HKUST
VISLAB

COMP 4462
Data Visualization Tutorial

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https://bit.ly/vis-t05

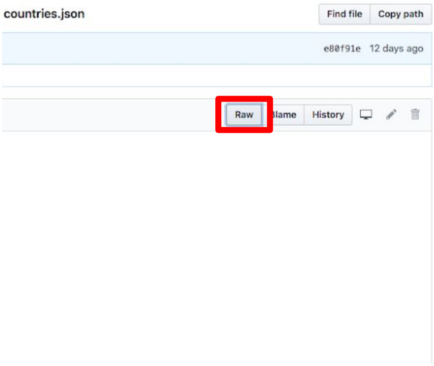
Pandas and visualization

- Pandas
  - Best data processing library
    - Fast and easy to use, inspired by R language
    - Can handle large dataset as long as it fits in memory (with some workarounds if not)
  - Can read many common file formats, e.g. csv, json, xlsx, sql
  - Easy to make plots with matplotlib / seaborn / bokeh / **altair**
  - Easy to pass data around with different libraries, like numpy, scikit-learn, etc.
- Altair
  - Designed to work with pandas
  - API designed with visualization language
    - Marks, encoding channels, data types, scale, interaction idioms, layers, facet
    - Backed by Vega-Lite, which is backed by D3.js
  - Web based visualization
    - Passing visualization specification to Jupyter notebook, then visualize by browser with js
    - matplotlib / seaborn are python based on native GUI

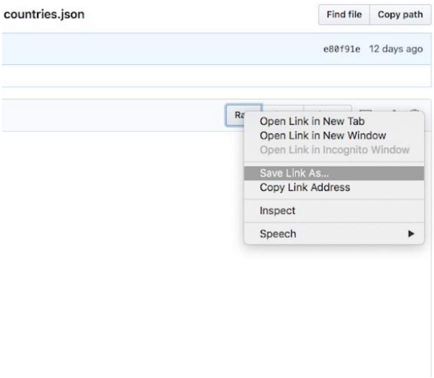
Download dataset from GitHub

1. Go to the tutorial repository
2. Go to the dataset file you want download, e.g. countries.json

3. Right click “Raw”



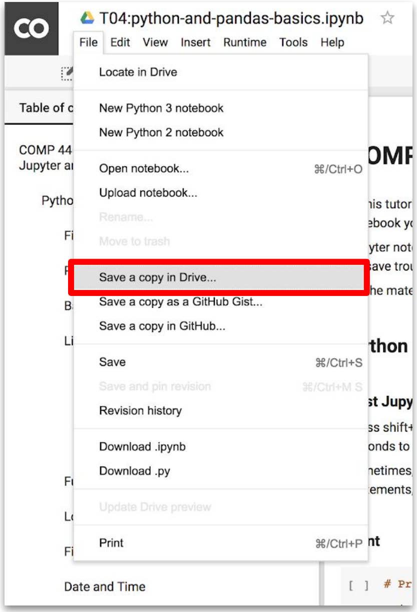
4. Save as file



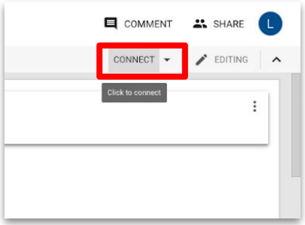
Google Colab

1. Sign in your Google account
2. Go to the [notebook of this tutorial]()

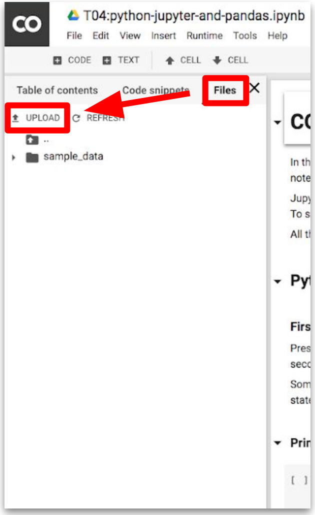
3. Make a copy



4. Connect



5. Upload dataset



Pandas / Altair

- See the Jupyter notebook on Google Colab
- Topics on Pandas:
  - Load data (csv, json) / summary / clean data / handle null values
  - Data selection / filter
  - Sort / groupby / aggregate
  - Join dataframes
  - Pivot and melt
  - Rename column / compute new attributes
- Topics on Altair:
  - Marks, encoding, scale
  - Basic charting (bar chart / line chart / scatter plot)
  - Multiplots / juxtapose (side-by-side)
  - Interactions / interactive filtering

Lab exercise

- Tasks
  - Open this Google Colab notebook, make a copy and connect
  - Download countries dataset (countries.json) from GitHub
  - Read through the notebook and fill in the “TODO” cells
  - Find out the top songs / artists in the world, different continents or regions
  - Find out the trends of your favorite songs / artists over the year
  - Plot your findings
  - Print the whole web page as .pdf and upload to Canvas
- Optional
  - If you like this tutorial so far, star our GitHub repository ⭐⭐⭐Thank you! ❤️
  - Explore the Spotify dataset
    - Find out more about your favorite songs / artists
    - Find out songs you may like
  - You may further explore with the Spotify Song Attributes dataset
    - A lot of interesting attributes: “danceability”, “energy”, “instrumentalness”, etc.
  - Do the lab with music!

More topics on Pandas and Visualization

- More on Pandas
  - **Dataframe**: load data from python objects / feather data format / slicing with selector / dataframe indexing / hierarchical indexing / data join (inner, outter, left, right)
  - **Data cleaning**: fill in missing value / interpolation / discretization and binning / permutation and random sampling / string operation / regex
  - **Grouping operations**: split-apply-combine / customized aggregation functions
  - **With other data science libraries**: scikit-learn / statsmodels / weighted average / correlation / regression
  - **Plotting libraries**: matplotlib / seaborn / bokeh / plotly
- More on Altair
  - **Charts**: stacked (bar, area) charts / streamgraph / histogram / maps
  - **Adjust charts elements**: axis / labels / legends / colors
  - **Data transformation**: aggregate / bin / custom calculation
  - **Interactions**: binding / brush / pan and zoom / selection
  - **Compound Charts**: overlay / horizontal concat / vertical concat / faceted / repeated charts

Next tutorial

Javascript basics and Observable

- Register on Observable
  - A notebook like environment
    - But with Javascript and solely on browser
    - Interactive
    - Design for visualization
  - Free!
  - No setup