HKUST
VISLAB

COMP 4462
Data Visualization Tutorial

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https://bit.ly/vis-t06

Javascript and Observable

- Javascript
  - Nothing to do with Java
  - The native programming language of web browsers
    - Compile to JS, e.g. coffeescript, typescript, scala.js, elm
    - Compile to binary for performance, see WebAssembly
    - Runs with HTML, CSS and web technologies (SVG, WebGL, HTML5 Canvas)
    - The programming language for data visualization
  - The most widely used programming language
    - Both web and server (node.js)
  - Big community and a lot of libraries on GitHub / npm
    - Data visualization: D3.js, Vega-Lite, p5.js and many more
- Observable
  - A Jupyter notebook like environment for Javascript
  - It runs on your browser entirely! No remote runtime (server) is needed.
  - Built by Mike Bostock (the author of D3.js), Jeremy Ashkenas (the author of Coffeescript) and Tom MacWright

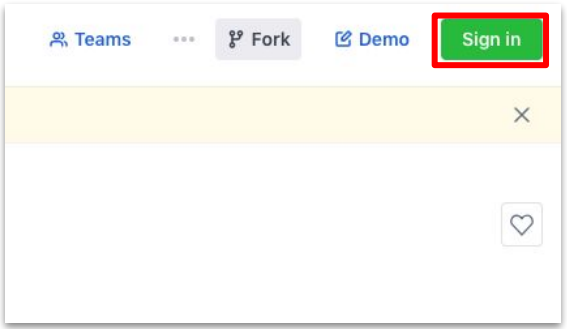
Data visualization workflow

1. Get data
2. Quick glance on data
    a. What attributes are available? How large is the data size? How many missing values?
3. **Investigate data**
    a. Make standard charts quickly
        i. With MS Excel/Tableau
    b. Twist and pull more data sources
        i. With Python and Pandas, visualize with Altair
4. **Form hypotheses/insights/stories in data**
    a. **Go back to 3** and check the hypotheses against the data
    b. Until finding sound hypotheses/insights/stories
5. Present with visualizations tailor-made for the data
    a. With D3 or other more expressive tools
        i. It takes longer and more efforts to tailor-made a solution

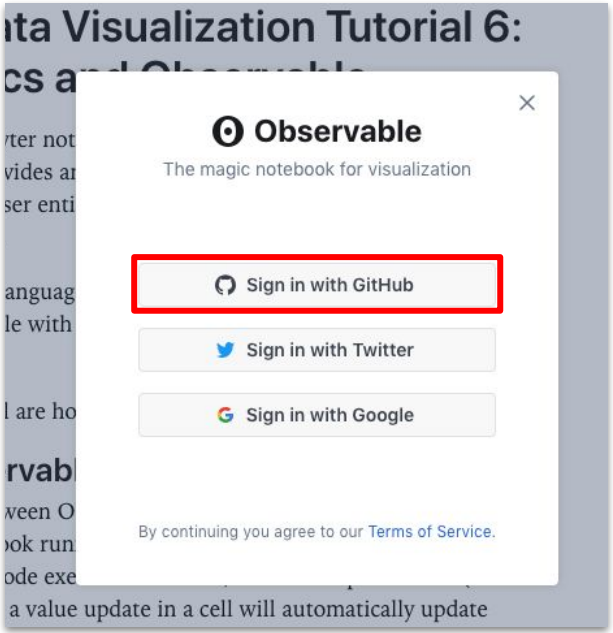
Sign in Observable

1. Go to the [notebook of this tutorial]

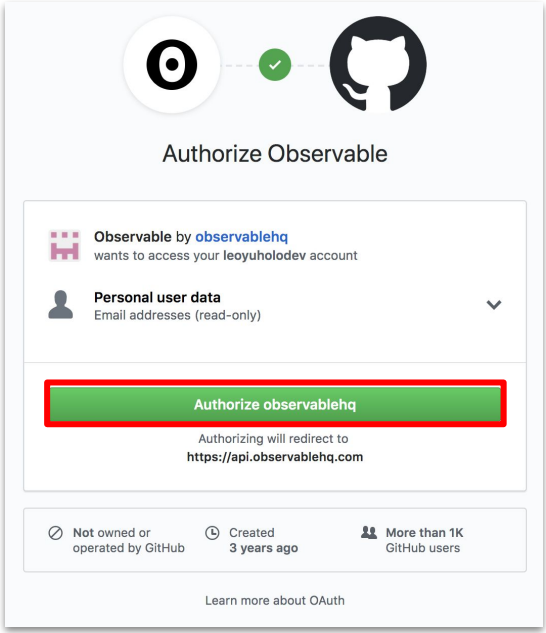
2. Click Sign in



3. Sign in with GitHub (recommended)



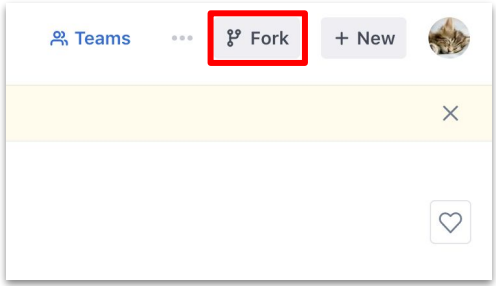
4. Authorize observablehq



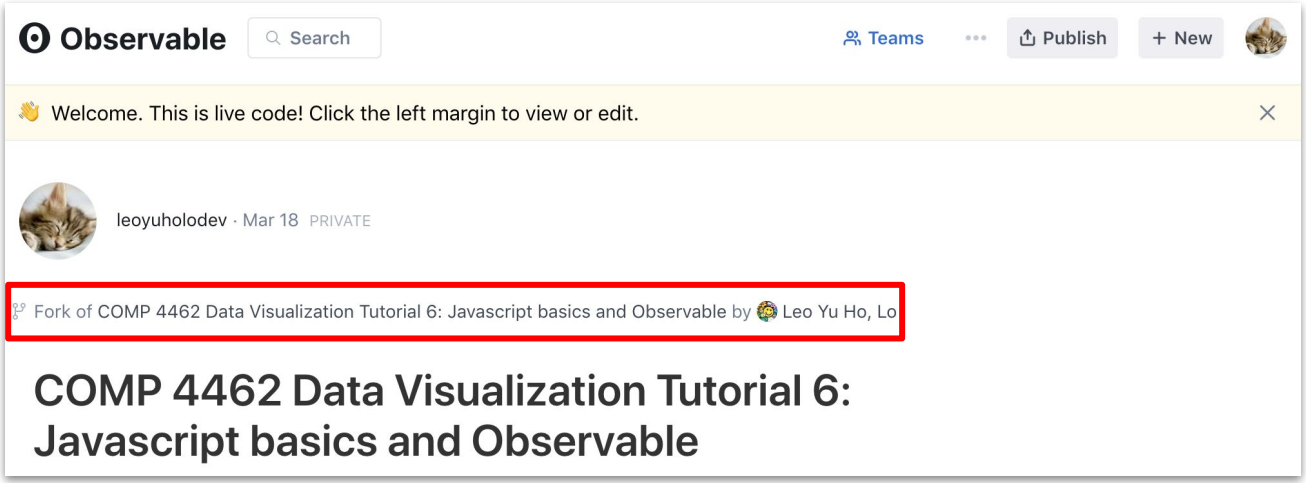
Fork Observable notebook

1. Go to the notebook of this tutorial

2. Click Fork



3. Check if you're working on your copy of the notebook (otherwise, your work will not be saved)



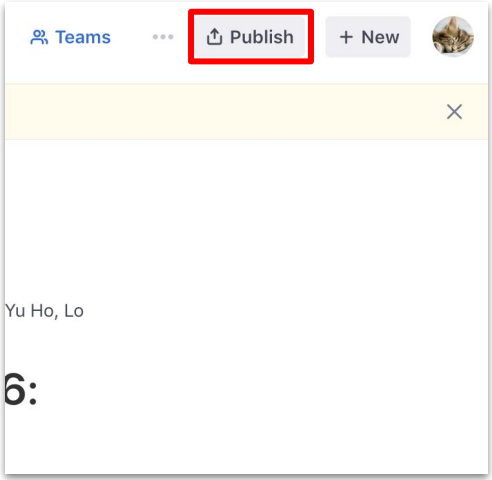
Javascript and Observable Basics

- See the Observable notebook of this tutorial
- Topics:
  - Javascript
    - Data types: number, string, array, object, date
    - Logic flow/loop
    - Function/arrow function
    - Callback/asynchronous
    - Datetime
  - Observable:
    - Expressions/blocks
    - Import libraries
    - Import data
    - Basic plot with Vega-Lite

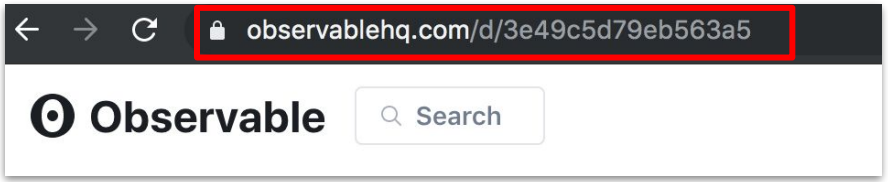
Publish your Observable notebook

1. In your working copy of the notebook

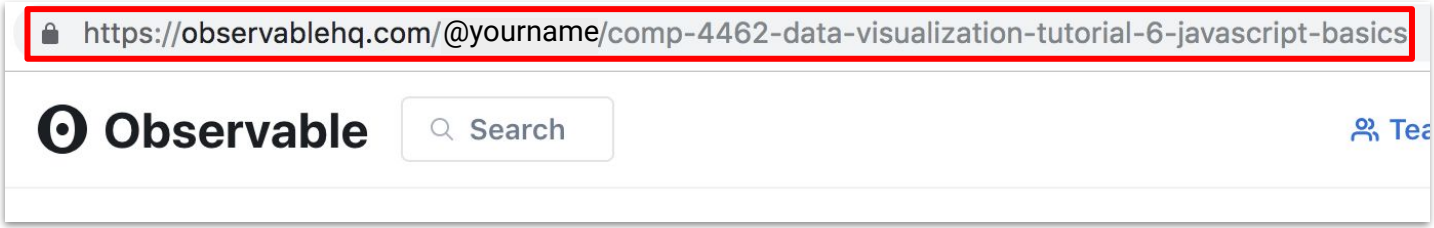
2. Click Publish



3. The URL changes from a hash...



4. To a meaningful URL, this URL is publicly accessible



Lab exercise

- Tasks
  - Sign in Observable
  - Open this Observable notebook and fork it (otherwise, your work will not be saved)
  - Read through “Javascript and Observable Basics” and fill in the “TODO” cells
  - Learn about how to load data from GitHub
  - Plot the Pokemon dataset with vizsla
  - Plot the Pokemon dataset with Vega-Lite
  - Publish your notebook when finished
  - Copy the URL of your Observable notebook and submit to Canvas
    - The URL should be something like:
      - https://observablehq.com/@yourname/comp-4462-data-visualization-tutorial-6-javascript-basics
- Optional
  - Like our Observable notebook ❤️❤️❤️ and star our GitHub repository ⭐⭐⭐Thank you! ❤️
  - Learn about asynchronous in Javascript: A blog post by Sebastian Lindström
  - Learn about event loop of Javascript: A visualized explanation by Philip Roberts

More topics on Javascript and Observable

- **A lot** more about Javascript
  - Promise / async / await / generator / iterator / delegation / asynchronous generator / variable scope / immutability / prototypal inheritance / event loop / “this” keyword / class / object destructuring / web worker
  - Compile to JS languages
    - Babel / Typescript / Coffeescript / Elm / Scala.js
  - Frontend development
    - Frameworks like React / Vue.js / AngularJS
    - Webpack module bundler
  - Backend development: Node.js and npm
  - Use Javascript to build desktop/mobile apps: Electron / React Native
- More on Observable features
  - See the "Observable: The User Manual" notebook
  - Streaming data / latex / files / viewof / mutable / different kinds of input / tables / saving SVG / presentation slides / streaming shapefiles / create animated gif

Next tutorial

Vega-lite and data processing libraries

- We will use Observable again
- Learn more about Javascript!
- Vega-Lite
  - The library behind Altair
- Lodash
  - Utility library of Javascript
- Moment.js
  - Datetime manipulation library