

June 4th, 2018

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Jupyter & Education



About Me



Matthias Bussonnier

- A Physicist/Bio-Physicist
- Core contributor of IPython/Jupyter since 2012
- Co-founder, and Steering Council member
- Post doctoral Scholar on Jupyter at BIDS

A short history



- 2001: Fernando Pérez Wrote “**IPython**”
- 2012: Birth of IPython **Notebook** (6th prototype)
 - Make IPython “network enabled”
 - Made possible by mature web tech.
- 2013: First non-Python (**Julia**) kernel
- 2014: We **renamed** the Python-Agnostic part to **Jupyter**.
- 2018:
 - Several millions users
 - Jupyter increasingly used in Education.



Contributors



- 500+ Open source contributors
- Organisation with Open Governance



Sponsors



ALFRED P. SLOAN
FOUNDATION

NUMFOCUS
OPEN CODE = BETTER SCIENCE

THE LEONA M. AND HARRY B.
HELMSLEY
CHARITABLE TRUST

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CONTINUUM
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Bloomberg

POWERED BY
rackspace®
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How Jupyter came to be



Life cycle of a Scientific Idea

- Individual exploratory work
- Collaborative development
- Parallel production runs (HPC, cloud, ...)
- Publication & communication (reproducibly!)
- Education
- Goto 1



**“The purpose of computing is insight,
not numbers”**

–Hamming'62

Life cycle of a Scientific Idea

- Individual exploratory work (Repl, Scripts)
- Collaborative development (Dropbox/ Google Doc / emails / git)
- Parallel production runs (MPI, rewrite C++, batch jobs)
- Publication & communication (Word, Latex, ppt...)
- Education
- Goto 1



Rise of Jupyter

- An increasing number of discipline have a fast growing amount of data
- Technology is **a tool** that should
 - Empower **the User**
 - Amplify **Domain Knowledge and Expertise**
 - Facilitate **Sharing and Collaboration**

Jupyter provide a framework that can be use in all the step in the cycle of a scientific idea



What is Jupyter

Individual,Collaboration,Parallel,Publication,Education

- Mainly Known for **The Notebook**

- Web server, a web app, containing code, narrative,

math and results.

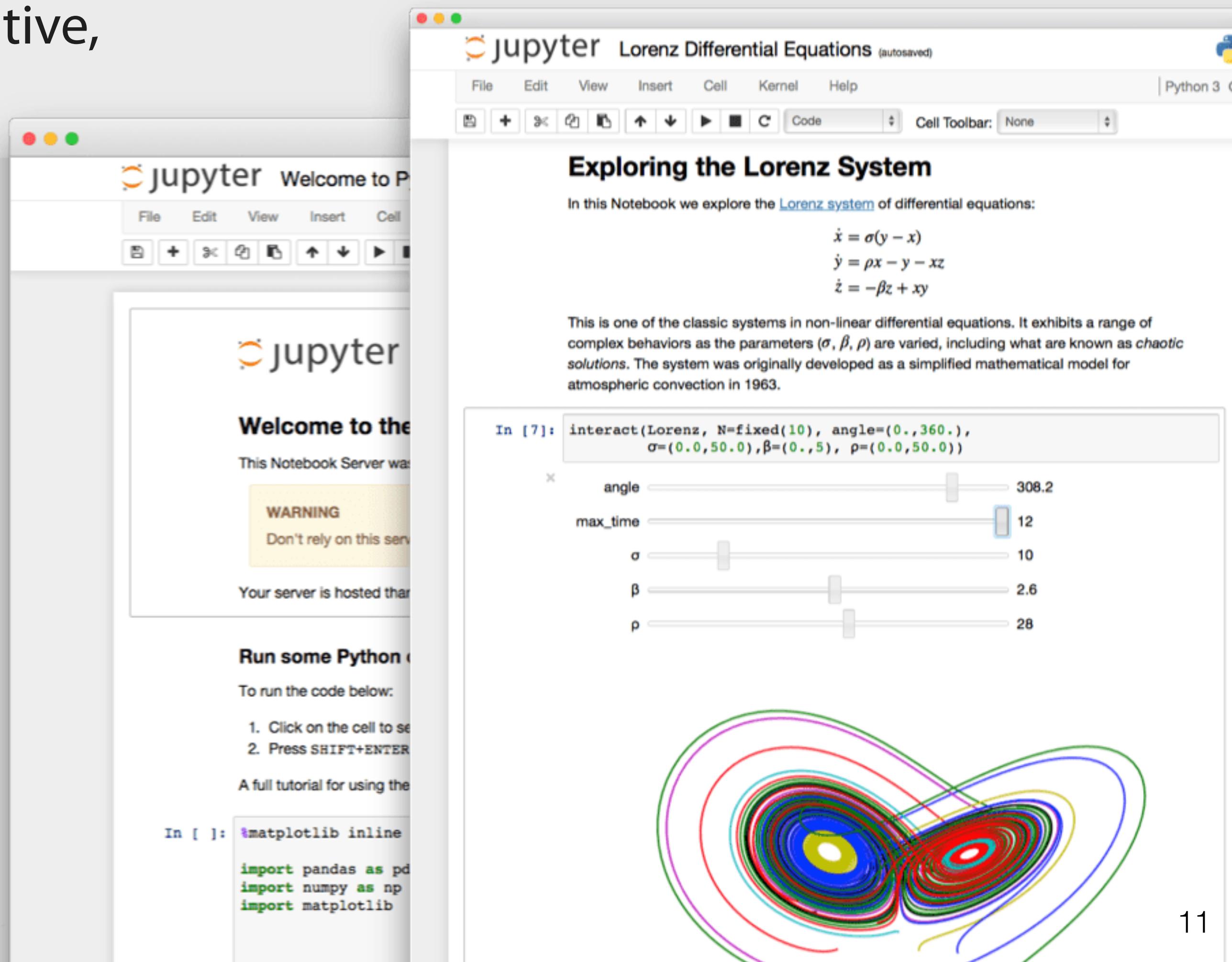
- Attached to a **Kernel** doing computation.

- Results can be:

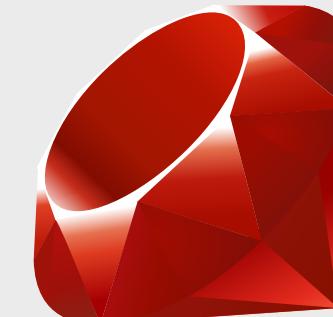
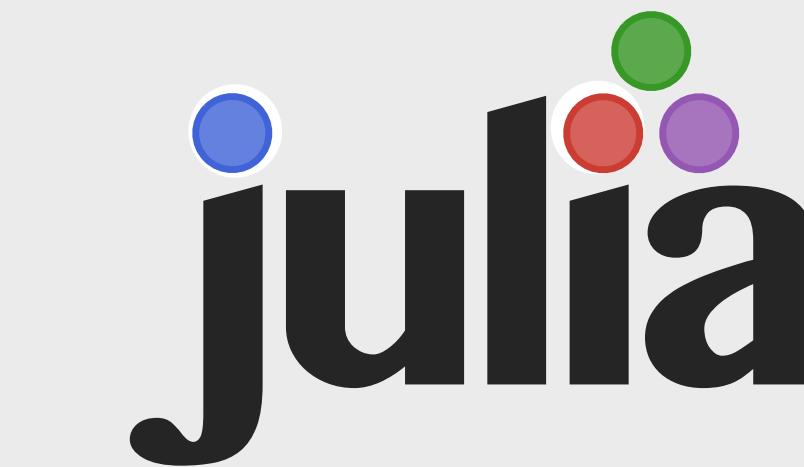
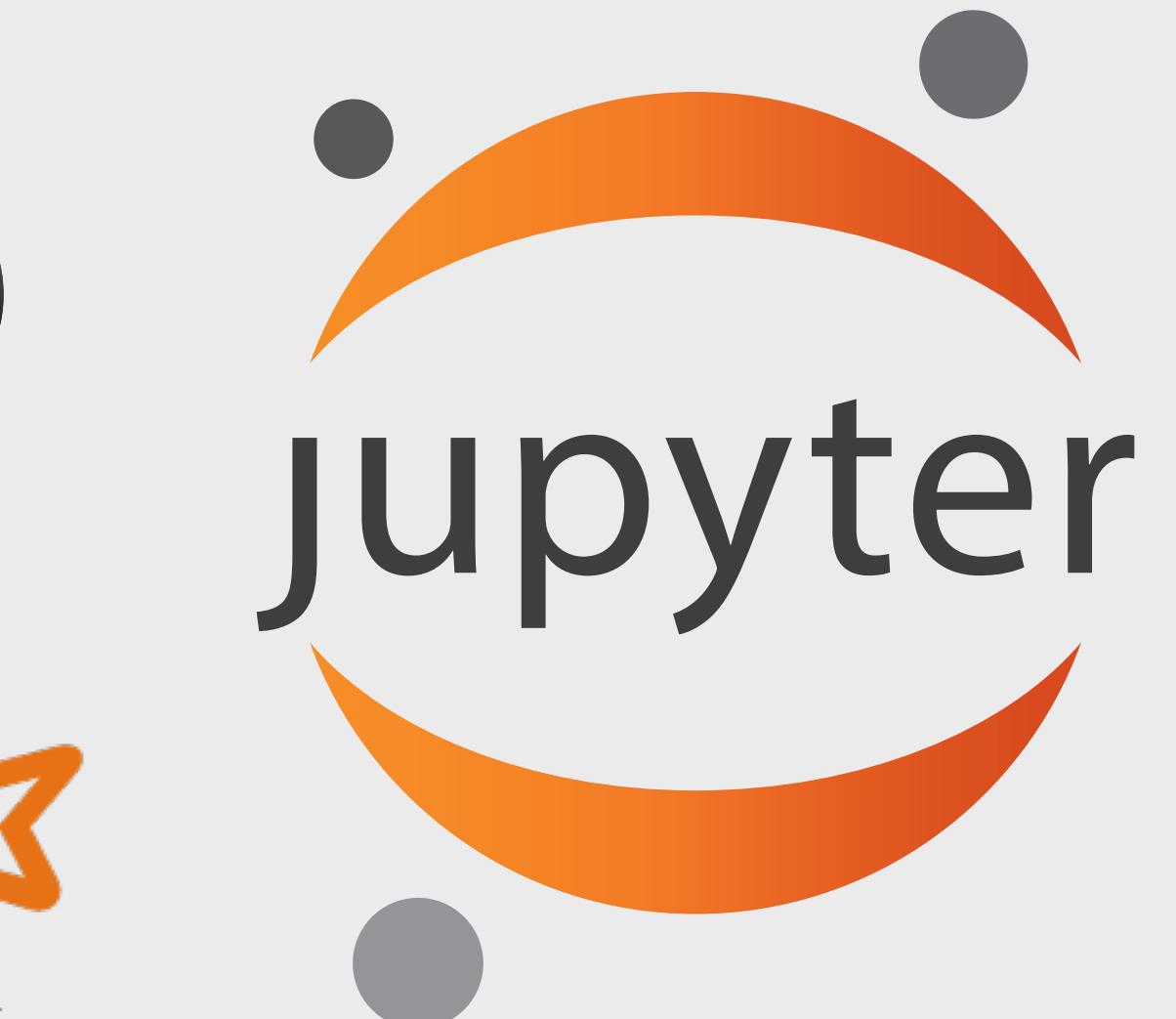
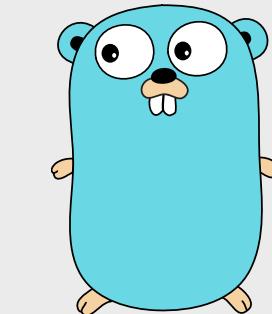
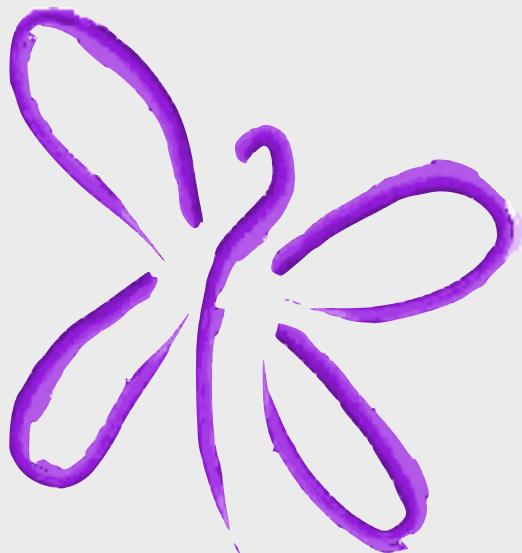
- Static (Image)

- Interactive (client-side scroll/pan/brush)

- Dynamic (Call back into Kernel)



Many languages



...

An article about computational science in a scientific publication is **not** the scholarship itself, it is merely **advertising** of the scholarship. The **actual scholarship** is the complete software development environment and the complete set of instructions which generated the figures.

Buckheit and Donoho, WaveLab and Reproducible Research, 1995

MENU ▾ nature microbiology

Altmetric: 202 Views: 823 More detail >

Letter

Dog and human inflammatory bowel disease rely on overlapping yet distinct dysbiosis networks

Yoshiki Vázquez-Baeza, Embriette R. Hyde, Jan S. Suchodolski & Rob Knight ✉

Nature Microbiology 1, Article number: 16177 (2016) doi:10.1038/nmicrobiol.2016.177 Download Citation

Dysbiosis Inflammatory bowel disease

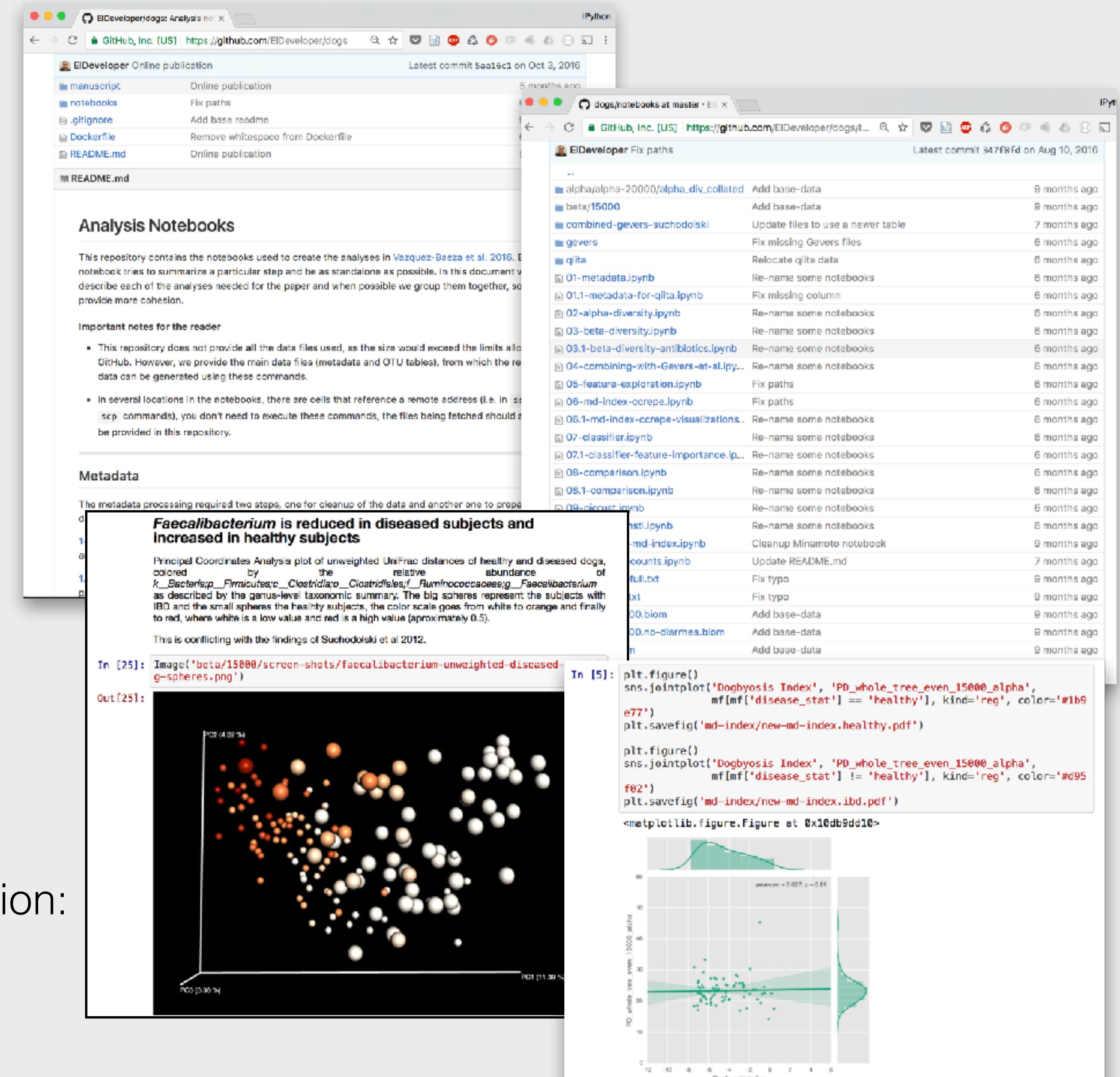
Microbiome Molecular medicine



Advertising

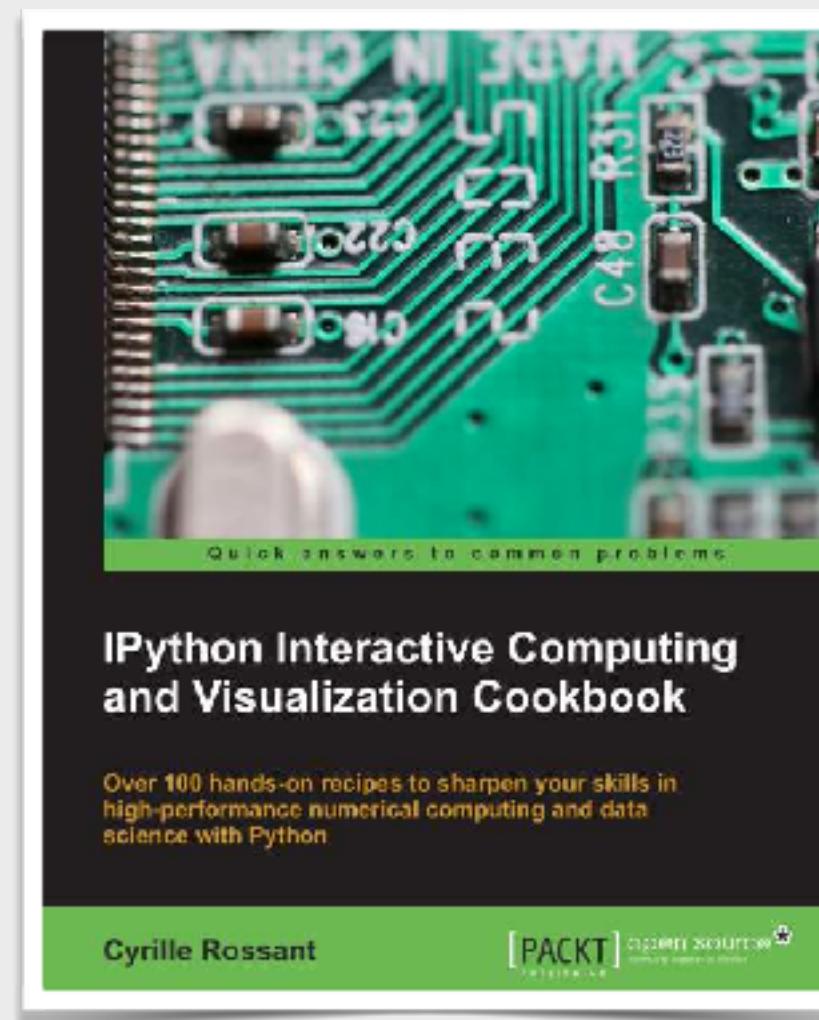
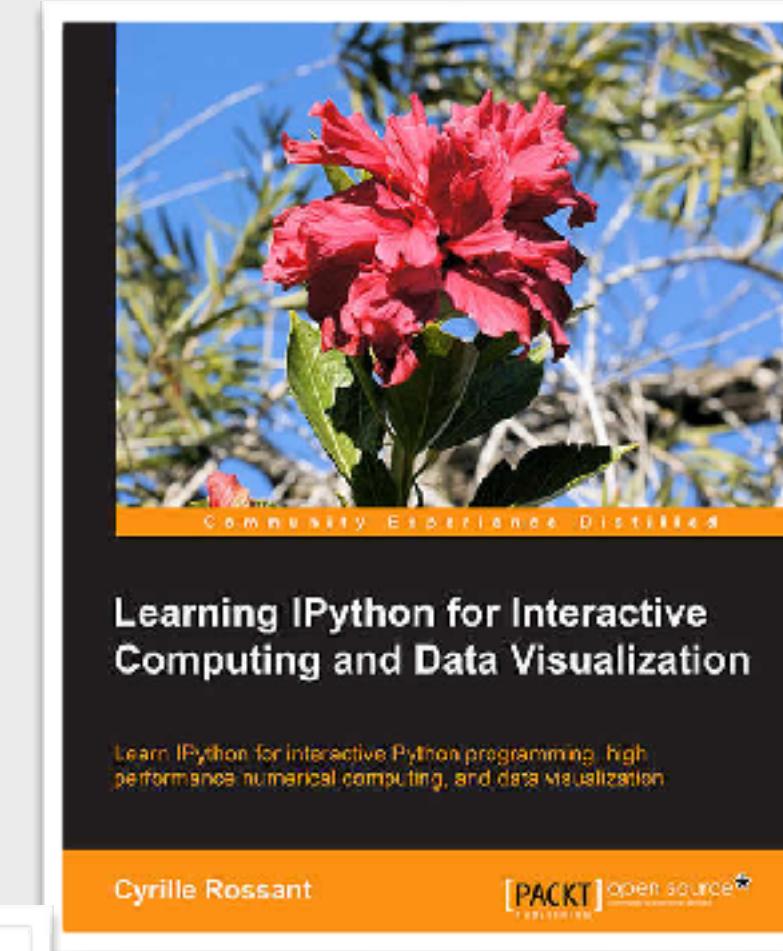
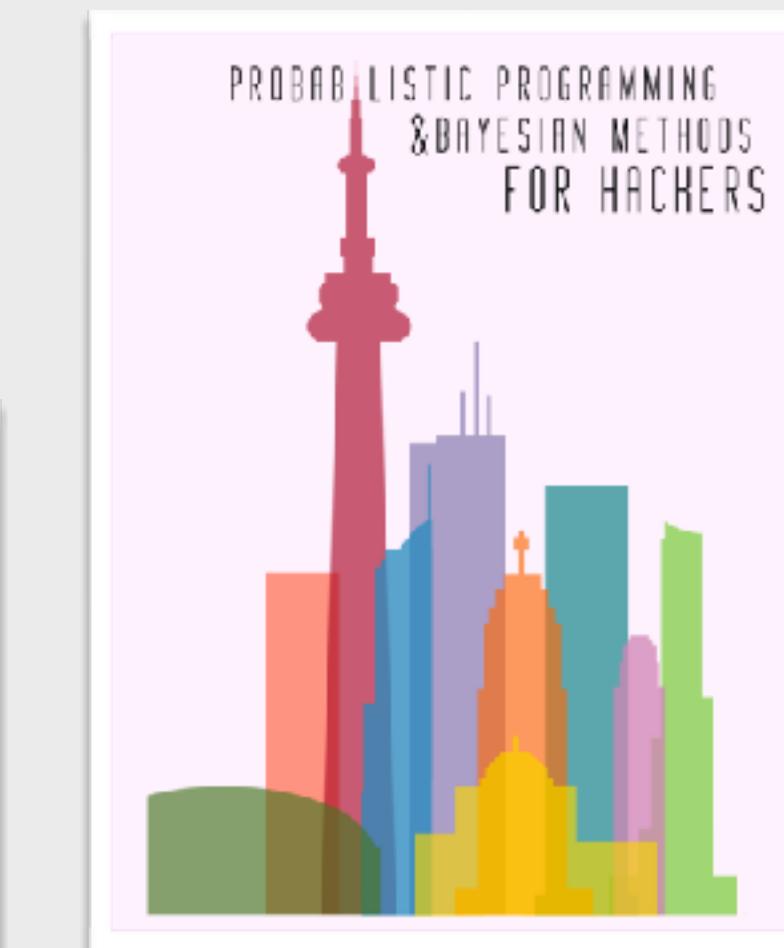
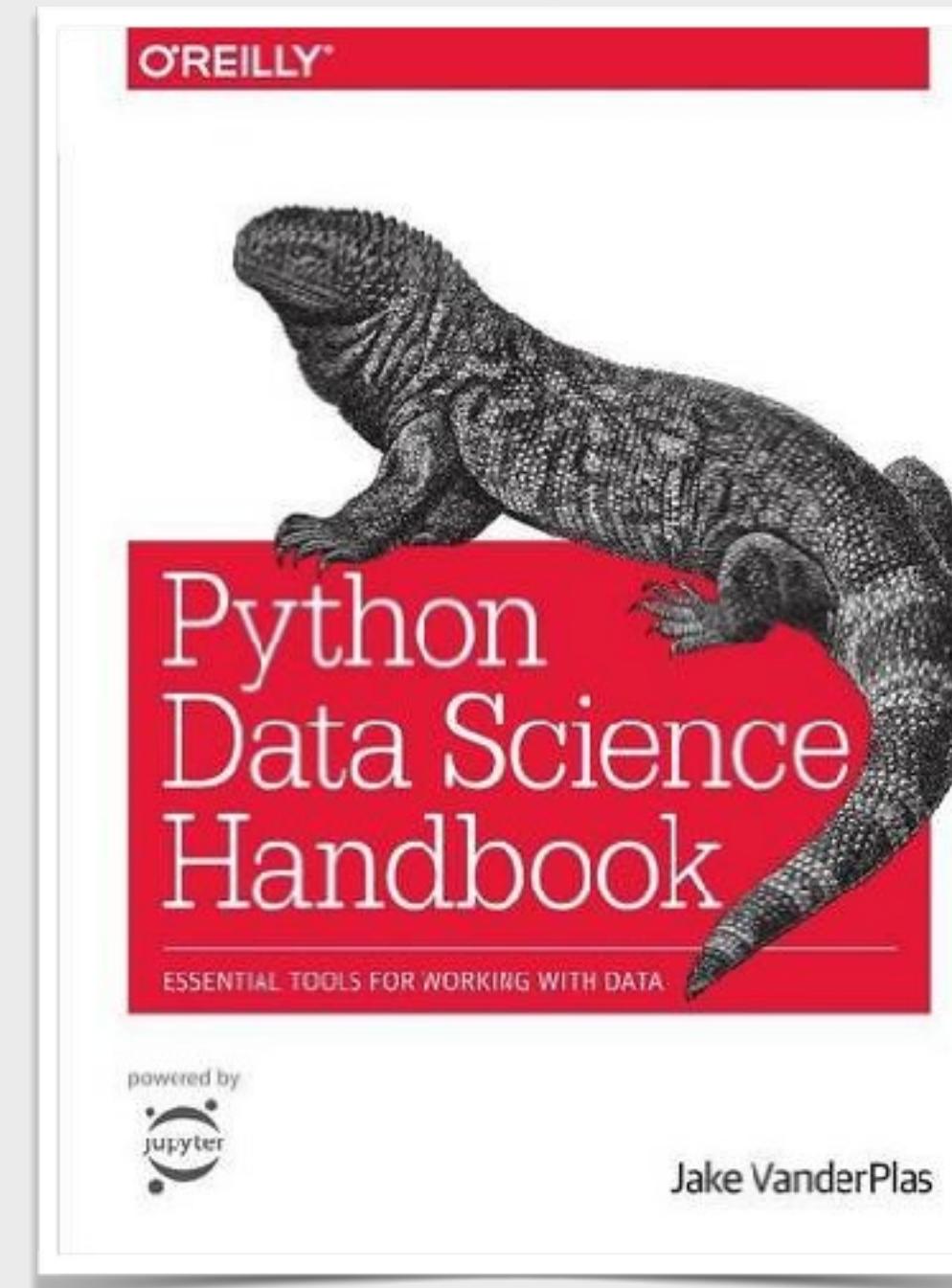
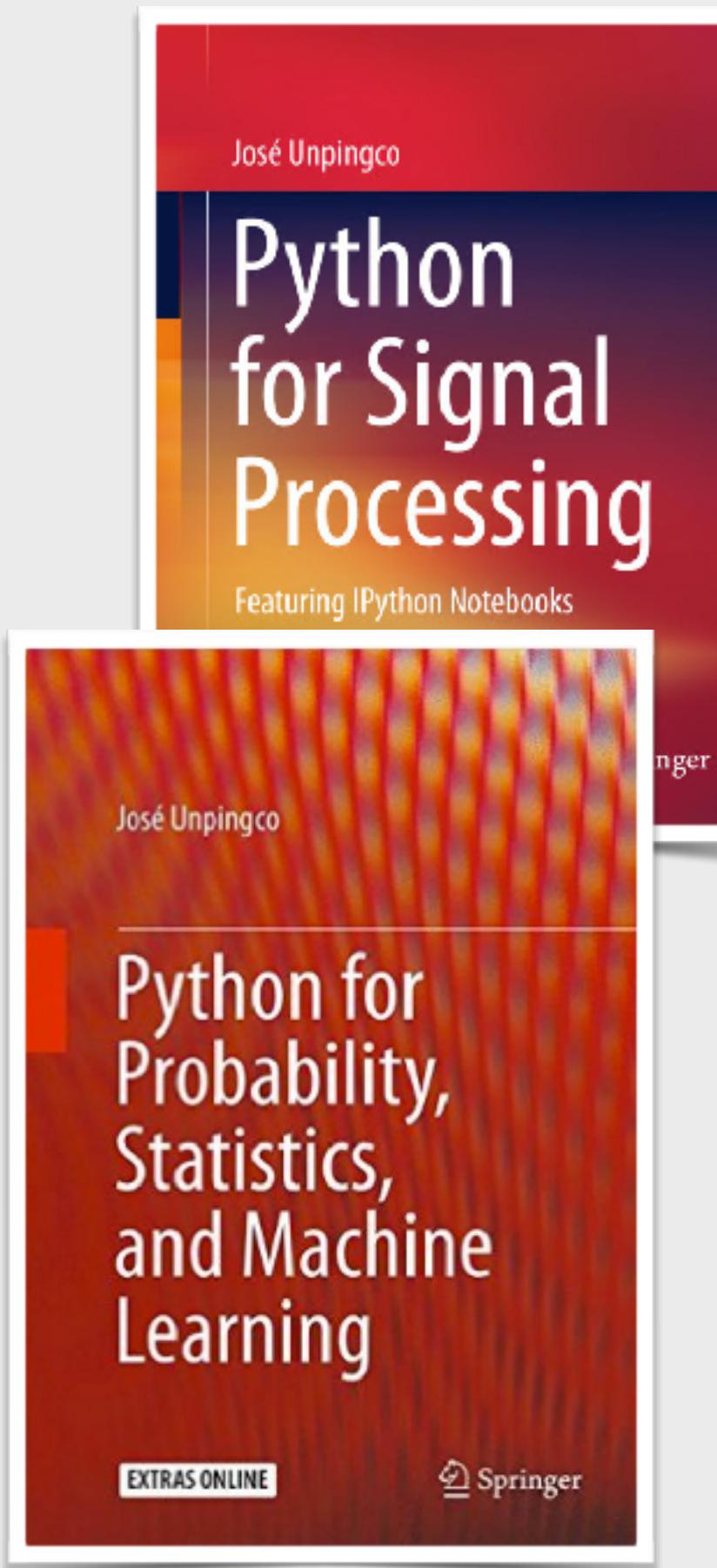
Full code and specific discussion:
executable supplementary
materials:

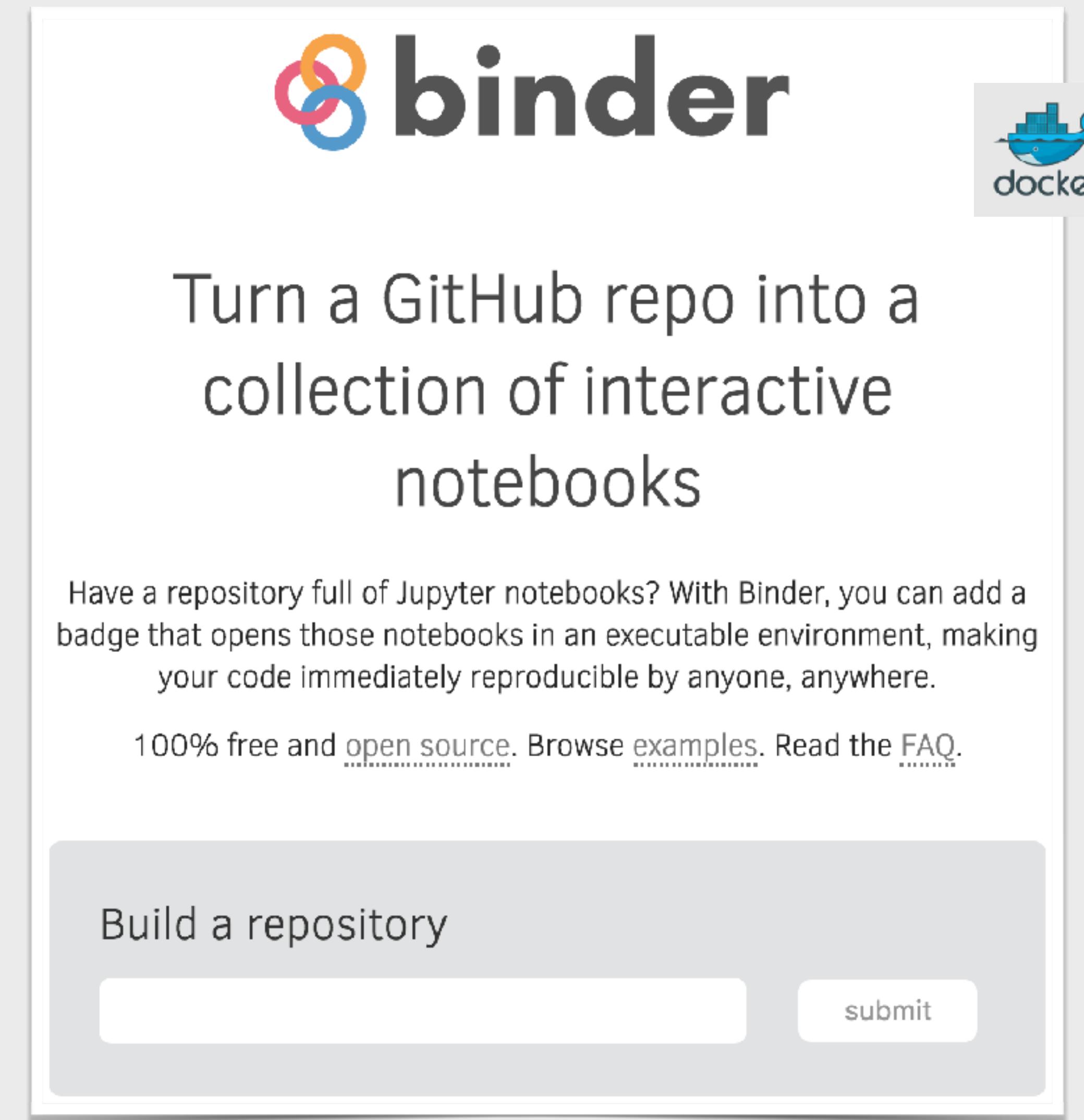
“computational companions”



<https://github.com/ELDeveloper/dogs>

Executable books





The image shows the MyBinder.org landing page. At the top left is the MyBinder logo, which consists of three overlapping circles in orange, red, and blue. To the right of the logo is the word "binder" in a large, bold, dark gray sans-serif font. Above the "binder" text is a small white square icon with a thin black border. To the right of the "binder" text is a "docker" logo featuring a blue whale icon above the word "docker". Below the main title is a large, centered text block that reads: "Turn a GitHub repo into a collection of interactive notebooks". Underneath this text is a descriptive paragraph: "Have a repository full of Jupyter notebooks? With Binder, you can add a badge that opens those notebooks in an executable environment, making your code immediately reproducible by anyone, anywhere." Below this paragraph is a line of text: "100% free and [open source](#). Browse [examples](#). Read the [FAQ](#)." At the bottom of the page is a large, light-gray button with rounded corners. Inside the button, the text "Build a repository" is centered in a dark gray font. Below this text is a long, thin input field for pasting a GitHub repository URL. To the right of the input field is a small, rectangular "submit" button with a thin black border and a white background.

binder

Turn a GitHub repo into a collection of interactive notebooks

Have a repository full of Jupyter notebooks? With Binder, you can add a badge that opens those notebooks in an executable environment, making your code immediately reproducible by anyone, anywhere.

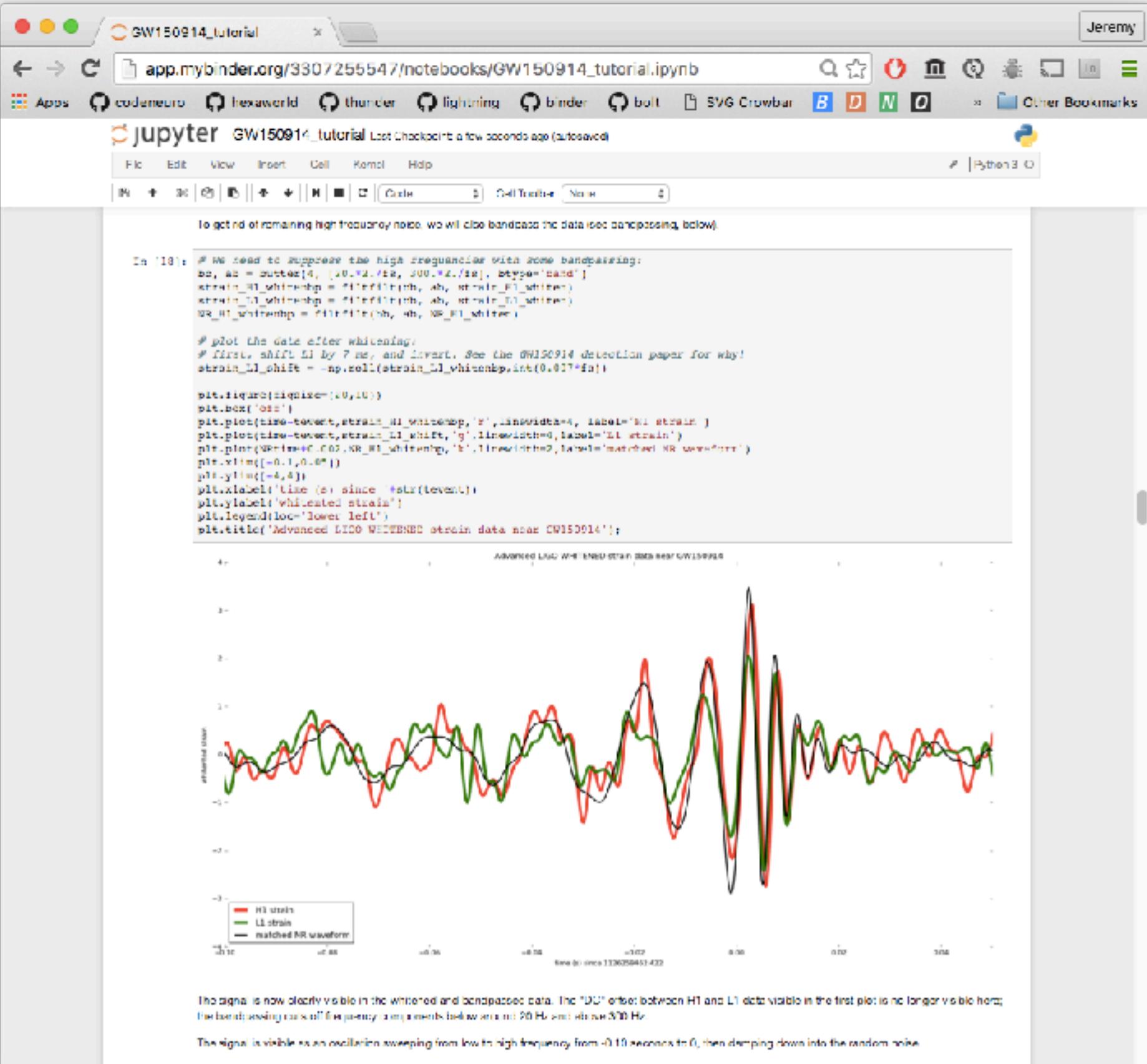
100% free and [open source](#). Browse [examples](#). Read the [FAQ](#).

Build a repository

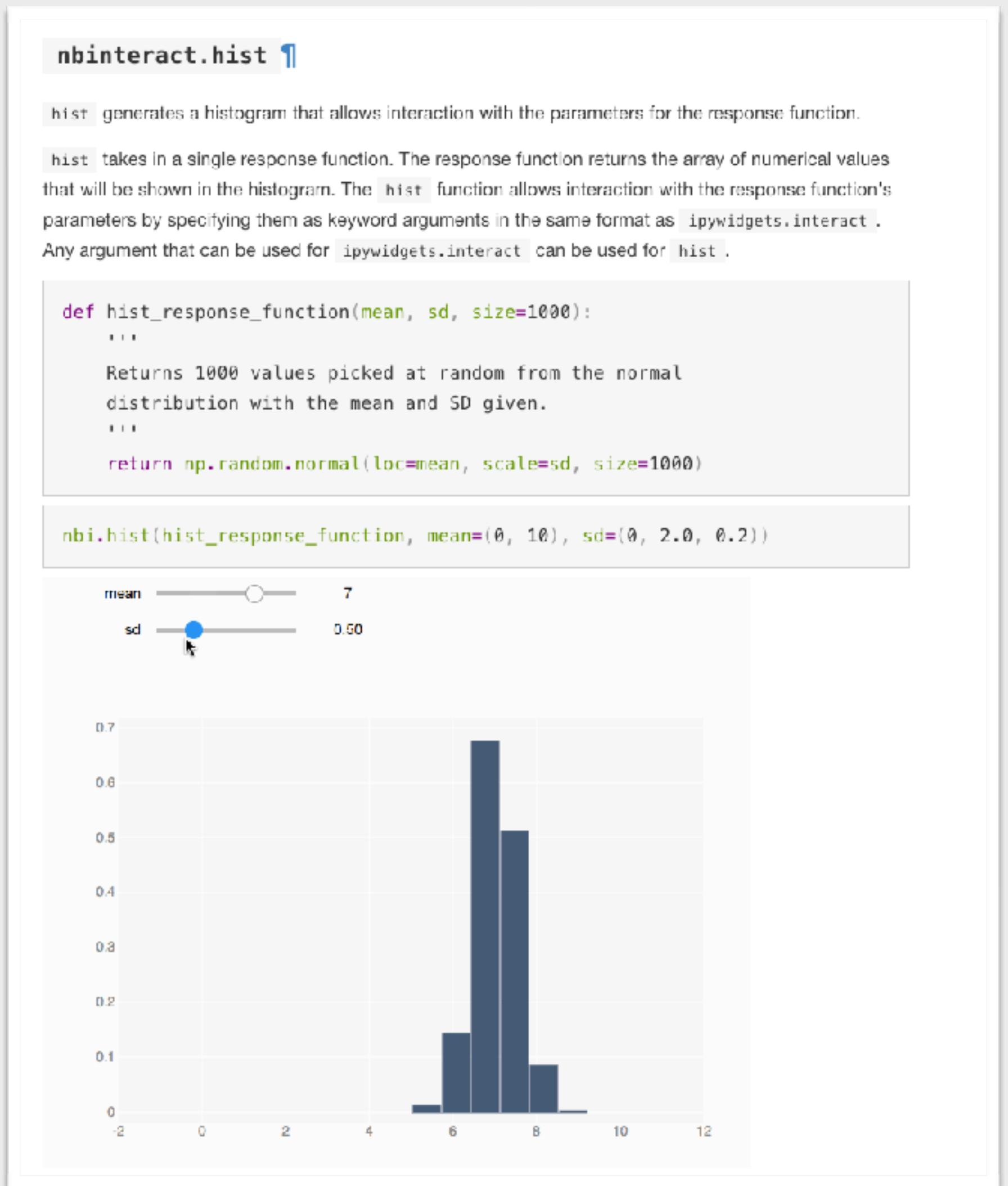
submit



Ligo binder



NbInteract



In the classroom





DataHub

datahub.berkeley.edu



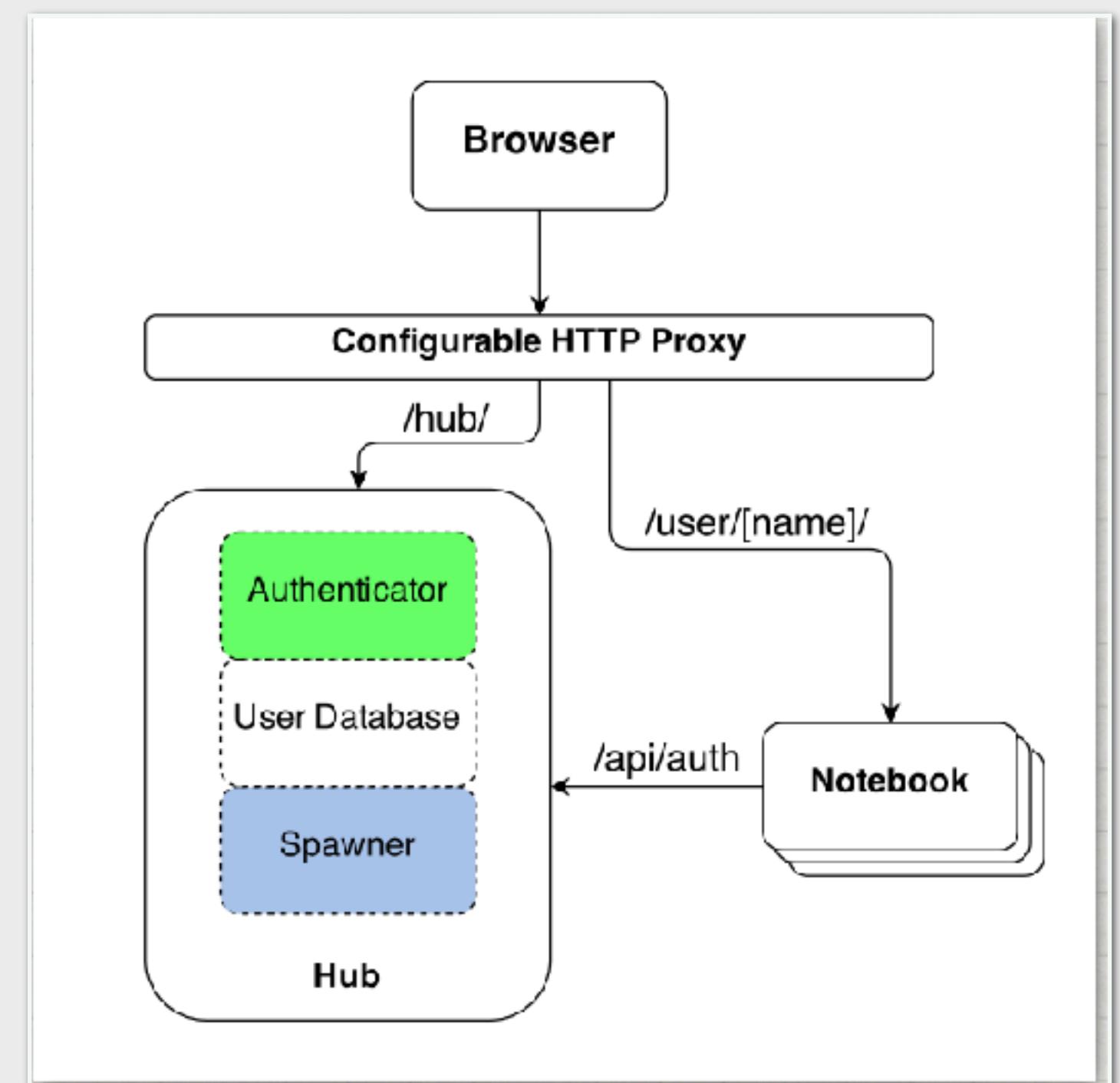
<http://www.ds100.org/>

Zero setup*



- Campus Wide deployment
- Login with Cal ID
- Can focus on Domain Knowledge

Students can still optionally install
Jupyter on their machine later on.



* At least for students



Autograding

- Via Nbgrader
- Generate “Students” version of the notebook
- Partial auto grading
 - Frees up a lo of TA time.



J. Hamrick
Deep Mind



B. Granger
Cal Poly



Fernando Pérez
UC Berkeley

jupyter Problem 1 Last Checkpoint: a few seconds ago (autosaved) | Python 3

File Edit View Insert Cell Kernel Help

Cell Toolbar: None

Part A (2 points)

Write code to compute the mean of a list of numbers.

```
In [ ]: def mean(x):
    """Compute the mean of a list of numbers given in `x`."""
    ### BEGIN SOLUTION
    return sum(x) / len(x)
    ### END SOLUTION
```

```
In [ ]: """Check that the `mean` function is correct."""
assert mean([1]) == 1.0
assert mean([1, 2]) == 1.5
assert mean([5.5, 0, 2, 3.4]) == 2.725
assert mean(range(100)) == 49.5
assert mean(range(100, 0, -1)) == 50.5
```

Part B (3 points)

Describe the difference between an *arithmetic mean*, a *harmonic mean*, and a *geometric mean*.

Arithmetic mean:

$$\frac{1}{N} \sum x_i$$


MOOCS



Ani Adhikari



John DeNero

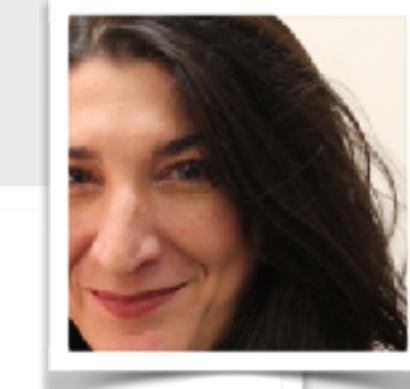


David Wagner

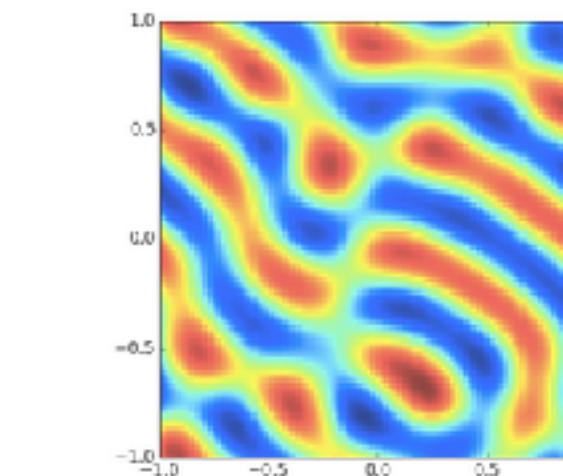
Foundation of Data Science
(edX/ Berkeley)



Practical Numerical Methods



Lorena Barba

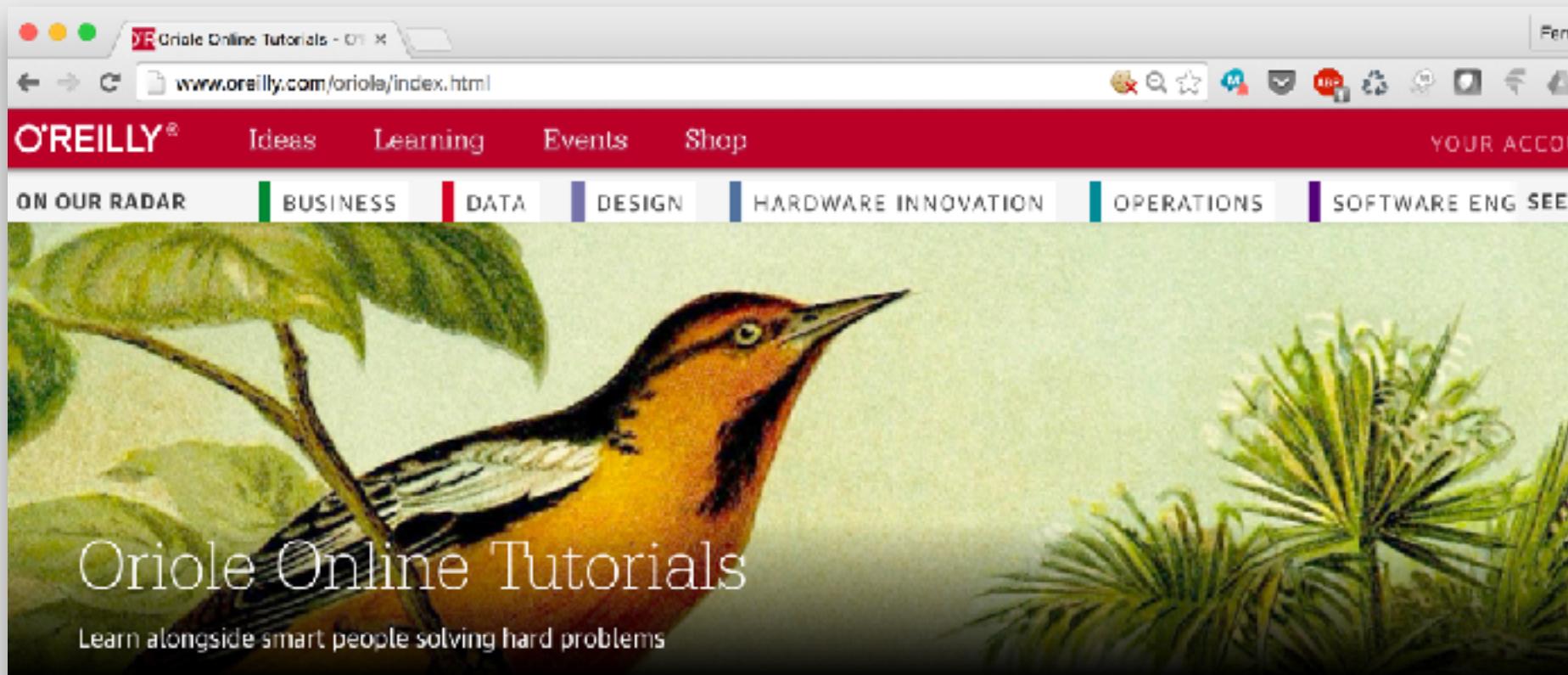


Pattern formation:
solution for a reaction-diffusion system like:

$$u_t = \delta D_1 \nabla^2 u + f(u, v)$$
$$v_t = \delta D_2 \nabla^2 v + g(u, v)$$

An example of the types of problems we will learn to solve in this course, among others governed by differential equations.

Oriole: executable, video-narrated tutorials



Oriole is a unique new medium that blends code, data, text, and video into a narrated learning experience with executable content.

Led by some of the most brilliant minds in technology, each lesson is an easily digestible and engaging thought-by-thought tour of the instructor's approach to the problem in both narrative and executable code. No set-up or installation is necessary; Oriole Online Tutorials require nothing more than an internet connection and a laptop. You can write and run code within the environment. Make a mistake? Change it, and try again.

Oriole combines the expert insight and hands-on learning of in-person or online courses with the on-demand, at-your-own desk, back-up-and-run-it-again convenience of video training. You learn by doing, on your own schedule, and at your own pace.



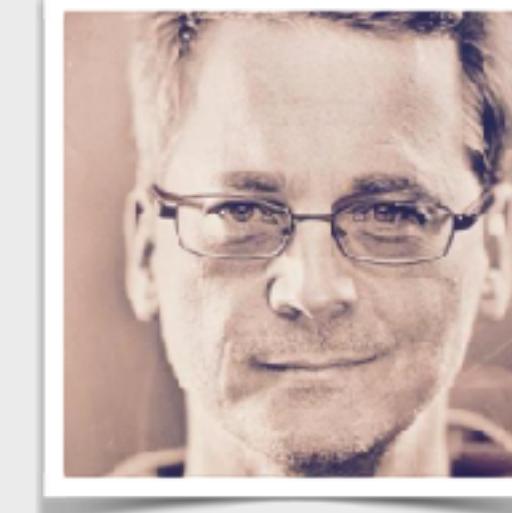
Paco Nathan



Taylor Martin

In Oriole, we get the complete integration of video synchronized with the flow of the text, as well as the ability to execute the code: **this is probably as close as we can get to learning side-by-side with Peter himself.**

Fernando Perez, creator of IPython, which evolved into Project Jupyter.



Andrew Odewahn

A screenshot of a web browser showing a regex-golf tutorial. The page has a sidebar with a cartoon strip titled "HEYA-REGEX GOLF" about a competition between arbitrary lists. The main content area shows a video player with a thumbnail of Peter Norvig. Below the video, text says "We have now fulfilled panel two of the strip. Let's try another example, separating the top ten best-selling drugs from the top 10 cities to visit:". A code editor window shows Python code for generating a report of drugs and cities. At the bottom, a text input field contains a regular expression pattern: "e.s|x|l|q|b|en".



oreilly.com/learning/regex-golf-with-peter-norvig

The Future ?



JupyterLab

- Extends the notebook interface with text

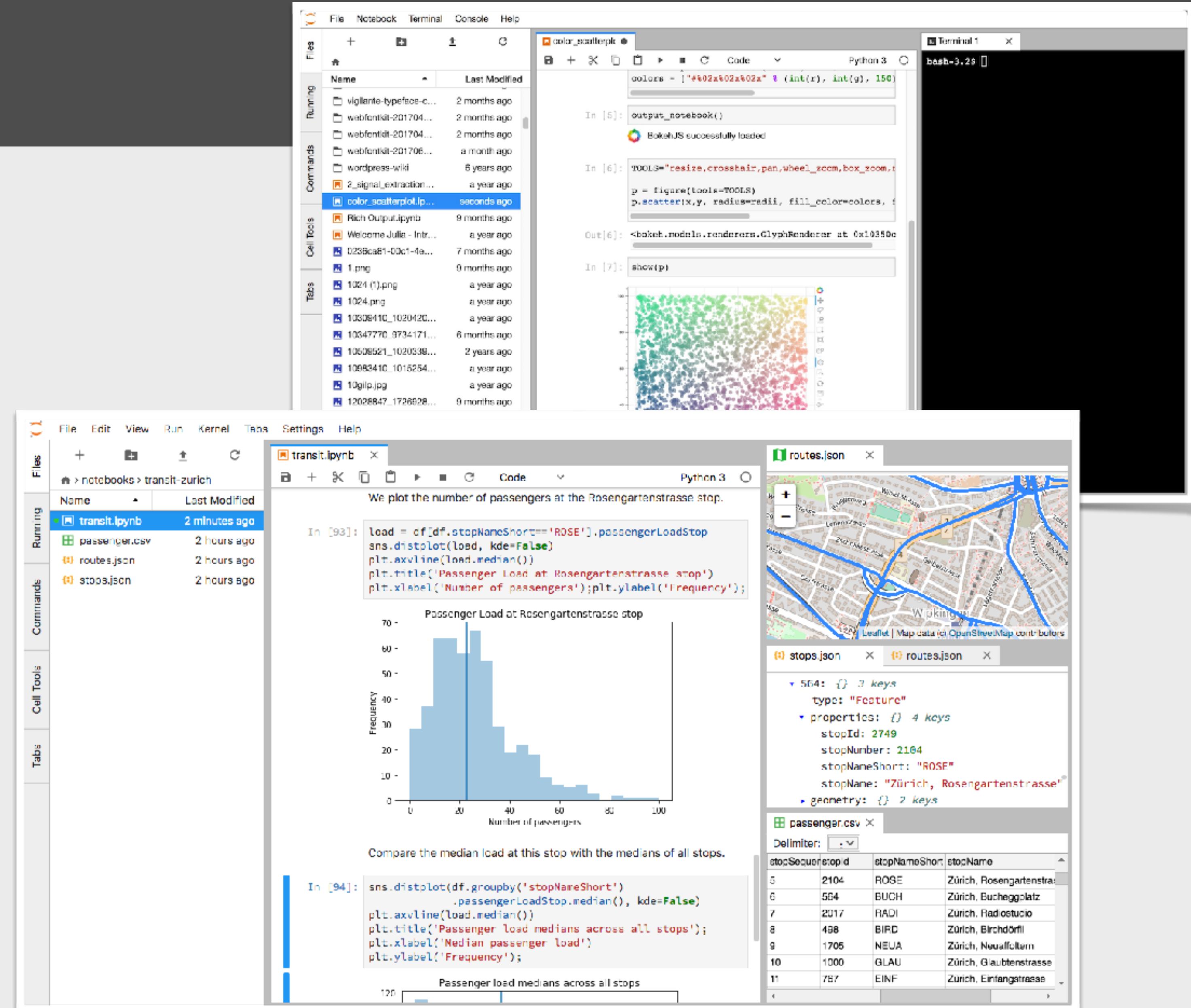
editor, shell, ...etc

- Plugins are first class citizen

- Custom Layouts (Education-oriented layout ?)

- Realtime collaboration

- Broadcast the teacher's notebook ?





jupyter-education@googlegroups.com



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August 21-25, 2018

New York, NY

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Questions ?