PYCON UK | Cardiff | Sept 2019

A tour of data viz in Python

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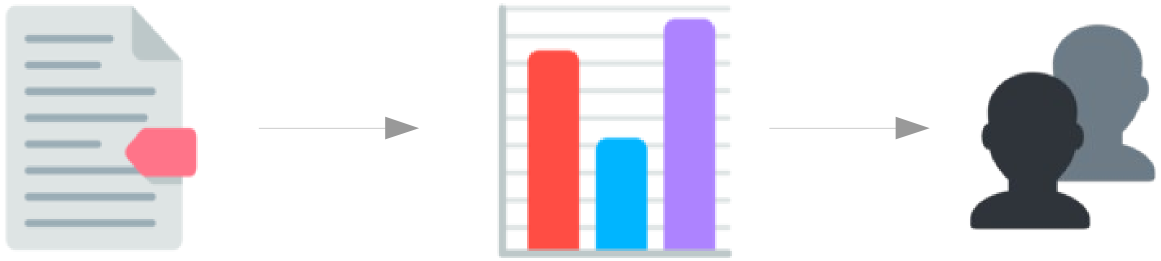
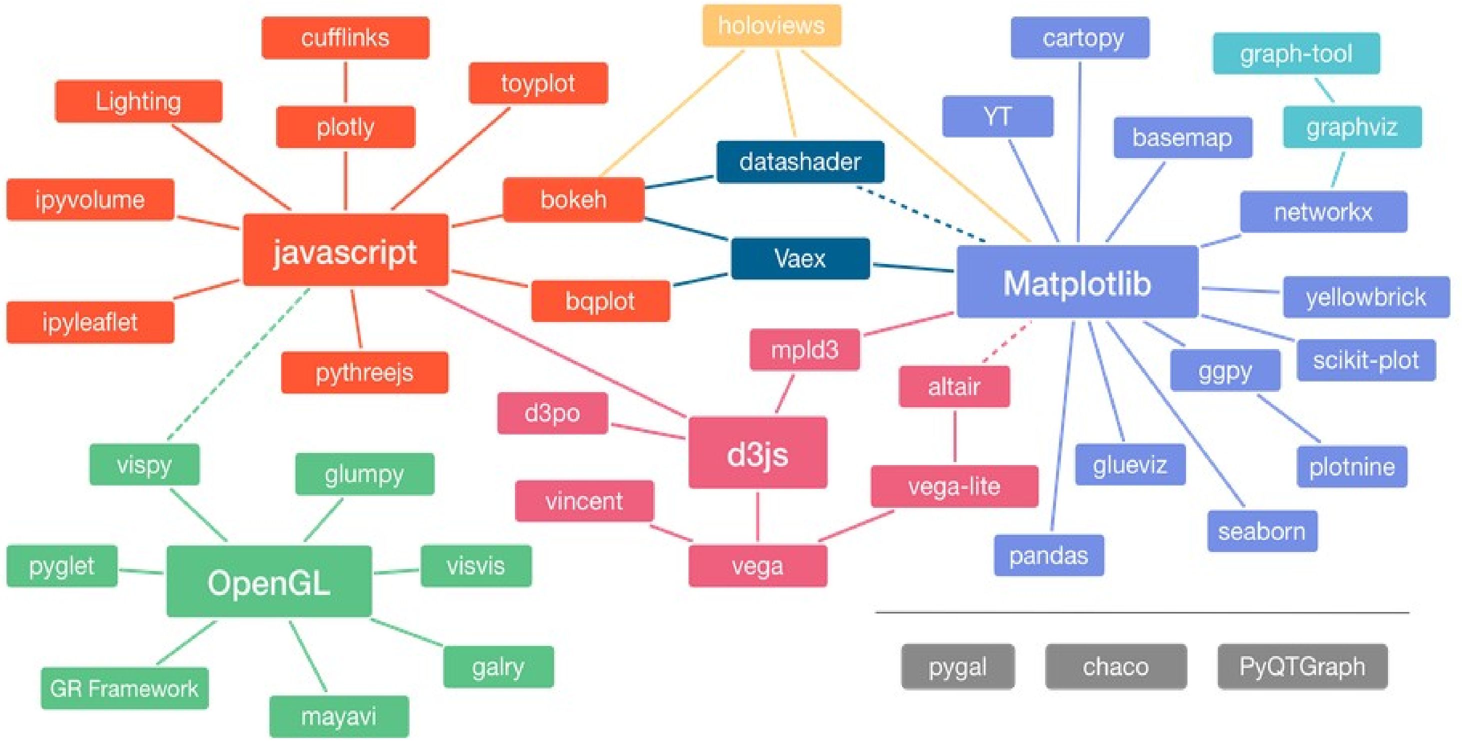


Different needs for different use cases

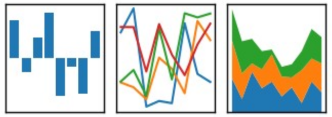
- yourself
- your colleagues
- your manager
- your clients

- exploring a dataset
- writing an internal report
- writing a client report
- writing a research article

overview



cufflinks
holoviews
cartopy
graph-tool
Lighting
plotly
toyplot
YT
basemap
graphviz
datashader
ipyvolume
javascript
bokeh
networkx
Vaex
Matplotlib
ipyleaflet
bqplot
yellowbrick
mpld3
scikit-lite
pythreejs
altair
ggpy
d3po
d3js
vispy
glumpy
vega-lite
glueviz
plotnine
vincent
seaborn
pyglet
OpenGL
visvis
vega
pandas
pygal
chaco
PyQTGraph
GR Framework
galry
mayavi



Adaptation of Jake VanderPlas graphic about the Python visualization landscape, by Nicolas P. Rougier

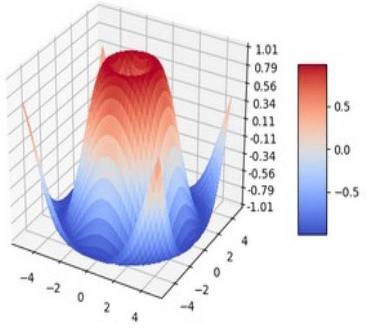
Source: https://pyviz.org/overviews/index.html

matplotlib

matplotlib

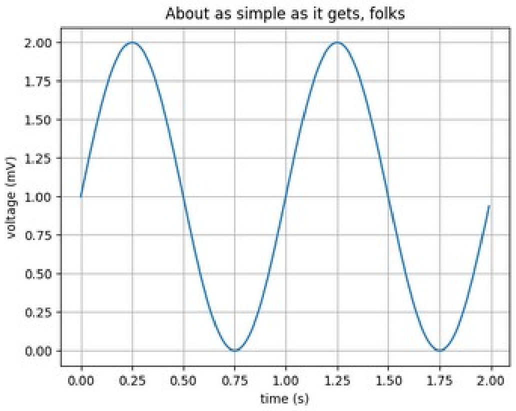
matplotlib.org

“Matplotlib tries to make easy things easy and hard things possible.”



The pyplot module provides a MATLAB-like interface

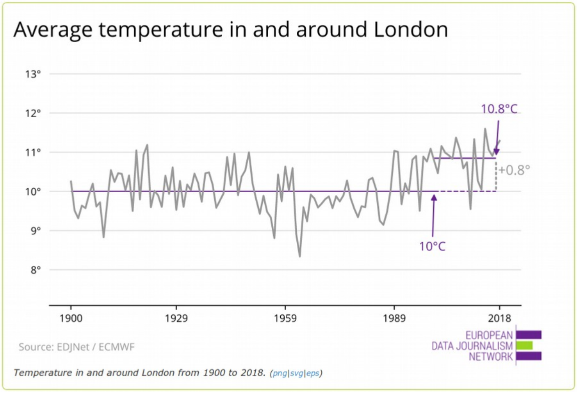
```
import matplotlib
import matplotlib.pyplot as plt
import numpy as np


# Data for plotting
t = np.arange(0.0, 2.0, 0.01)
s = 1 + np.sin(2 * np.pi * t)

fig, ax = plt.subplots()
ax.plot(t, s)

ax.set(xlabel='time (s)', ylabel='voltage (mV)',
       title='About as simple as it gets, folks')
ax.grid()

fig.savefig("test.png")
plt.show()
```



Customisable labels, lines and annotations...

```
matplotlib.axes.Axes.axhline
ax.axhline(y=10yrs_average, color='#6f2c91',
           linewidth=1.5)
```

```
matplotlib.pyplot.annotate
ax.annotate(f'{temperature}°C',
            Xy=(3, 1), xycoords='data',
            xytext=(0.8, 0.95),
            arrowprops=dict(facecolor='#6f2c91'),
            horizontalalignment='right',
            verticalalignment='top')
```



Source: EDJNet / ECMWF

Temperature in and around London from 1900 to 2018. (png|svg|eps)

onedegreewarmer.eu

pandas

$y_{it} = \beta' x_{it} + \mu_i + \epsilon_{it}$

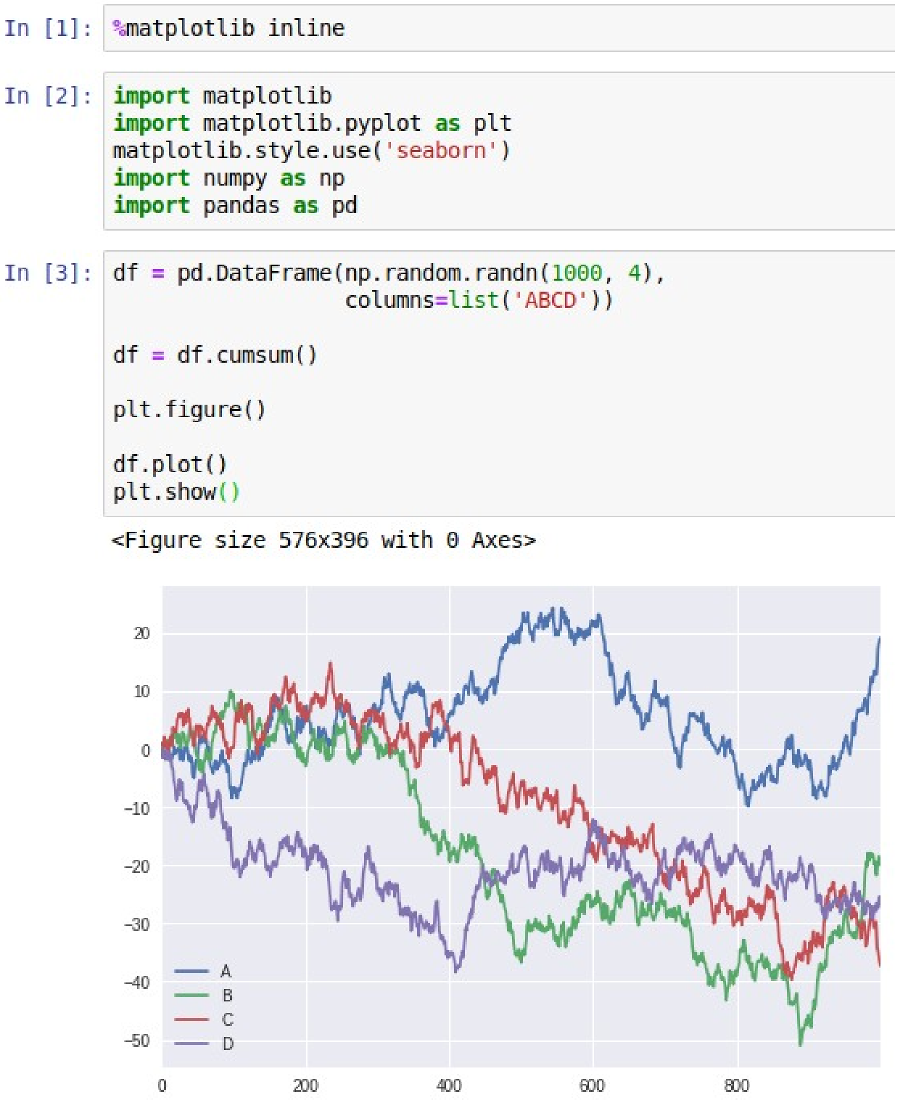
pandas.pydata.org

"[…] high-performance, easy-to-use data structures and data analysis tools for the Python programming language."

Uses Matplotlib for plotting

```
import matplotlib.pyplot as plt
```

```
DataFrame.plot(x=None, y=None, kind='line', ax=None,
               subplots=False, sharex=None, sharey=False,
               layout=None, figsize=None, use_index=True,
               title=None, grid=None, legend=True,
               style=None, logx=False, logy=False,
               loglog=False, xticks=None, yticks=None,
               xlim=None, ylim=None, rot=None,
               fontsize=None, colormap=None,
               table=False, yerr=None, xerr=None,
               secondary_y=False, sort_columns=False, **kwds)
```



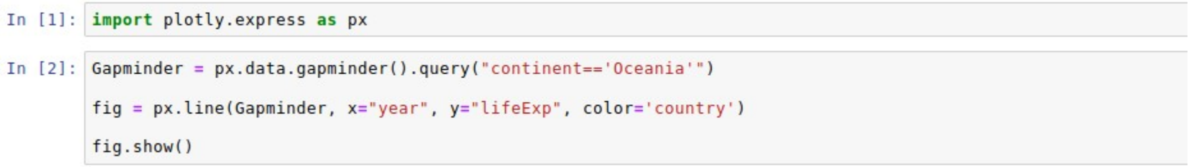
```
In [1]: %matplotlib inline

In [2]: import matplotlib
        import matplotlib.pyplot as plt
        matplotlib.style.use('seaborn')
        import numpy as np
        import pandas as pd

In [3]: df = pd.DataFrame(np.random.randn(1000, 4),
                          columns=list('ABCD'))

        df = df.cumsum()

        plt.figure()

        df.plot()
        plt.show()

        <Figure size 576x396 with 0 Axes>
```

plotly

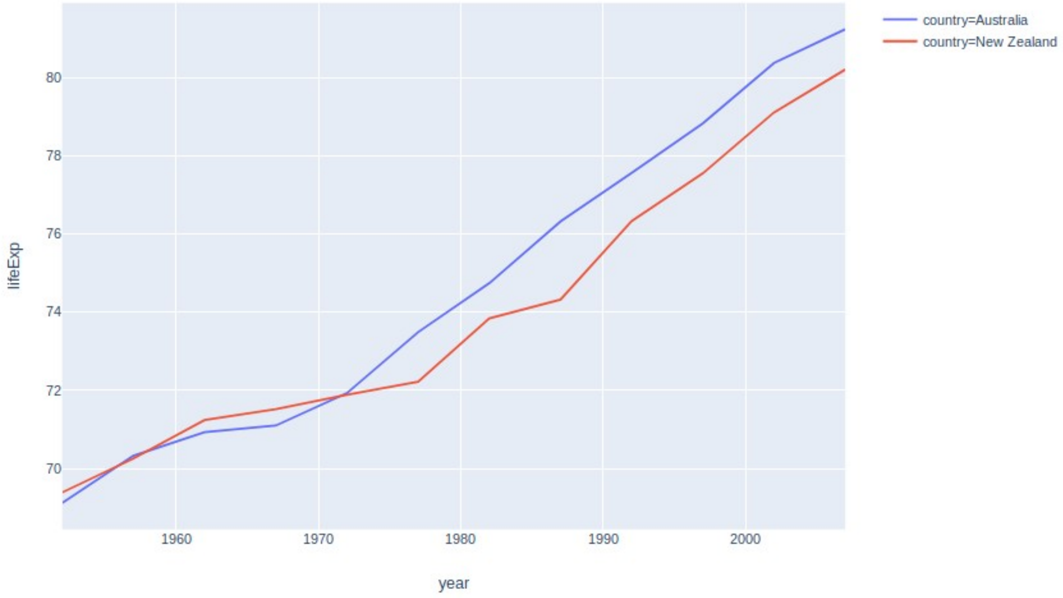
plot.ly/python

Plotly Python Open Source Graphing Library

Plotly's Python graphing library makes interactive, publication-quality graphs. Examples of how to make line plots, scatter plots, area charts, bar charts, error bars, box plots, histograms, heatmaps, subplots, multiple-axes, polar charts, and bubble charts.



```
In [1]: import plotly.express as px

In [2]: Gapminder = px.data.gapminder().query("continent=='Oceania'")
        fig = px.line(Gapminder, x="year", y="lifeExp", color='country')
        fig.show()
```



plotly.py

github.com/plotly/plotly.py

```
pip install plotly==4.1.0
```

Plotly Express

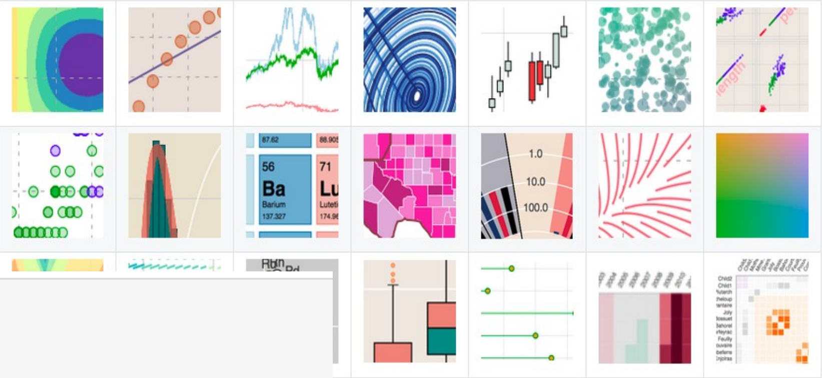
github.com/plotly/plotly_express

```
pip install plotly_express==0.4.1
```

bokeh.org

“Bokeh is an **interactive** visualization library for Python that enables beautiful and meaningful visual presentation of data in modern web browsers.”

github.com/bokeh/bokeh

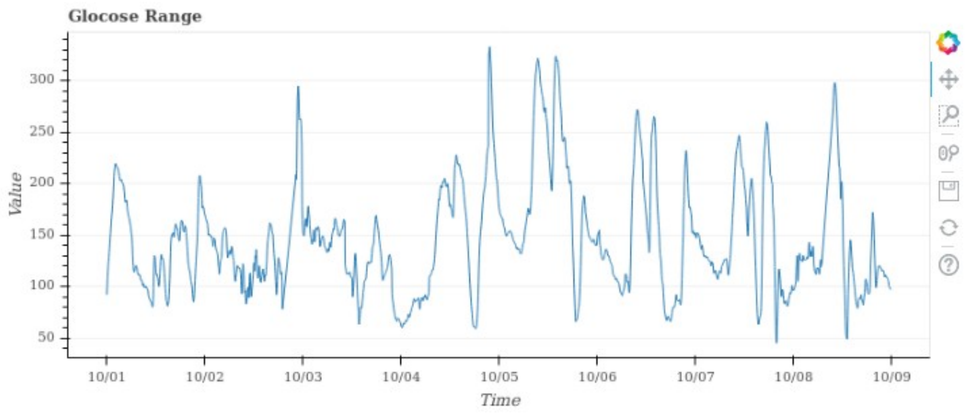


```
In [1]: from bokeh.io import output_notebook, show
        from bokeh.plotting import figure

        # Install bokeh sample data (the first time you run it)
        # import bokeh
        # bokeh.sampledata.download()

        # Glucose sample data requires Pandas to be installed
        from bokeh.sampledata.glucose import data
```

```
In [2]: output_notebook()
```

BokehJS 1.3.4 successfully loaded.

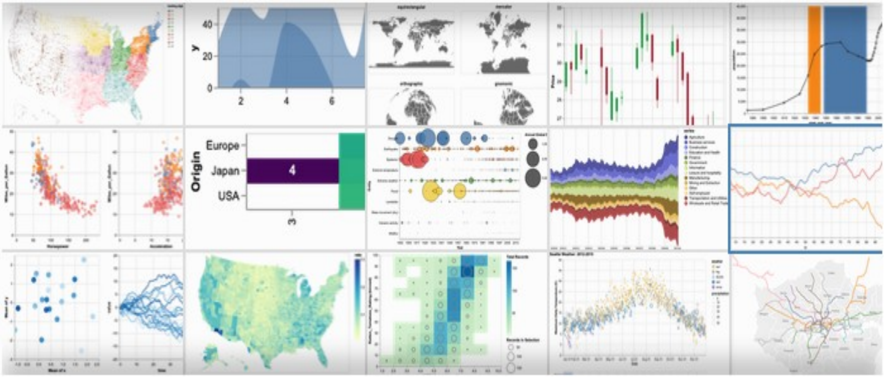
```
In [3]: # reduce data size to one week
        week = data.loc['2010-10-01':'2010-10-08']

        p = figure(x_axis_type="datetime", title="Glocose Range", plot_height=350, plot_width=800)
        p.xgrid.grid_line_color=None
        p.ygrid.grid_line_alpha=0.5
        p.xaxis.axis_label = 'Time'
        p.yaxis.axis_label = 'Value'

        p.line(week.index, week.glucose)

        show(p)
```



altair

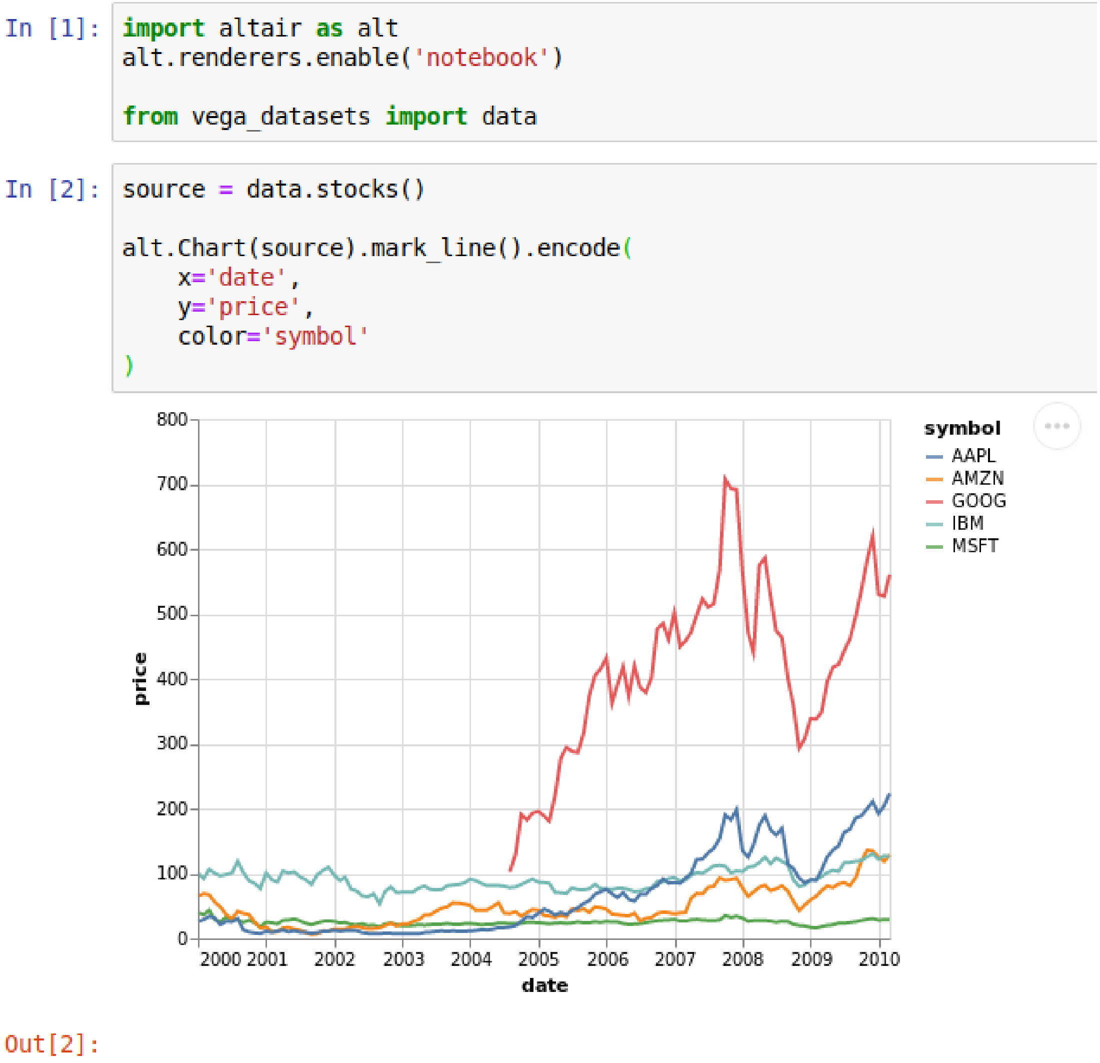
altair-viz.github.io

“Altair is a declarative statistical visualization library for Python, based on Vega and Vega-Lite.”



vega.github.io/vega

“Vega is a visualization grammar, a declarative language for creating, saving, and sharing **interactive** visualization designs.”



```
In [1]: import altair as alt
        alt.renderers.enable('notebook')

        from vega_datasets import data
```

```
In [2]: source = data.stocks()

        alt.Chart(source).mark_line().encode(
            x='date',
            y='price',
            color='symbol'
        )
```

Out[2]:

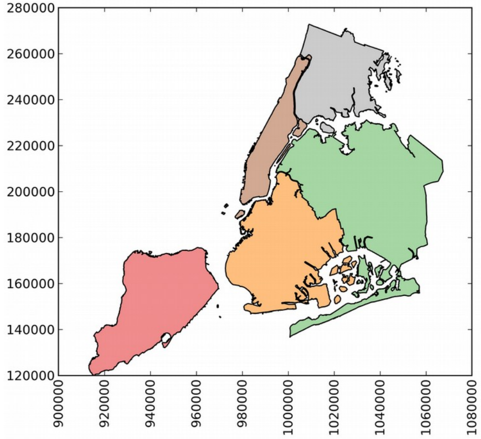
summary

	Best for	Challenges
matplotlib	Complex or customised plots	Syntax can become tricky
pandas	Plotting during data analysis	Not the most aesthetic → try Seaborn
plotly	Notebook or plain html report	Mainained by a private company
Bokeh	Interactive plots or dashboards	Tricky to create dashboard apps
	Interactive plots and maps	One main maintainer

geospatial

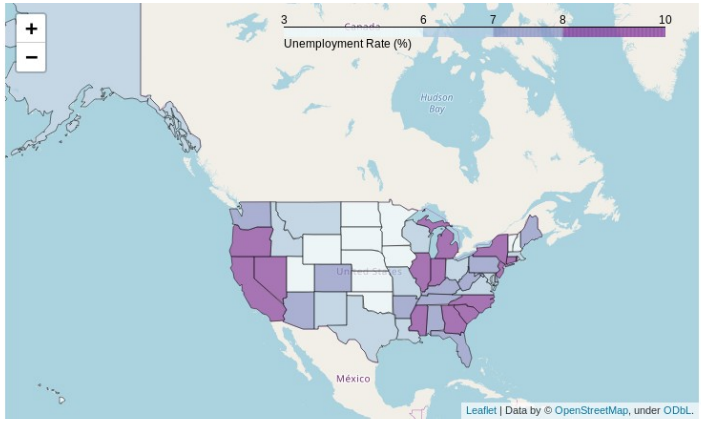
GeoPandas

https://github.com/geopandas/geopandas



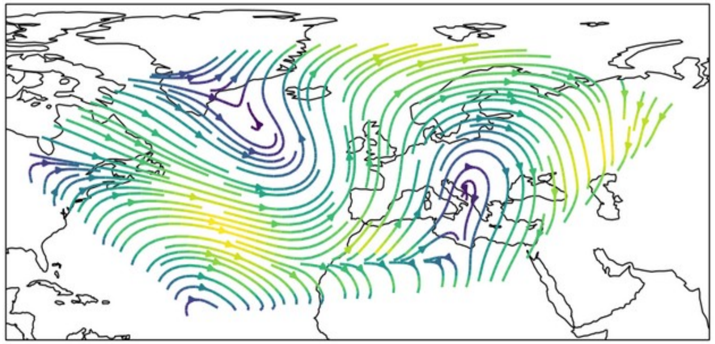
Folium

https://github.com/python-visualization/folium



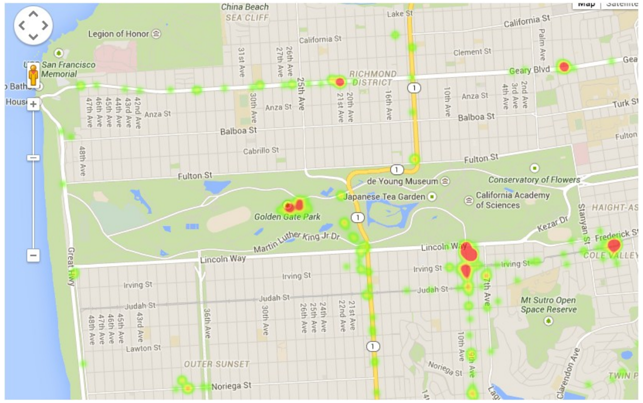
CartoPy

https://github.com/SciTools/cartopy



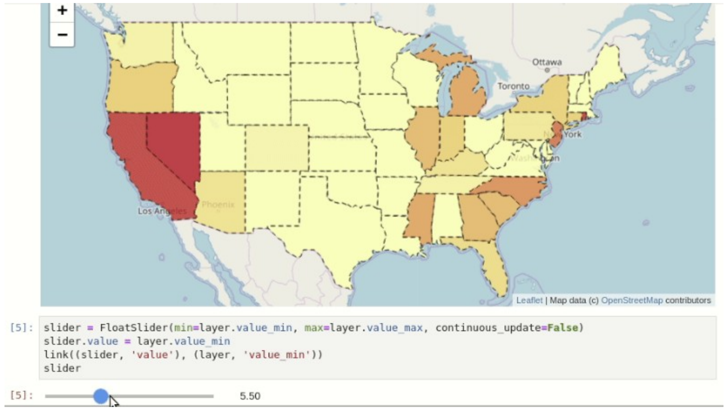
gmplot

https://github.com/vgm64/gmplot



ipyleaflet

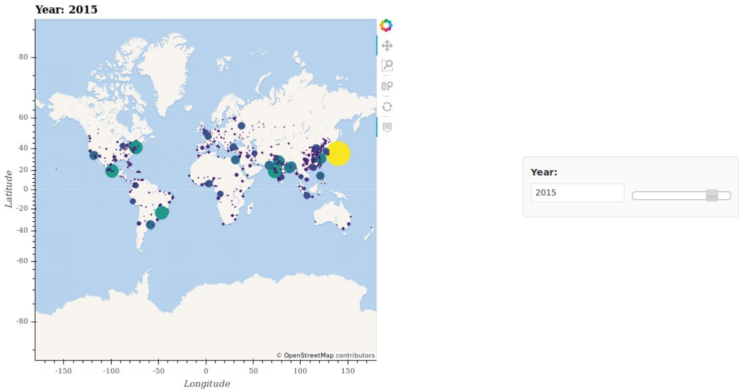
https://github.com/jupyter-widgets/ipyleaflet



```
[5]: slider = FloatSlider(min=layer.value_min, max=layer.value_max, continuous_update=False)
     slider.value = layer.value_min
     link((slider, 'value'), (layer, 'value_min'))
     slider

[5]:                          5.50
```

geoviews

https://github.com/pyviz/geoviews



Thank you

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github.com/Eleonore9/tour_dataviz_python

- Exhaustive list of Python tools for data viz: pyviz.org/tools.html
- Libraries mentioned:
  - matplotlib.org
  - pandas.pydata.org
  - plot.ly
  - bokeh.org
  - altair-viz.github.io