(2))
        return (lat, lng)
    except:
        return (np.NaN, np.NaN)
```

```
lat_lngs = [extract_lat_lng(location)for location in \
           bus_stops2.loc[:, 'Location']]
bus_stops2['lat'] = [lat for lat, lng in lat_lngs]
bus_stops2['lng'] = [lng for lat, lng in lat_lngs]
```

Nashville open data



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Let's practice!

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Geometries and shapefiles

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Shapefiles

Shapefiles store a special type of data known as *geometry*.

Shapefile components

KEEP ALL THE FILES TOGETHER!

```
$ ls my_map_files/

my_map.dbf
my_map.shp
my_map.shx
```

- my_map.shp (contains the geometry)
- my_map.dbf (holds attributes for each geometry)
- my_map.shx (links the attributes to the geometry)

geopandas

This code reads a shapefile into a GeoDataFrame and looks at the first few rows.

```
import geopandas as gpd

geo_df = gpd.read_file('My_Map_Files/my_map.shp')
geo_df.head()
```


KEEP NASHVILLE CLEAN

Viewing a geometry

```
service_district.loc[0, 'geometry']
```

Printing a geometry

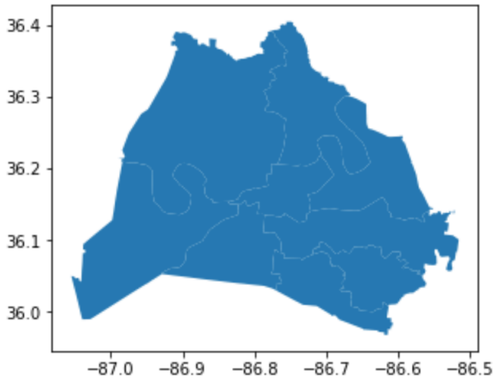
```
print(service_district.loc[0, 'geometry'])
```

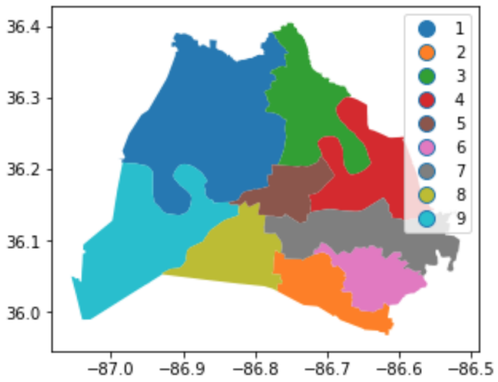
```
POLYGON ((-86.68680500011935 36.28670500013504,
-86.68706099969657 36.28550299967364, -86.68709498823965 36.28511683351293,
-86.68712691935902 36.28475404474551, -86.6871549990252 36.28443499969863,
-86.68715025108719 36.28438104319917, -86.68708600011215 36.2836510002216,
-86.6870599998375 36.28335400009232, -86.68683200030846 36.28073200026927,
-86.68678671280243 36.2804916722591, -86.68668199966068 36.27993600019391,
-86.686543000303 36.27920000021985, -86.68641799989246 36.27853199938513,
-86.68600744248923 36.27759483150202, -86.68579942352289 36.27711998225582,
-86.68482299948184 36.2748910007355, -86.68476799897849 36.27478700083996,
-86.68372700043393 36.27281799971492, -86.6832880000829 36.27208000018629,
-86.68313199902317 36.27181700012145, -86.68278700024624 36.27108100075766,
-86.68257822861736 36.27077209799597, -86.68177585777893 36.2694062861527,
-86.68129400001521 36.2685690000872, -86.68085800015712 36.26798600010722,
-86.68029000024265....
```

Plotting a GeoDataFrame

```
school_districts.plot()
plt.show()
```

```
school_districts.plot(column =
                      'district',
                      legend = True)
plt.show()
```





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Putting it all together

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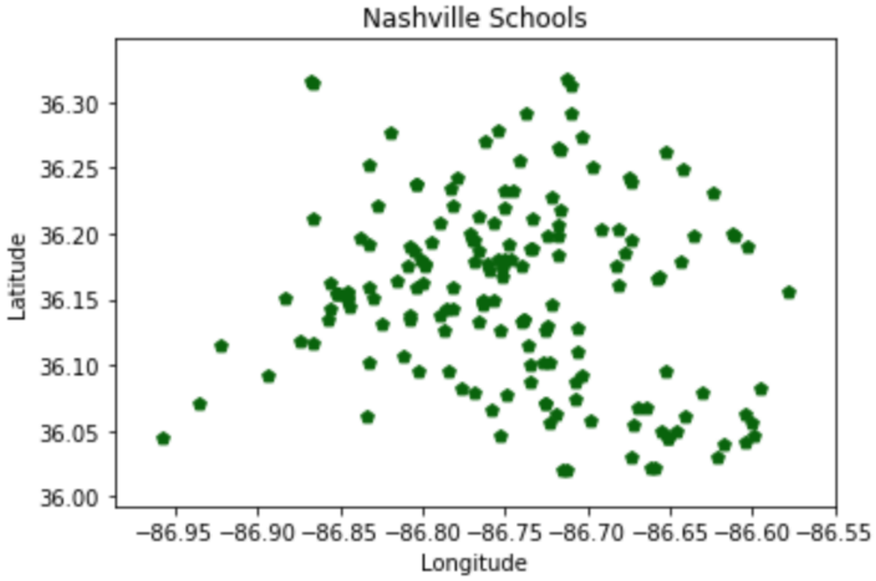
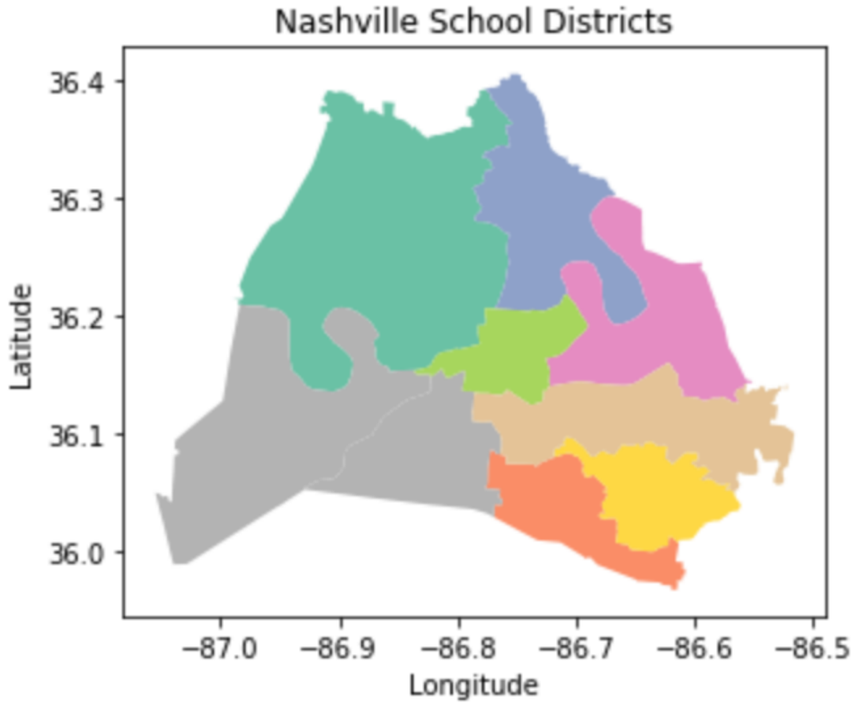
Skills list

- Understanding longitude and latitude
- Extracting longitude and latitude
- Plotting points on scatterplot using longitude and latitude
- Styling scatterplots for better aesthetics and insight
- Plotting polygons from shapefiles

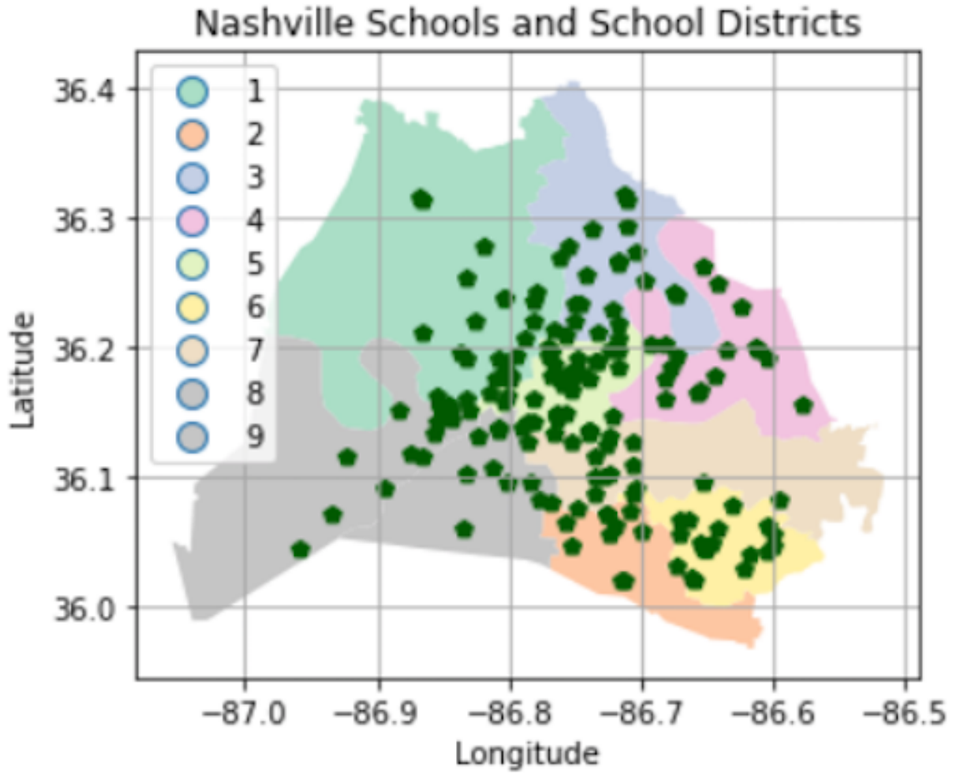
Combining scatterplots and polygons





Combining scatterplots and polygons

```
school_districts.plot(column = 'district', legend = True, cmap = 'Set2')
plt.scatter(schools.lng, schools.lat, marker = 'p', c = 'darkgreen')
plt.title('Nashville Schools and School Districts')
plt.show();
```



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