# Extending Plotting

It's time to extend your plotting skills. Over the past two lessons, you've learned how to create a range of interactive plots using hvPlot and Plotly Express; however, you haven't had one centralized location to embed these plots. Now you do! Integrate Plotly map visualizations with hvPlot scatter plots to create a Population and Crimes dashboard.

```python
[1]: import plotly.express as px
     import hvplot.pandas
     import panel as pn
     import pandas as pd
     import os
     from pathlib import Path
```

### Use extension function to specify plugin

```python
[2]: # Set up Panel Plotly extension
     pn.extension('plotly')
```

### Set up Mapbox token and prepare data

```python
[3]: # Extract token
     mapbox_token = os.getenv("MAPBOX_API_KEY")

     # Set token using Plotly Express set function
     px.set_mapbox_access_token(mapbox_token)

     # Read in data
     city_pop = pd.read_csv(Path("../Resources/population_counts.csv")).drop_duplicates()
     crime_rates = pd.read_csv(Path("../Resources/crime_rates.csv")).drop_duplicates()

     pop_with_index = city_pop.set_index("city")
     crime_with_index = crime_rates.set_index("city")
     population_crime = (
         pd.concat([pop_with_index, crime_with_index], axis=1, sort=True)
         .dropna()
         .reset_index()
     )
```

### Create plots

```python
[4]: # Create plots
     population_plot = px.scatter_mapbox(
         population_crime,
         lat="latitude",
         lon="longitude",
         size="pop_2015",
         color="index",
         color_continuous_scale=px.colors.cyclical.IceFire,
         title="City Population",
         zoom=3,
         width=1000,
     )

     crime_plot = px.scatter_mapbox(
         population_crime,
         lat="latitude",
         lon="longitude",
         size="violent_crime",
         color="index",
         color_continuous_scale=px.colors.cyclical.IceFire,
         title="City Crime",
         zoom=3,
         width=1000,
     )

     population_violence = population_crime.hvplot.scatter(
         x="pop_2015",
         y="violent_crime",
         title="Violent Crime by Population Correlation",
         width=1000,
     ).opts(yformatter="%.0f")

     violent_murder = population_crime.hvplot.scatter(
         x="violent_crime",
         y="murder",
         title="Correlation Between Number of Violent Crimes and Murder",
         width=1000,
     ).opts(yformatter="%.0f")
```

### Create Panel columns and tabs

```python
[5]: # Create panels to structure the layout of the dashboard
     geo_column = pn.Column("## Population and Crime Geo Plots", population_plot, crime_plot)
     scatter_column = pn.Column(
         "## Correlation of Population and Crime Plots", population_violence, violent_murder
     )
```

```python
[6]: crime_pop_dashboard = pn.Tabs(
     ("Geospatial", geo_column),
     ("Correlations", scatter_column))

     crime_pop_dashboard
```
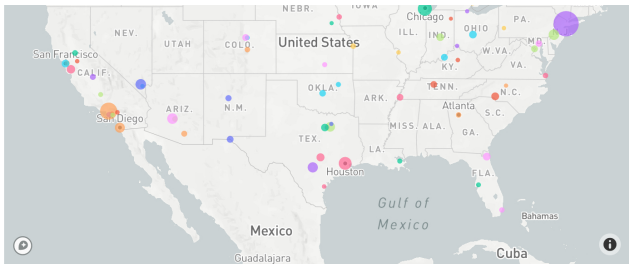
[6]:  Geospatial   Correlations

## Population and Crime Geo Plots

City Population

index=Bakersfield
index=Baltimore
index=Boston
index=Buffalo
index=Charlotte
index=Chicago
index=Cincinnati
index=Colorado Springs
index=Columbus
index=Corpus Christi
index=Dallas
index=Denver
index=Detroit
index=El Paso
index=Fort Wayne

City Crime



index=Albuquerque
index=Anaheim
index=Anchorage
index=Arlington
index=Atlanta
index=Aurora
index=Austin
index=Bakersfield
index=Baltimore
index=Boston
index=Buffalo
index=Charlotte
index=Chicago
index=Cincinnati
index=Colorado Springs
index=Columbus
index=Corpus Christi
index=Dallas
index=Denver
index=Detroit
index=El Paso
index=Fort Wayne