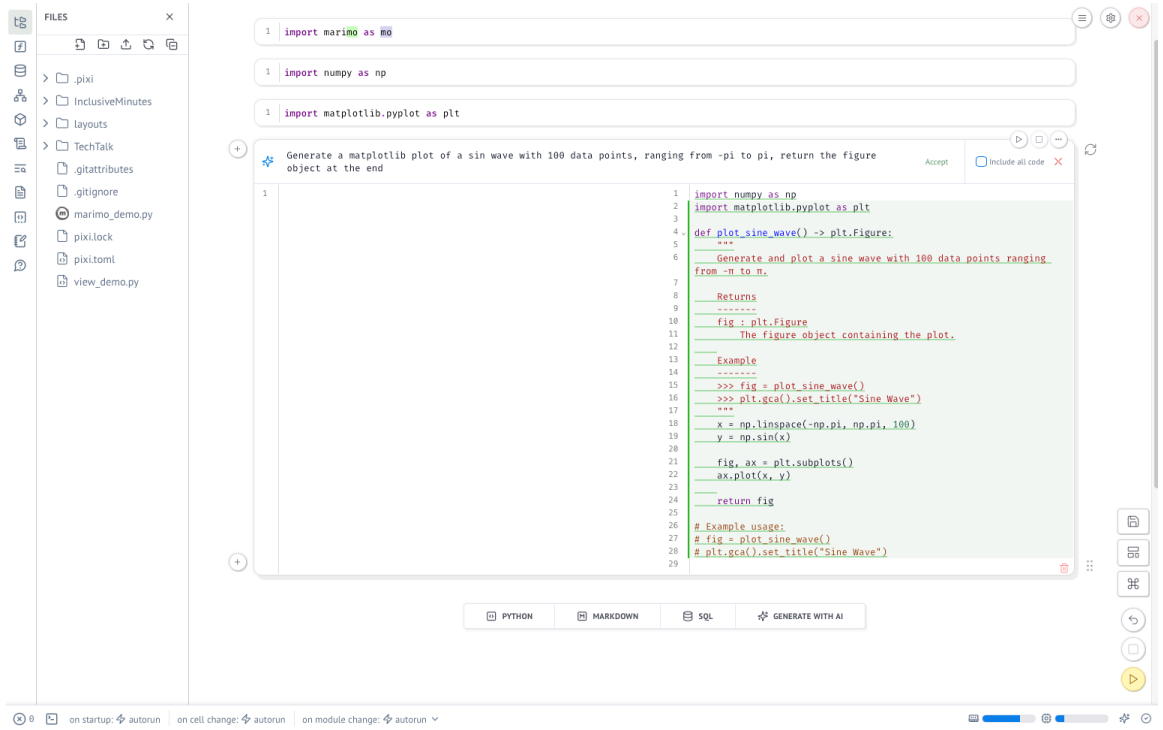
Marimo: An Alternative to Jupyter Notebooks

Tech Talk | Feb 19, 2025

Presented by Chen Zhang

What is Marimo

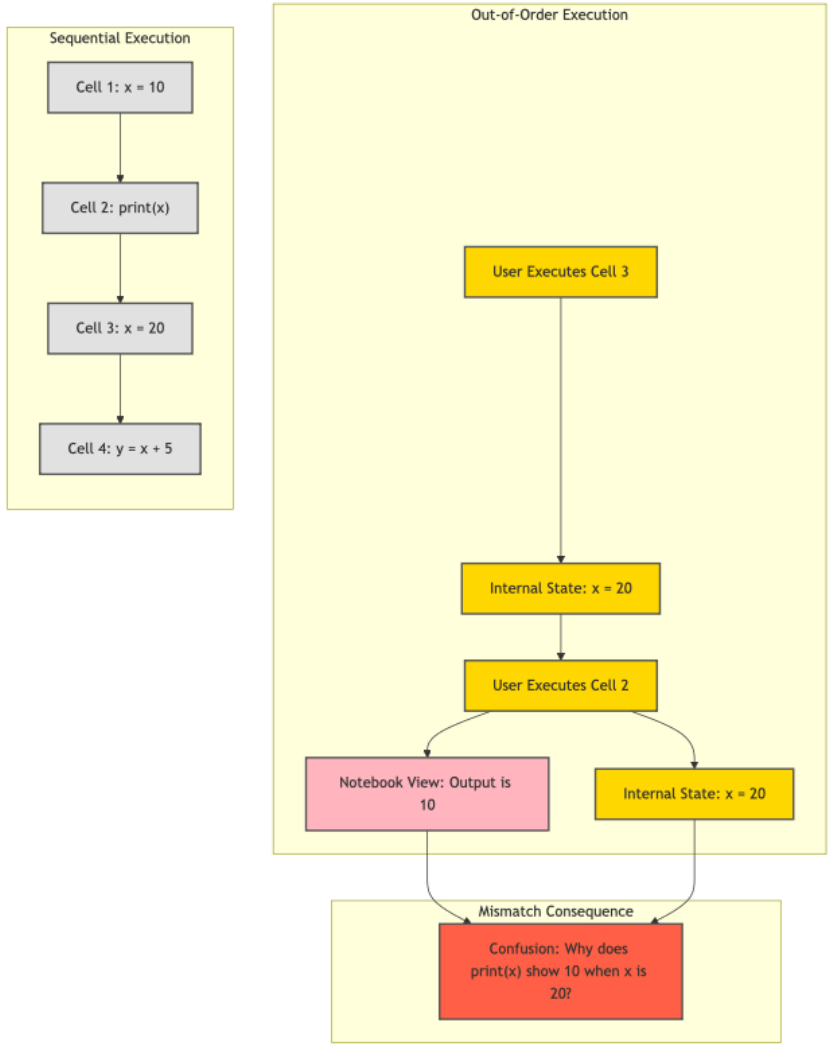
- Marimo is a **reactive** Python notebook.
- Pure `Python` file (`git` friendly).
- UI components shipped with library (battery included).
- Easy deploy as a web app, similar to `streamlit`, `gradio`.



Why Marimo?

Jupyter notebooks are great, except for

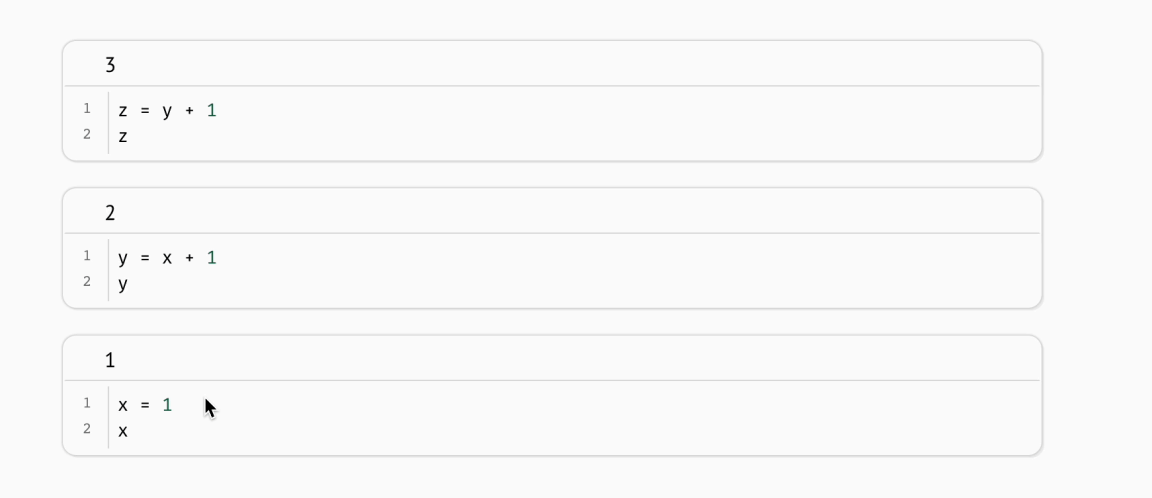
- Runtime/Display Mismatch
- Plugins management
- Not Git friendly



How Marimo helps

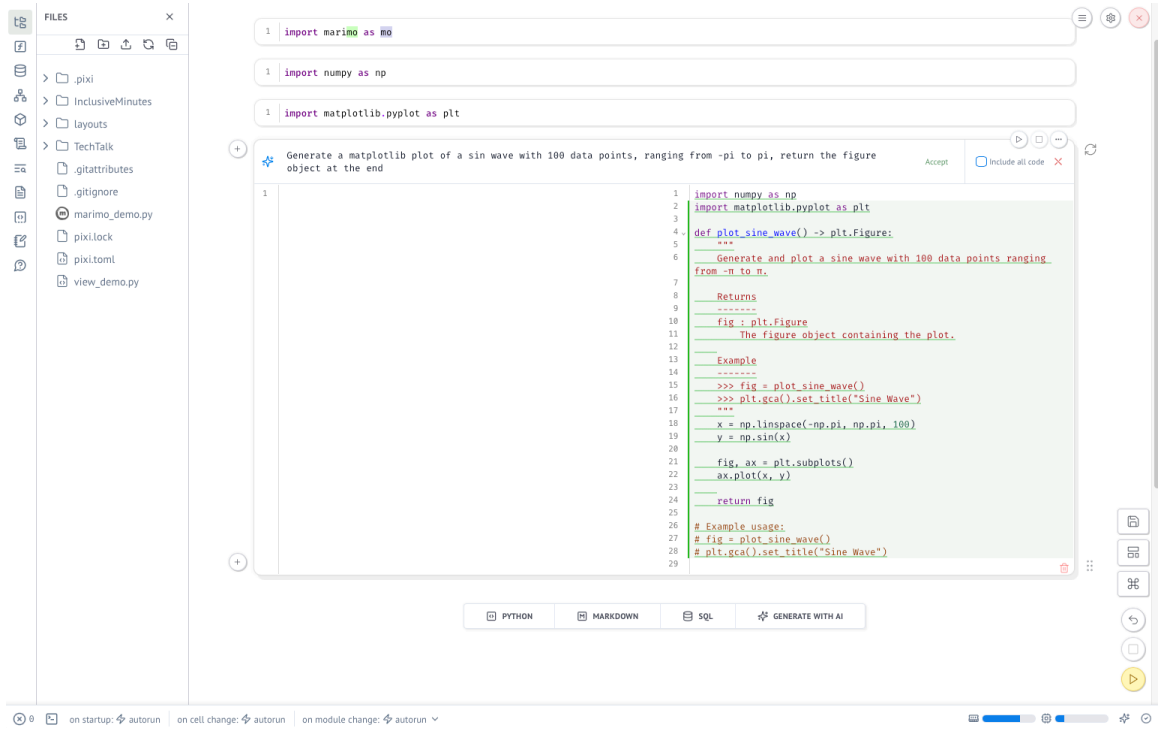
Reactive by design

- Each **cell** is a **function**, and dependencies between cells are automatically tracked and update via Directed Acyclic Graph (DAG) analysis.
- Global and local variables are managed by naming convention, all variables are global by default unless leading with `_`.



Marimo comes with UI components

- Common UI elements shipped with `marimo` library.
- Easy to deploy the notebook as web app built with `marimo` UI components.



Marimo is Git friendly

- Marimo notebook is a pure `Python` file.

```python
import marimo

__generated_with = "0.10.13"
app = marimo.App(width="medium", layout_file="layouts/marimo_demo.slides.json")

@app.cell
def _():
    import marimo as mo
    return (mo,)

@app.cell
def _():
    import pandas as pd

    # Create a fake dataframe with three features
    data = {'Name': ['Alice', 'Bob', 'Charlie'],
            'Age': [24, 35, 42],
            'Gender': ['Female', 'Male', 'Non-binary']}
    df = pd.DataFrame(data)
    return data, df, pd

@app.cell
def _():
    return

if __name__ == "__main__":
    app.run()
```

Live demo

Setup Marimo

```
# init the project with pixi
pixi init
# install python (required)
pixi add python
# install node.js (required)
pixi add nodejs
# install marimo, need to pull from PyPI to enable the AI feature
pixi add --pypi "marimo[recommended]"
```

> Given NDP is switching to `pixi` for Python environment management, we will be using `pixi` to manage the project.

AI integration with Marimo

- `marimo` has native support for Github's copilot and Codium AI for code completion.
- `marimo` can use both commercial LLM service (OpenAI, Claude, Gemini etc.) and local LLM services (e.g. Ollama, LMStudio, etc.)

```
# Install Ollama and pull a model from huggingface [skipped]
# Start the Ollama service [skipped, Ollama server is started in the background on this machine]
# Start the Model server
ollama run phi4
```

Once the prompt returns, we can start the `marimo` notebook with

```
pixi run marimo edit demo.py
```

> `marimo` has two modes: `edit` mode is similar to Jupyter notebook where one interactively develop the notebook; `run` mode is starting the notebook as a webapp, similar to `streamlit`.

Setup example case

Prompt to use

- Generate Python code to create a pandas DataFrame with 100 rows and 10 features. The features should include a mix of numeric, categorical, and datetime types. Include realistic data values and randomization for variability.
- Generate a cumulative distribution plot for `@df` Numeric1, using `matplotlib`, return the figure object at the end.
    - When a library is missing, `marimo` will ask to install the library on your behalf, restart the server and rerun the entire notebook.
    - `marimo` requires an interactive object handle to display, therefore we need to add `plot.show()` at the end to view the graph.

Adding more code

- Add a new feature to @df to update it, new feature is a combination (add) of Numeric2 and Numeric3, and name it as `2+3`.

> Local model generally do not have the hidden agent like ChatGPT and Claude.ai, therefore you will need to adjust the code to make it work.

Global var v.s. Local var

- `marimo` uses DAG to track var update and dependencies, therefore unique name is required for all global vars to avoid conflict.
- Local vars are identified by leading `_`, and are not tracked by DAG.

```
# cell 1
a = 1
_b = 2
# cell 2
a = 3 # this will lead to error
_b = 4 # this is fine
```

> This check only works for native Python vars, if you are using a `dataframe`, which can be modified in-place even passed as a function argument, you are responsible for tracking the changes.

Example UI elements

Most of the LLM services have not learned the `marimo` UI elements, therefore you will need to manually write the code by referring to the official documentation.

```
# in one cell
slider = mo.ui.slider(start=0, stop=10)

# in anther cell
mo.vstack([
    slider,
    mo.md(f'Hello, islands! {"🏝️" * int(slider.value)}'),
])
```

Q&A