Project Prototyping Workshop

BIO 512

Digital Epidemiology

Project Prototyping Workshop 1
Objectives

- Learn the basics of Streamlit 🚀

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- Watch a demo of a project prototype 

Project Prototyping Workshop 1
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- Learn the basics of Streamlit 🚀
  - Streamlit components.
  - Organise your Streamlit project.
  - Integrate an LLM-powered chatbot in a Streamlit project.

- Watch a demo of a project prototype 

- **Your turn !** ⭐

Streamlit
Short introduction

- Free, open-source, Python library.
- Build user-friendly apps with pure Python.
- Doesn't require extensive web development knowledge.

Documentation : https://docs.streamlit.io/.

Streamlit
Fundamentals

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- Run the application using the terminal command:
  `streamlit run app.py`
- Streamlit starts a local server to open the app in a browser page.
- Shut down the application using the terminal command:
  `[Ctrl] + C`

Streamlit
Reactive programming

- Initial step : the script is executed from **top to bottom**.

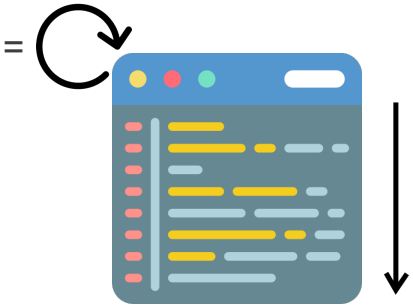
Streamlit
Reactive programming

- Initial step : the script is executed from **top to bottom**.
- Streamlit **re-runs** the entire script each time the user **interacts** with the application.

User interaction =

Streamlit
Reactive programming

🚨 **Implication 1:** Variables don't persist

User interaction = 

⚠️ **Removes variables!**

Streamlit
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🚨 **Implication 1:** Variables don’t persist

➡️ We will store variables in the **Session State**

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➡️ We will store variables in the **Session State**

- *Session State* : Streamlit object in which we store variables across application reruns and pages.

```python
import streamlit as st

# Dictionary-like syntax
if 'key' not in st.session_state:
    st.session_state['key'] = 'value'

# Attribute-based syntax
if 'key' not in st.session_state:
    st.session_state.key = 'value'
```

Streamlit
Reactive programming

🚨 **Implication 1:** Variables don't persist

➡️ We will store variables in the **Session State**

- *Session State* : Streamlit object in which we store variables across application reruns and pages.
- Streamlit removes the Session State whenever it is shut down.

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Streamlit
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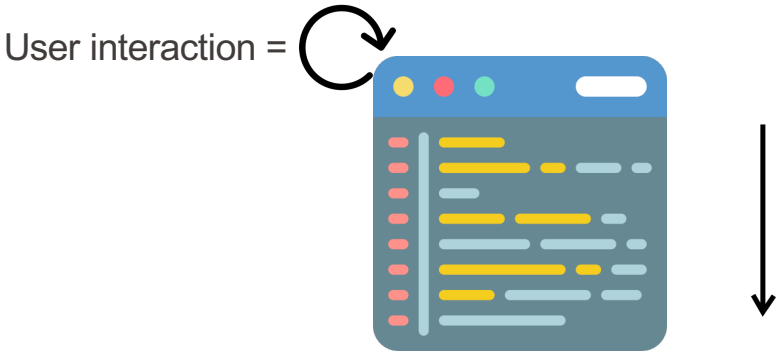

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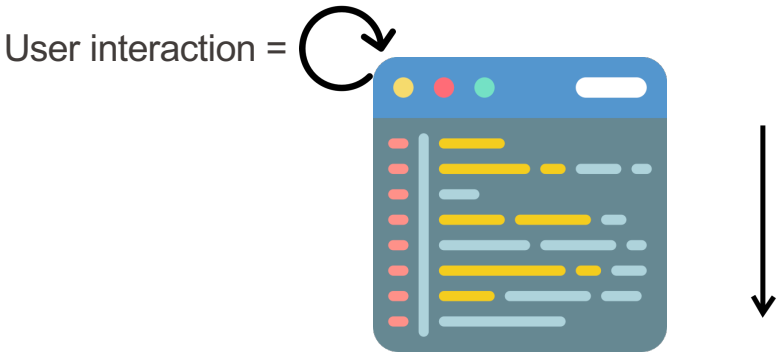
➡️ but not **functions!**



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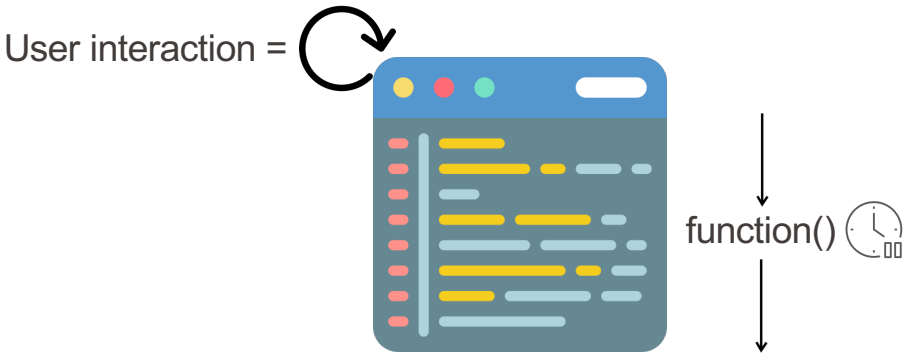
➡️ but not **functions!**

- Long-running functions will **block** the app from reacting to the user inputs.

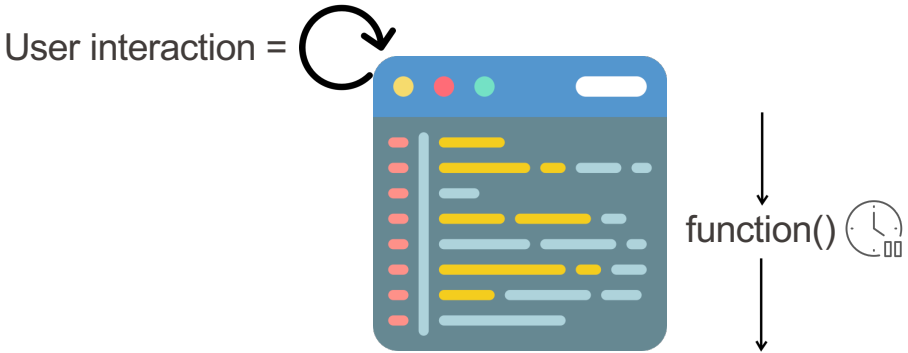


Streamlit
Reactive programming

🚨 **Implication 2:** Code can be interrupted by user interactions

➡️ but not **functions!**

- Long-running functions will **block** the app from reacting to the user inputs.
- **Design strategy**: Implementing main UI features using functions



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1. Set up your Gitlab access, **if you have never done it before**:

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   a. First, we check if you already have SSH keys.

Terminal command : `ls ~/.ssh`

- If you see : `id_rsa.pub` and other "*id_xxx*" files ➡️ Great!

- ⚠️ **If you don't see anything, generate new SSH keys:**

  Terminal command: `ssh-keygen -t rsa -b 4096 -C your_email@epfl.ch`

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   a. First, we check if you already have SSH keys.

   b. Copy your public SSH key :

      Terminal command: `cat ~/.ssh/id_rsa.pub`

      Manually copy the entire key (should begin with *ssh-rsa*)

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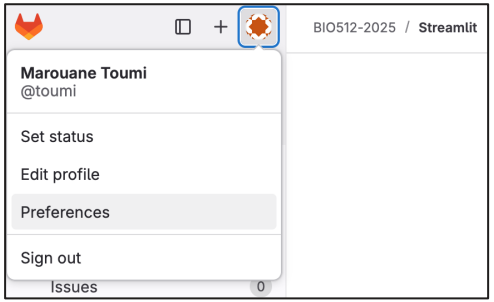
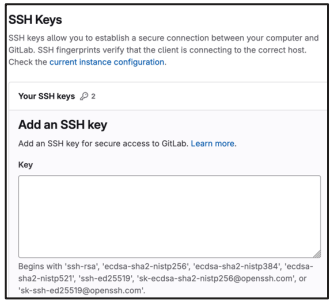
   a. First, we check if you already have SSH keys.
   b. Copy your public SSH key.
   c. Go to your Gitlab profile, preferences, and paste your SSH key !

Gitlab documentation





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1. Set up your Gitlab access, **if you have never done it before.**
2. Open your terminal :

```
cd {path_to_streamlit_workshop}
git clone git@gitlab.epfl.ch:bio512-2025/streamlit.git
```


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      - To exit this environment : **`deactivate`**
    - `conda install pip`
    - `pip install –r requirements.txt`
- Check installation:
  - Open a terminal window, (activate the environment if not),
    - **`streamlit hello`**

Streamlit
Tutorial overview

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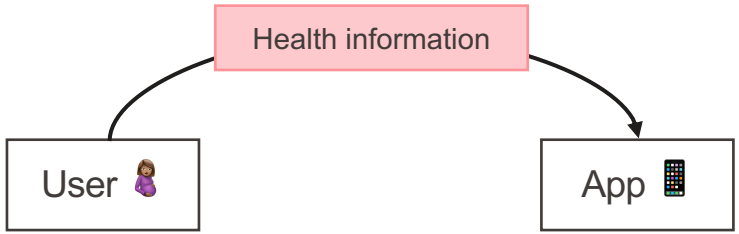

Health information

- General information,
- Blood sugar levels,
- Pregnancy,
- Medications,
- Mood…

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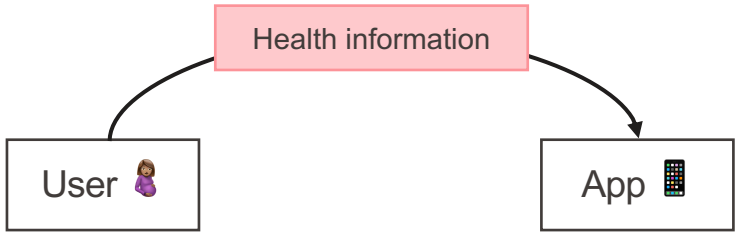

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➡️ Different types of data !

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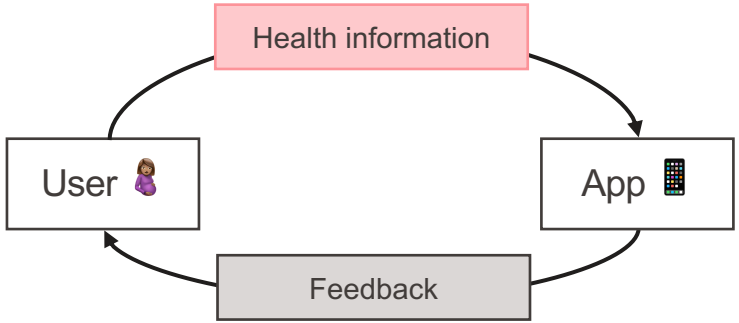

Feedback

- On a different page,
- Graphs,
- Metrics,
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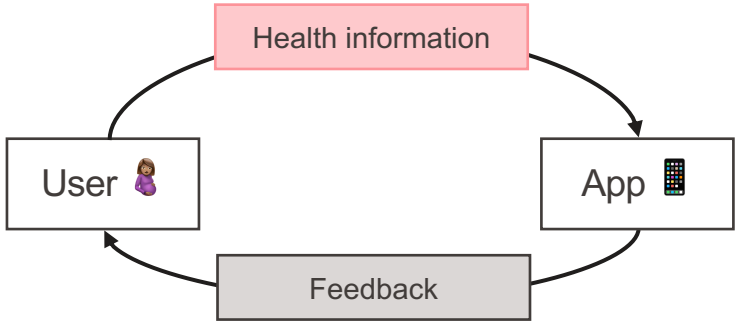

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➡️ Different data processing !

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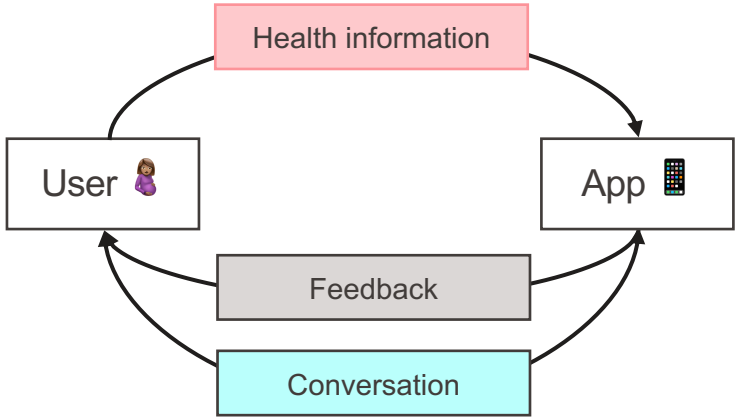

Conversation

- Initialize a conversation,
- Define the context,
- Further insight generation,
- Personalize the chatbot…

➡️ We need a LLM !

Streamlit
LLM-derived features

- Two LLM-derived features
  - `generate_insight()` ➡️ textual explanation of data
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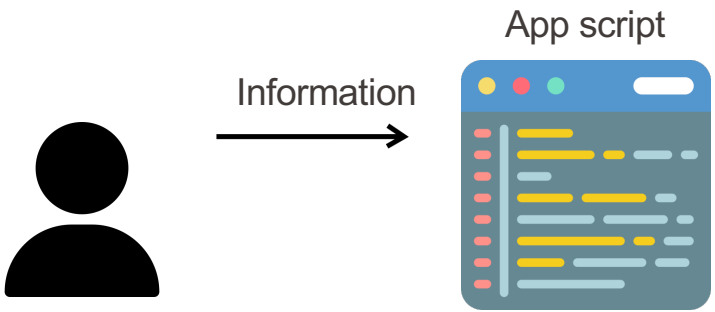
- We will use the GPT 3.5-Turbo model
  - https://platform.openai.com/docs/models/gpt-3.5-turbo

Streamlit
API interactions

- The user inputs an information



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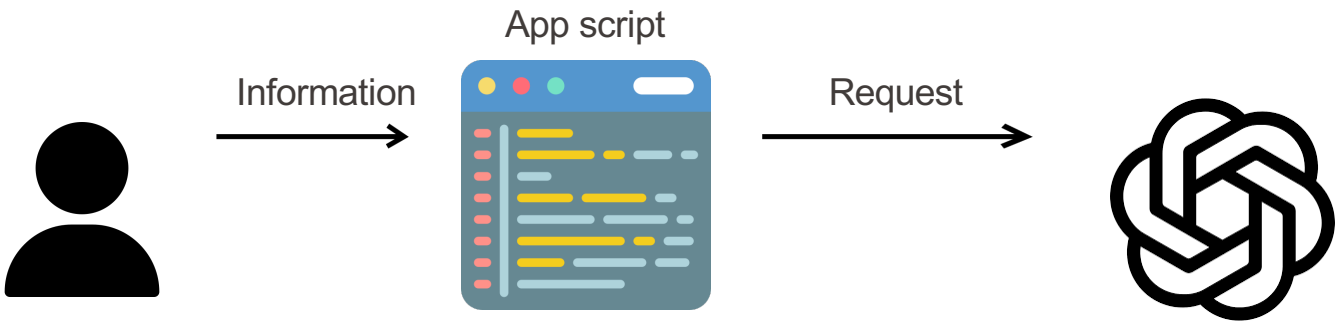

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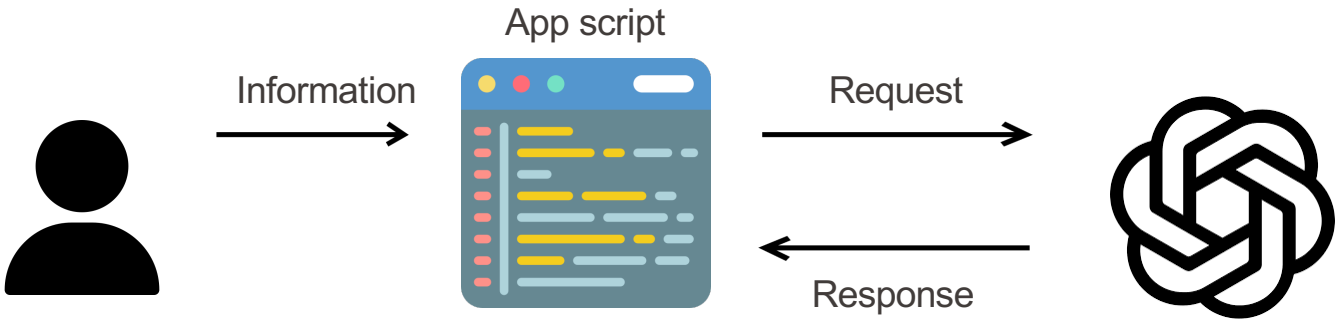

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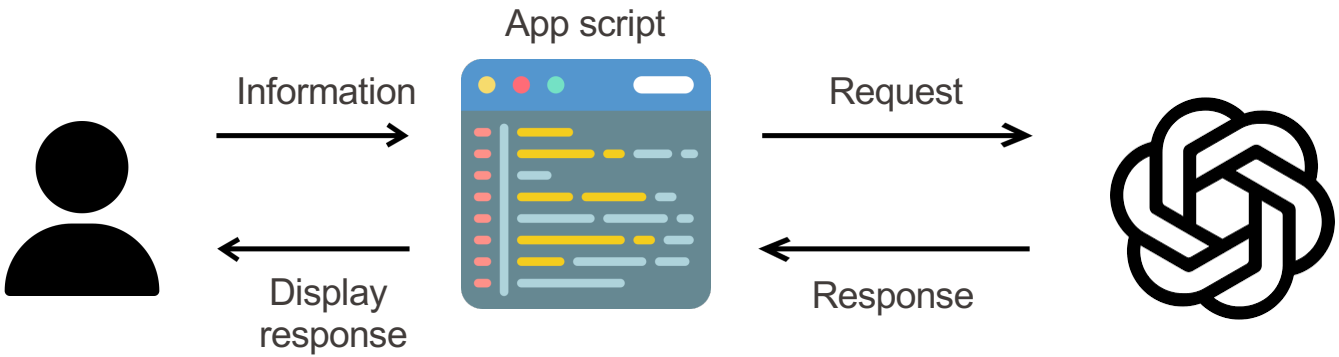
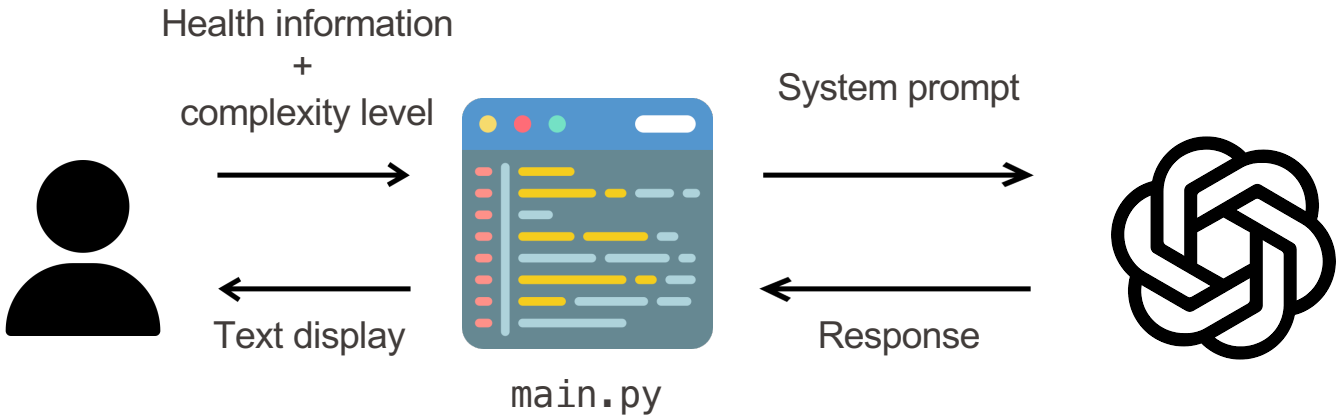
- The app receives the response and **shows it to the user**.



Streamlit
Insight generations overview



Streamlit
Chatbot overview

- Just like insight generations, but iterated over user messages :

1. **Initialization**:
   - Define the context (health information + expectations)
   - Set up the conversation history (Python dictionary stored in the Session State)

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   - Set up the conversation history (Python dictionary stored in the Session State)

2. **FOR each new user message** :
   1. Get the user message.
   2. Generate the API response using the message history + the new user message
   3. Display the conversation it in the chat
      ➡️ st.chat_message()
   4. Save both the user message + API response in the message history,
      ⚠️ within the Session State

Projects

Tips for a successful project

- Start with a clear core idea.

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- Think about real users.
- The prototype building shouldn’t limit your idea.
- Tell a good story.
- Explore ideas that matter to you.