If you want to follow along with the Python code, please go here and try the “Launch into JupyterHub” link:
https://github.com/benjum/oarc-python-data-viz-1

Data Visualization with Python Part 1

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OARC

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Overview

- Brief intro to some libraries
- Quick dive into matplotlib, pandas, and seaborn
- Comparing plotting processes
  - A few simple plots made with each in turn
- Looking at a few showy examples

Disclaimer

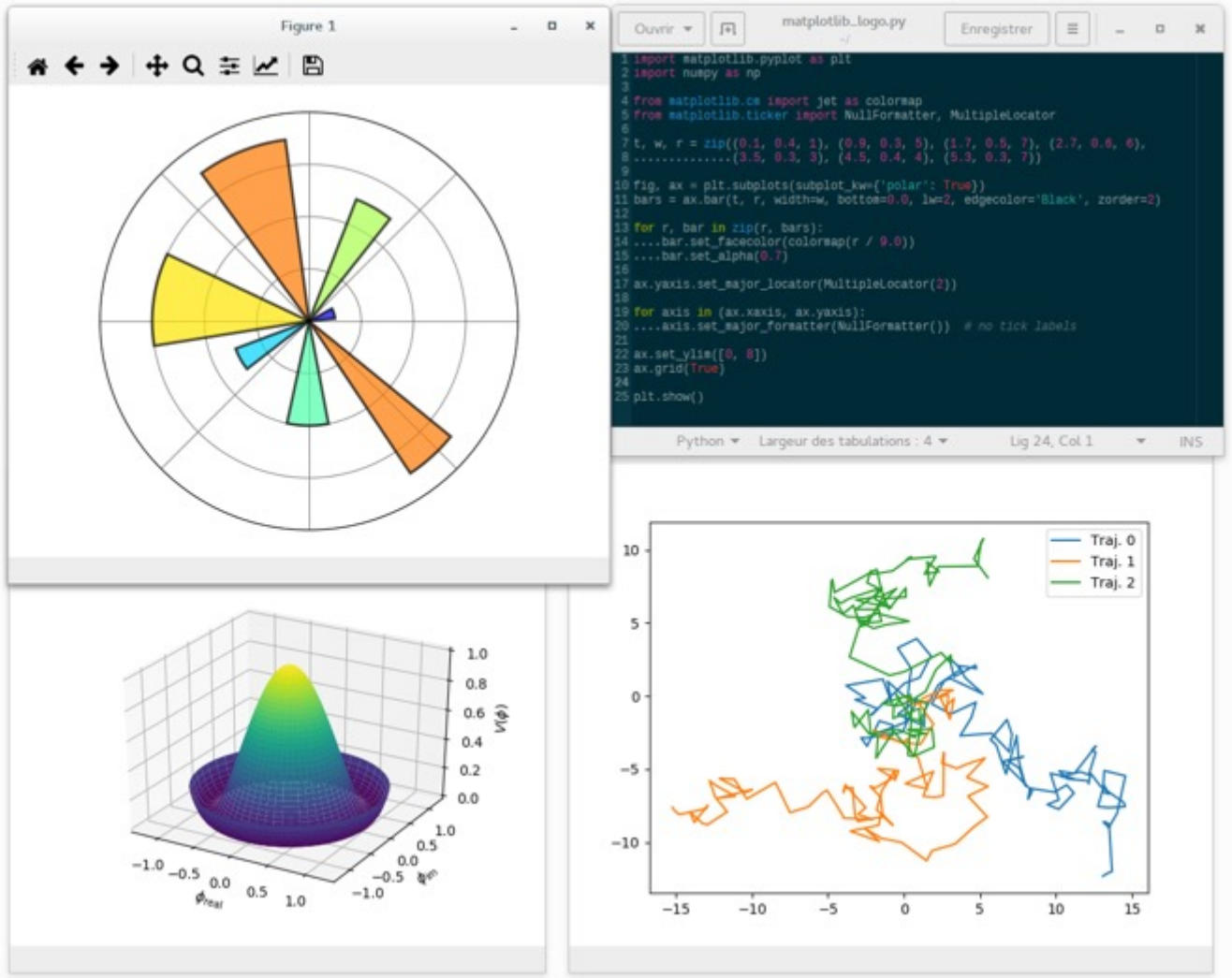
- Aim: To get your feet wet
  - This is not the whole story, not even close
  - There's so so so ***SO*** much out there
  - And it's developing very quickly

- I won't cover installing libraries or Python fundamentals
  - Though if you have questions, please reach out to me afterwards

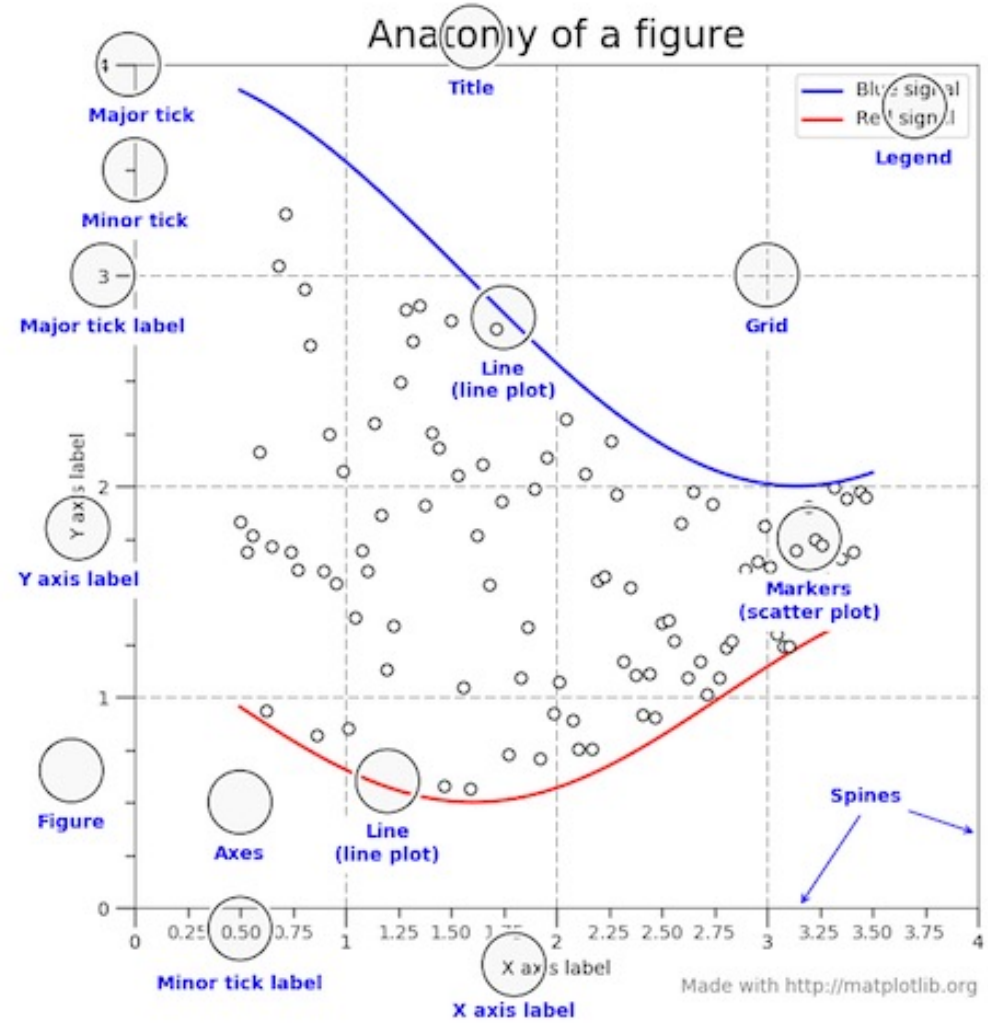
- If this is your first exposure, don't worry:
  - Deeper understanding comes with practice
  - Lots of practice

Visualization in Python: matplotlib is the workhorse lib

"Matplotlib tries to make easy things easy and hard things possible."



https://matplotlib.org/



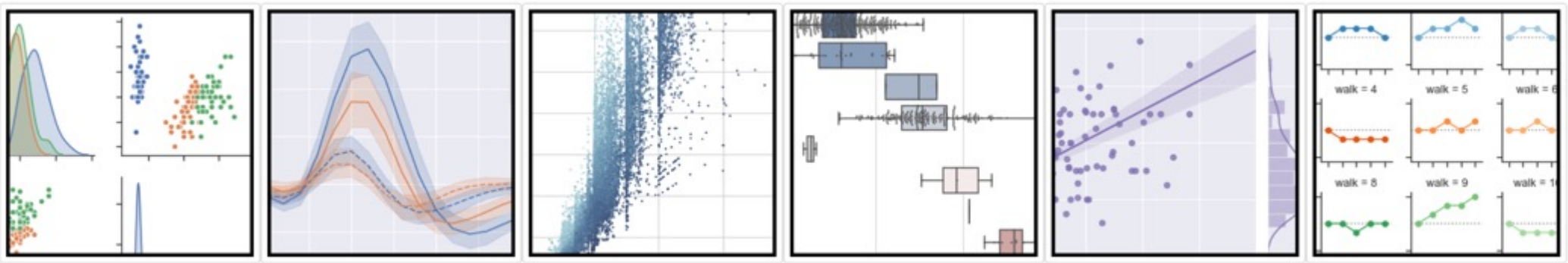
Matplotlib

- Built on the NumPy and SciPy frameworks and initially made to enable interactive Matlab-like plotting via gnuplot from iPython
- Gained early traction with support from Space Telescope Science Institute and JPL
- Easily one of the go-to libraries for academic publishing needs
  - Create publication-ready graphics in a range of formats
  - Powerful options to customize all aspects of a figure
- Matplotlib underlies the plotting capabilities of Pandas and Seaborn

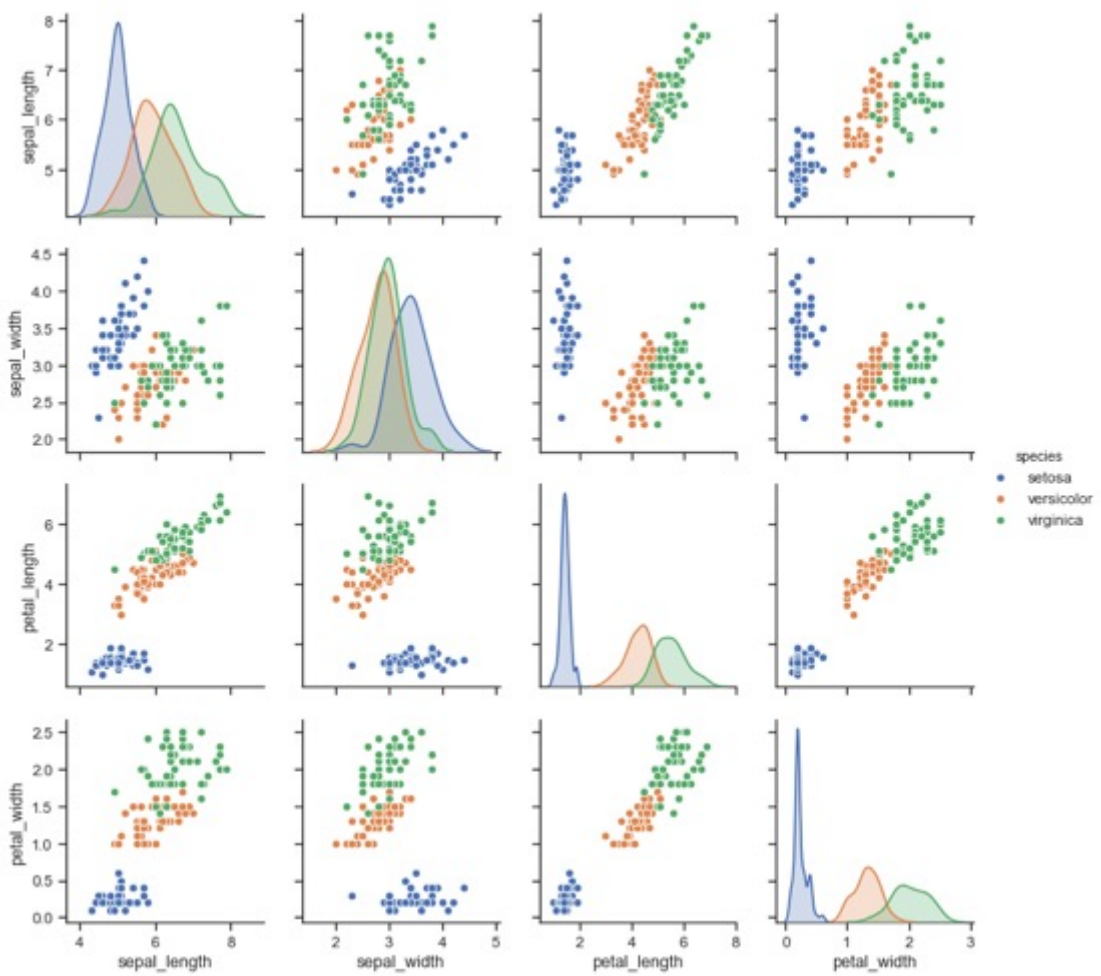
https://matplotlib.org/

Seaborn

If Matplotlib “tries to make easy things easy and hard things possible,”
Seaborn tries to make a well-defined set of hard things easy too.



https://seaborn.pydata.org/

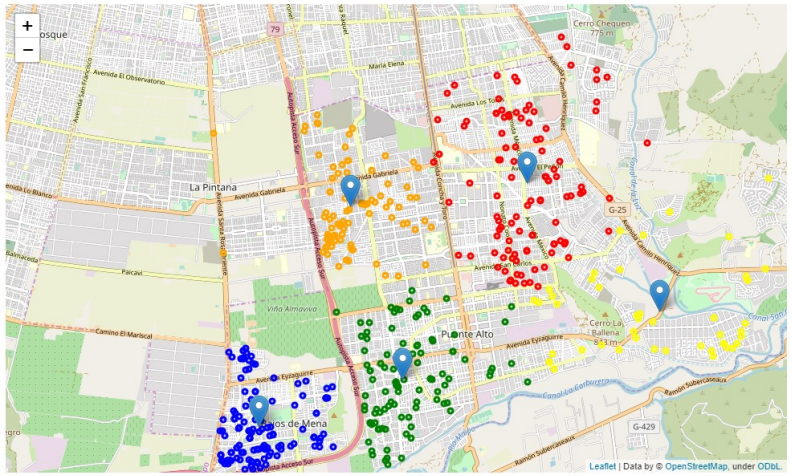


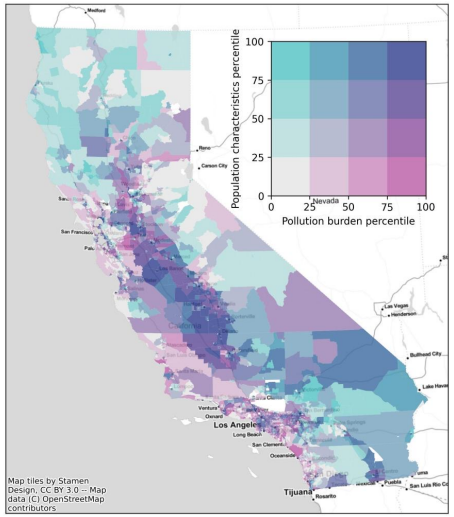
Seaborn

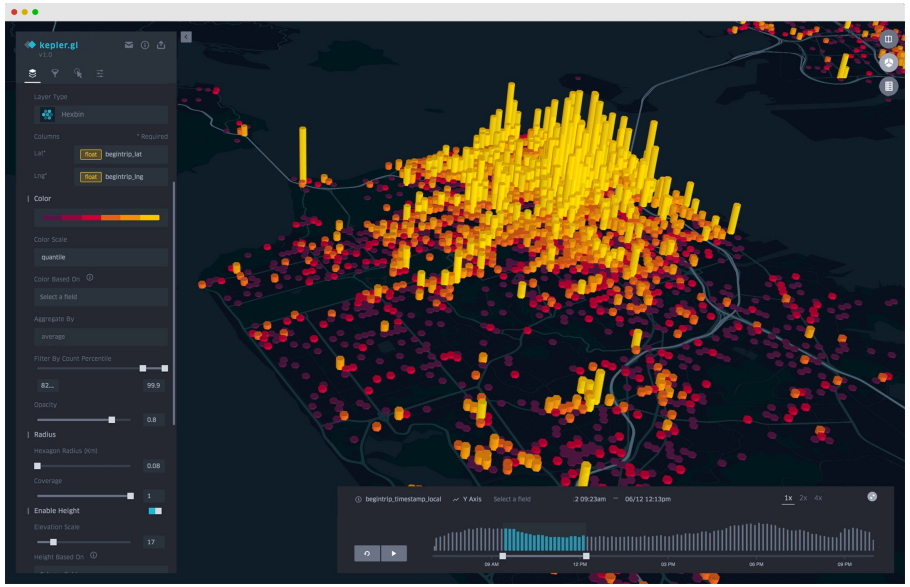
- Built on top of matplotlib and closely integrated with Pandas data structures
- Used for making statistical graphics and using visualization to quickly and easily explore and understand data
- The style settings can also affect Matplotlib plots, even if you don't make them with Seaborn

https://seaborn.pydata.org/

Specialized libraries -> for mapping



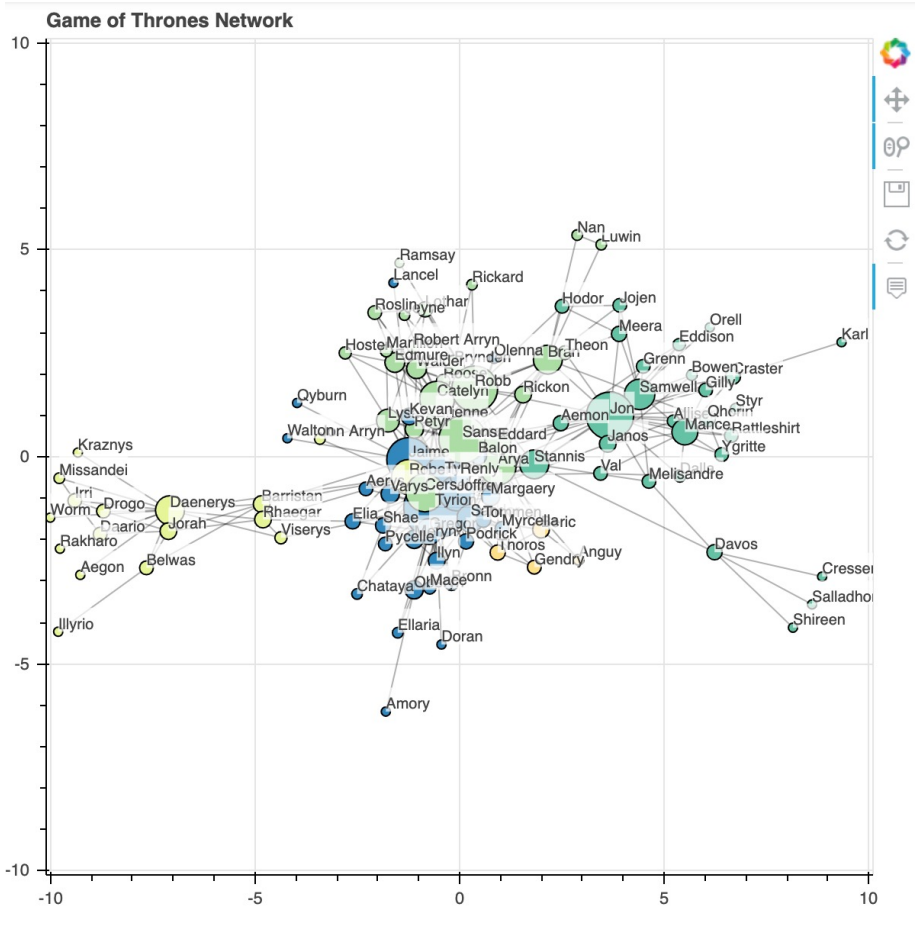


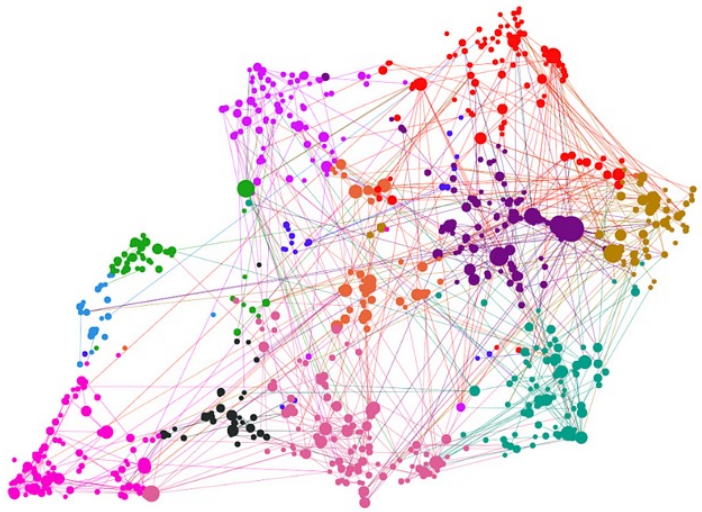


- **GeoPandas** extends Pandas datatypes for spatial operations on geometric types; depends on matplotlib for plotting.
  - https://geopandas.org/en/stable/
- **Folium** combines Python data wrangling abilities with the leaflet.js library.
  - https://python-visualization.github.io/folium/
- **Kepler.gl** is designed for high-performance web-based visualization of large-scale geolocation data.
  - https://docs.kepler.gl/

Specialized libraries -> for networks

- **Networkx** – Python library for network analysis; provides basic functionality for graph visualization.
- **Bokeh** and **Dash Cytoscape** (from Plotly) – combine Python with Javascript elements to produced very interactive data visualizations





Minimum citation(s):

2

Journal(s) published:

- PLoS One (658 publication(s))
- Viruses (200 publication(s))
- PLoS Pathog (197 publication(s))
- Virol J (143 publication(s))

Citation network:

Show citation connections

Dimensionality reduction algorithm

UMAP t-SNE

t-SNE parameters (not applicable to UMAP):

Current t-SNE perplexity: 43 (min: 10, max:100)

10 100

Title: Ifitm3 Polymorphism Rs12252-C Restricts Influenza A Viruses

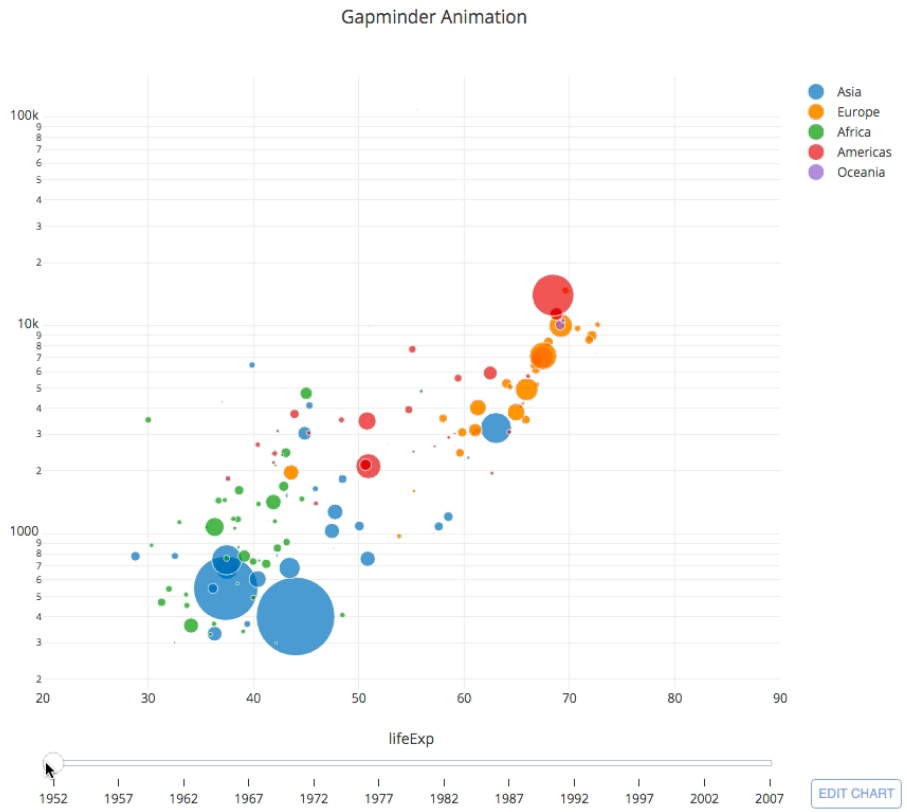
Journal: Plos One, Published: 2014-10-14

Author(s): Williams, David Evan Joseph; Wu, Wan-Lin; Grotefend, Christopher Robert; Radic, Vladimir; Chung, Changik; Chung, Young-Hwa; Farzan, Michael; Huang, I-Chueh, Citations: 3

Plotly

The plotly Python library (plotly.py) is an interactive, open-source, and browser-based graphing library

https://plot.ly/python/



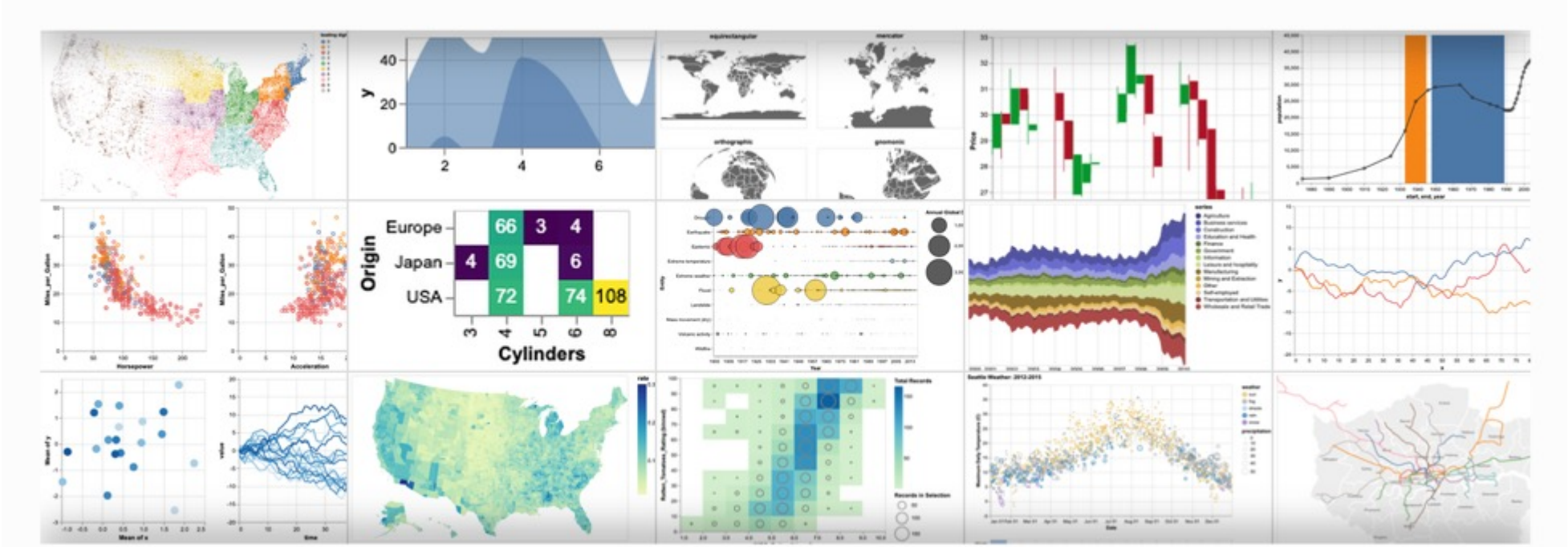
Plotly

- An open-source product of Plotly, Inc., that is built on top of Javascript (plotly.js).
- Enables Python users to create beautiful interactive web-based visualizations that can be displayed in Jupyter notebooks, saved to standalone HTML files, or served as part of pure Python-built web applications using Dash.
- Also has a version for R, as well as other web visualization products

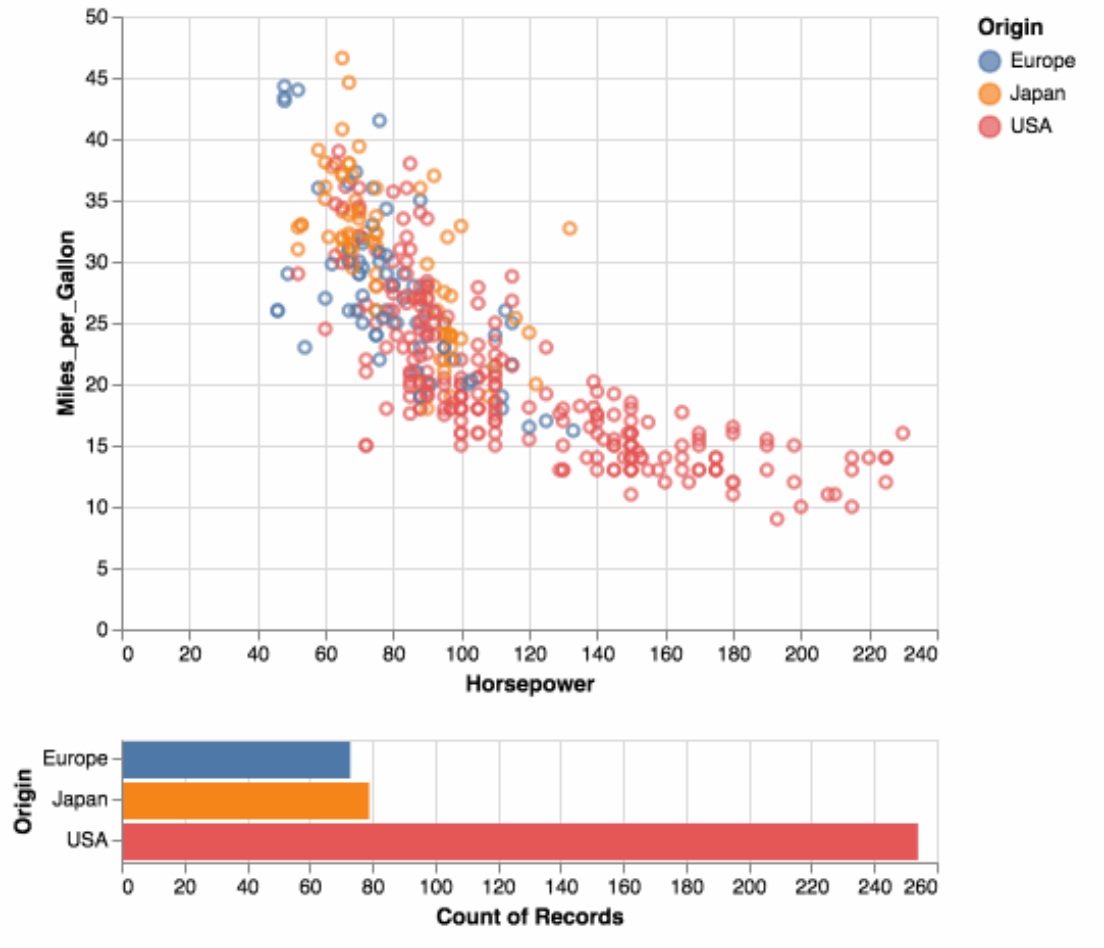
https://plot.ly/python/

Altair

Altair is a declarative statistical visualization library for Python,
based on Vega and Vega-Lite (high-level grammar of interactive graphics)



https://altair-viz.github.io/



Altair

- Based on Vega and Vega-Lite (high-level grammar of interactive graphics)
  - Vega-Lite provides a concise JSON syntax for rapidly generating visualizations to support analysis
  - Its specifications describe visualizations as mappings from data to properties of graphical marks
- Aims for elegant simplicity so focus can be on understanding data

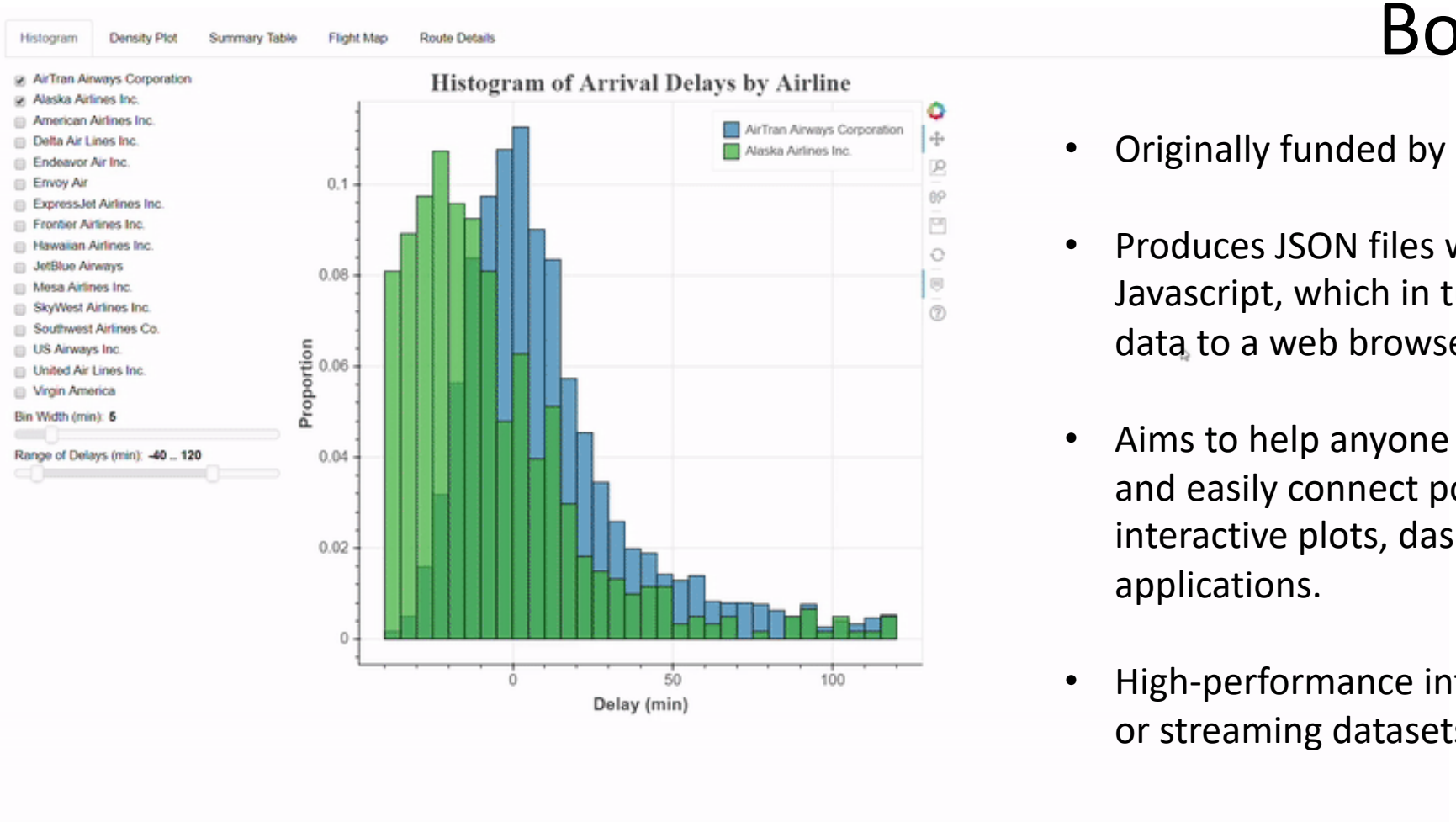
https://altair-viz.github.io/

Bokeh

Bokeh creates shareable, interactive data applications for modern browsers …
all without having to delve into JavaScript or “web tech”.

https://docs.bokeh.org/en/latest/index.html

Bokeh

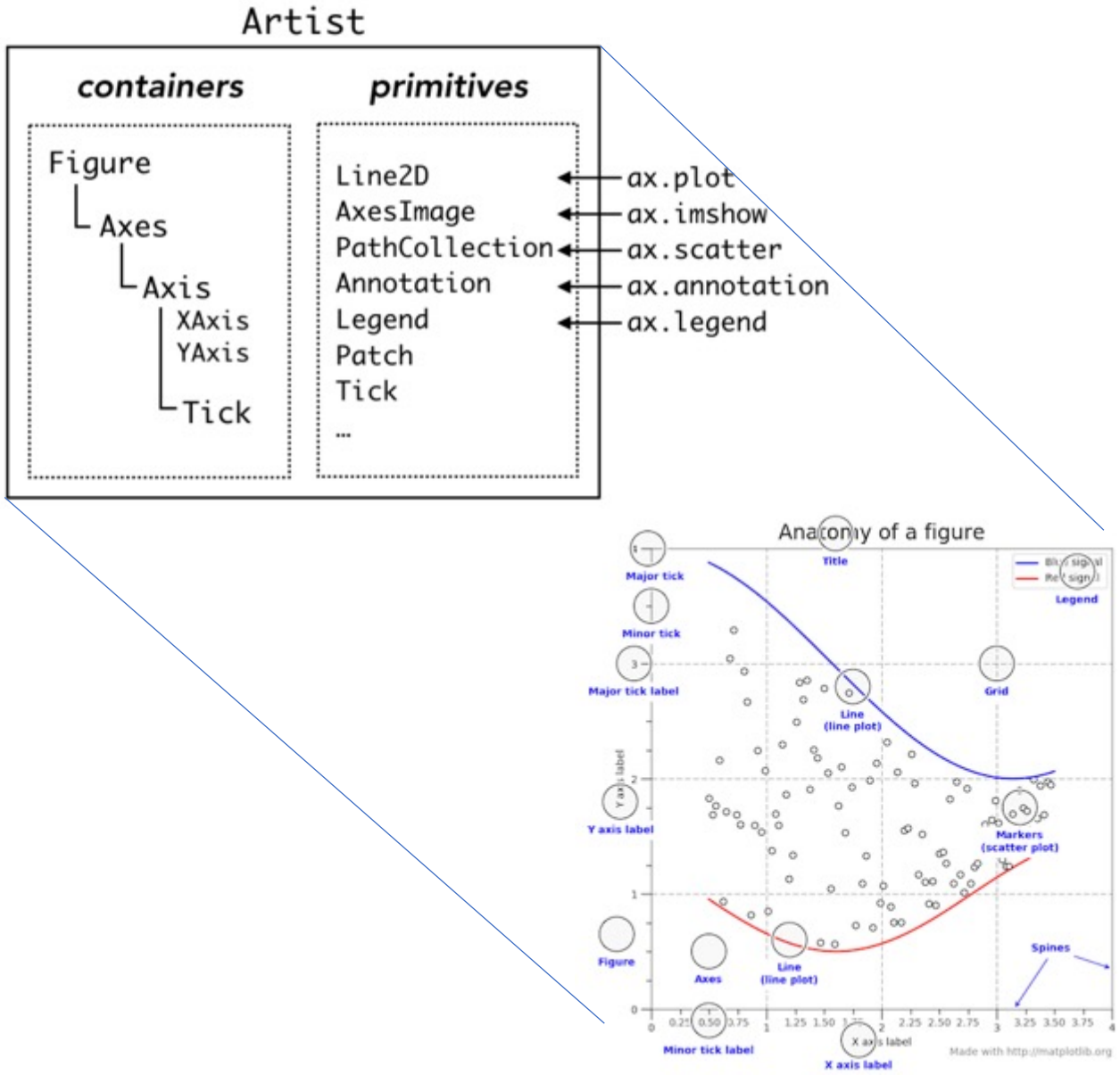


- Originally funded by DARPA
- Produces JSON files which work as input for Javascript, which in turn are used to present data to a web browser
- Aims to help anyone who would like to quickly and easily connect powerful PyData tools to interactive plots, dashboards, and data applications.
- High-performance interactivity over very large or streaming datasets

https://docs.bokeh.org/en/latest/index.html
gif obtained from https://towardsdatascience.com/data-visualization-with-bokeh-in-python-part-iii-a-complete-dashboard-dc6a86aa6e23

Quick Dive: matplotlib

- Matplotlib is organized in a hierarchy
- At the top: matplotlib.pyplot
  - This is a module that provides high-level functions to add elements to the current axes in the current figure
- Lower levels can be accessed by figure and axes objects
  - “Figure”: an object that keeps track of child “Axes” objects (and other things like titles, legends, and the canvas)
  - “Axes”: an object that can be thought of as the plot
  - “Axis” is a different object than “Axes”



Coding time:

https://github.com/benjum/oarc-python-data-viz-1