HKUST
VISLAB

COMP 4462
Data Visualization Tutorial

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D3.js Introduction

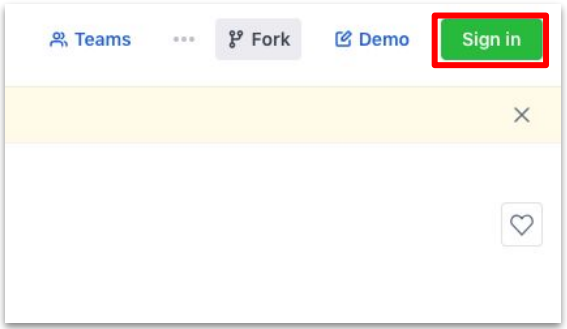
Visualization with D3.js

- SVG (Scalable Vector Graphics)
  - An extension of HTML for representing scalar graphics in XML syntax
  - Available in all the web browsers
- D3.js
  - The most widely used visualization library
  - The library behind Vega, Vega-Lite and Altair
  - Binding data with SVG DOM, marking data points visually onto screen
  - Imperative syntax, compared to the declarative syntax of Vega-Lite and Altair
- Why D3.js
  - ❌Exploring a dataset, use Altair with Python or Tableau instead
  - ❌Embed visualization in web applications, use Vega-Lite instead
  - ✅Make customized plots, customized interactions or transitions
- Cost
  - Much more coding, much easier to make mistakes
  - Check Vega-Lite Gallery and Vega Gallery before committing to D3.js

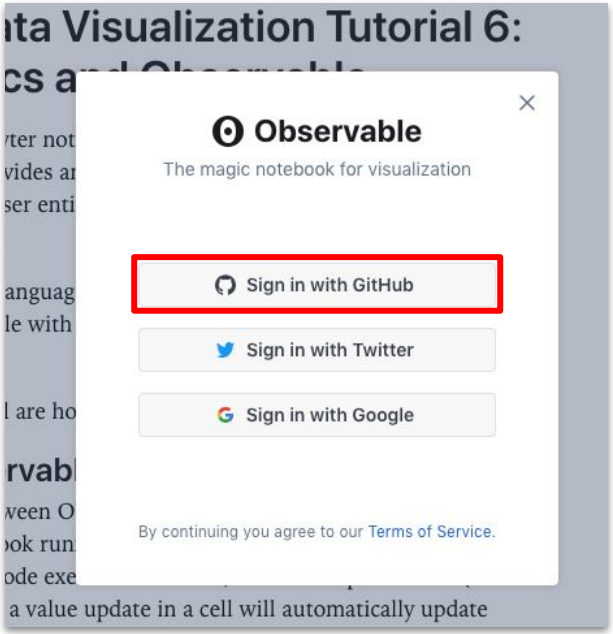
Sign in Observable

1. Go to the [notebook of this tutorial]

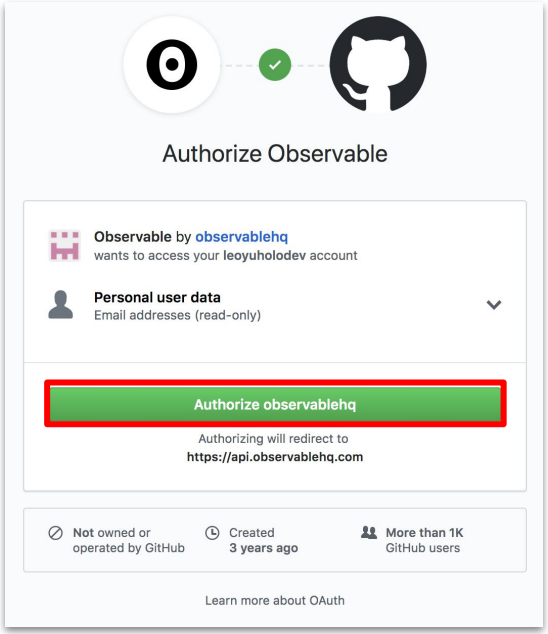
2. Click Sign in



3. Sign in with GitHub (recommended)



4. Authorize observablehq



Fork Observable notebook

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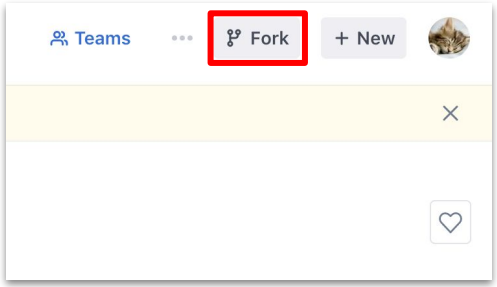
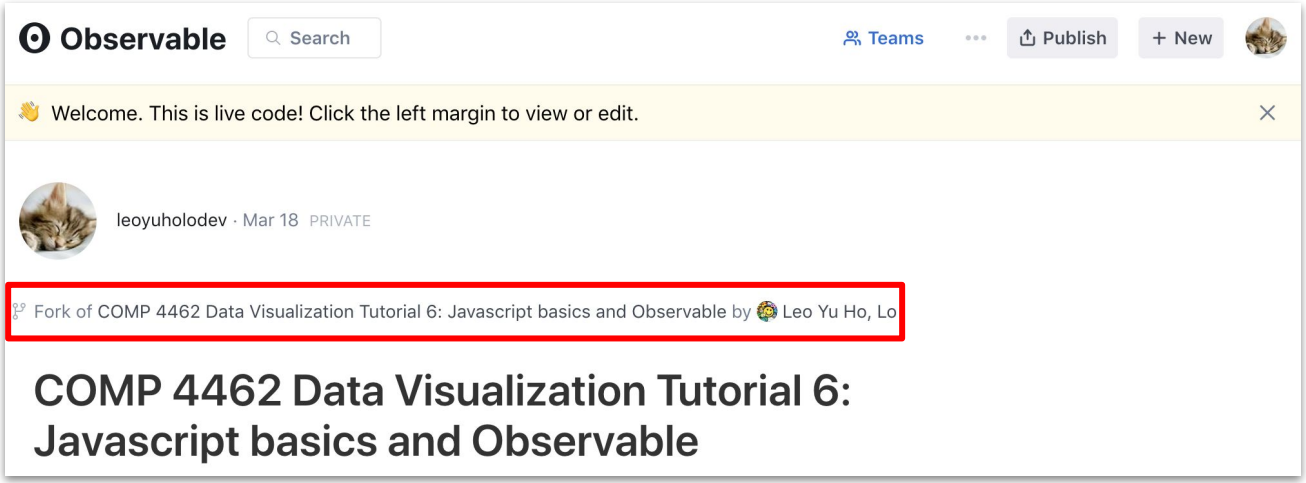


3. Check if you're working on your copy of the notebook (otherwise, your work will not be saved)



Visualization with D3.js

- See the Observable notebook of this tutorial
- SVG
- Scales
  - Linear scale (numeric, color)
  - Time scale
  - Point scale (categorical)
- Coordinate System
  - Axes
  - Cartesian coordinate (X and Y)
  - Polar coordinate (angular and distance)
- Marks and channel
  - Point: scatter plot
  - Line: (multi-)line chart, parallel coordinate, radar chart
- Selection

Interaction with D3.js

Visualization and Interaction with D3.js

- Interaction with visualization
  - Visualization has well established before the invention of computer
    - But interaction with visualization only available through the use of computers
  - Huge space of possibilities
    - But all successful interaction designs follow **“Overview first, details on demand”**
  - Visualization interactions mostly through mouse
    - Seldomly with keyboard
    - Interaction through touch devices is a grand challenge in data visualization
- Animation
  - Makes interaction smoother, more responsive
  - Keep conceptual consistency, objects enter the scene instead of appear suddenly
  - Motion is a very attention attractive channel
    - It is built-in in our mind to track moving objects (because of primal instincts?)
    - But too much moving objects will overwhelm viewers

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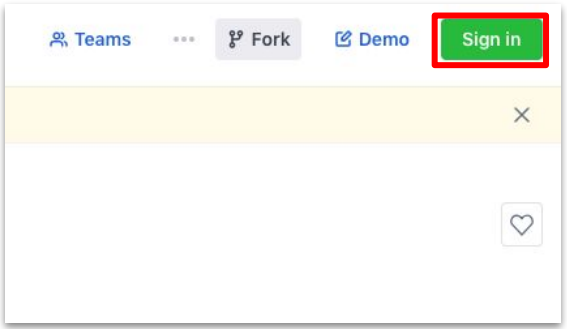

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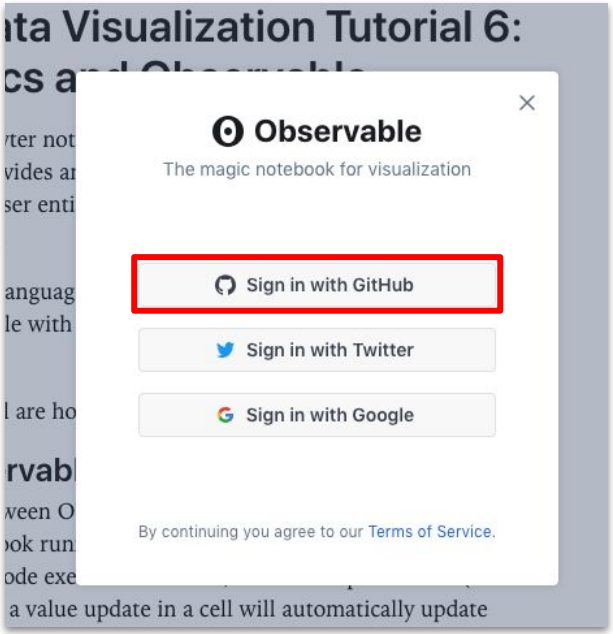

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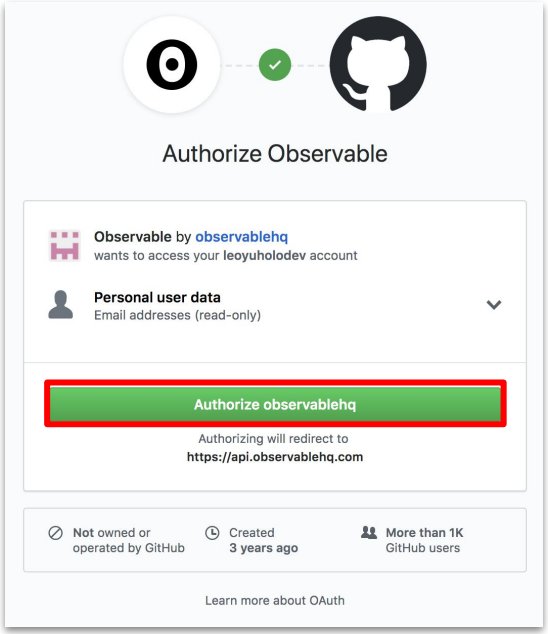

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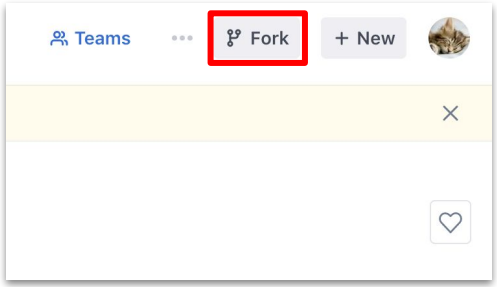

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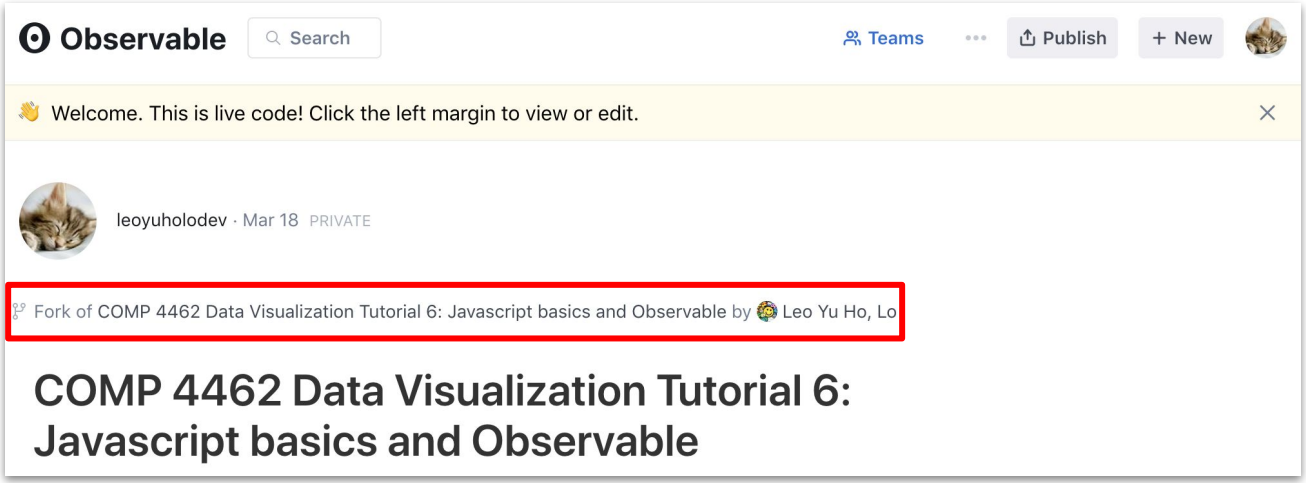

Visualization and Interaction with D3.js

- See the Observable notebook of this tutorial
- Choropleth (maps with color encoding)
- Interaction
  - Overview first, details on demand!
  - Tooltip with <title> element, d3-tip
  - Mouse events: mouseover, mouseout, click
  - Observable inputs: dropdown menu, slider
  - Linked views
- Animation
  - Eyes beat memory!
  - Animation with redraw, D3.js transition
  - Motion encoding, pop-out effect
- Data analysis techniques
  - Daily average over month total
  - How to handle missing data?

More on interactions and D3.js

- More on interactions
  - D3.js: d3-drag, d3-zoom, d3-brush
    - Demos: d3-drag, d3-zoom, d3-brush
  - Vega-Lite:
    - Interactive Plots with Selection in Vega-Lite
  - Altair:
    - Making Charts Interactive in Altair
- Visualizations not covered in tutorials
  - Wordle (a.k.a. Word Cloud)
    - Javascript implementation of wordle by Jason Davies
    - Vega Word Cloud Example
  - Graph visualization
    - D3 in Depth: Layouts and D3 in Depth: Force layout
    - Vega Force Directed Layout Example
    - Besides D3, Gephi is a professional graph visualization tool

Lab Exercise

- Tasks
  - Sign in Observable
  - Open the two observable notebooks and fork them:
    - Part 1: Notebook 1
    - Part 2: Notebook 2
  - Read through the notebook and fill in the “TODO” cells, For Notebook 1, there are five todos, For Notebook 2, there are four todos.
  - Copy the URL of your Observable notebook and submit to Canvas