



Biolmage.IO Chatbot

Powered by Large Language Models and AI Agents

Caterina Fuster-Barceló, UC3M

Wanlu Lei, Ericsson & KTH

Benedict Diederich, Leibniz-IPHT Jena

Songtao Cheng, KTH

Wei Ouyang, KTH

June 11th, 2024

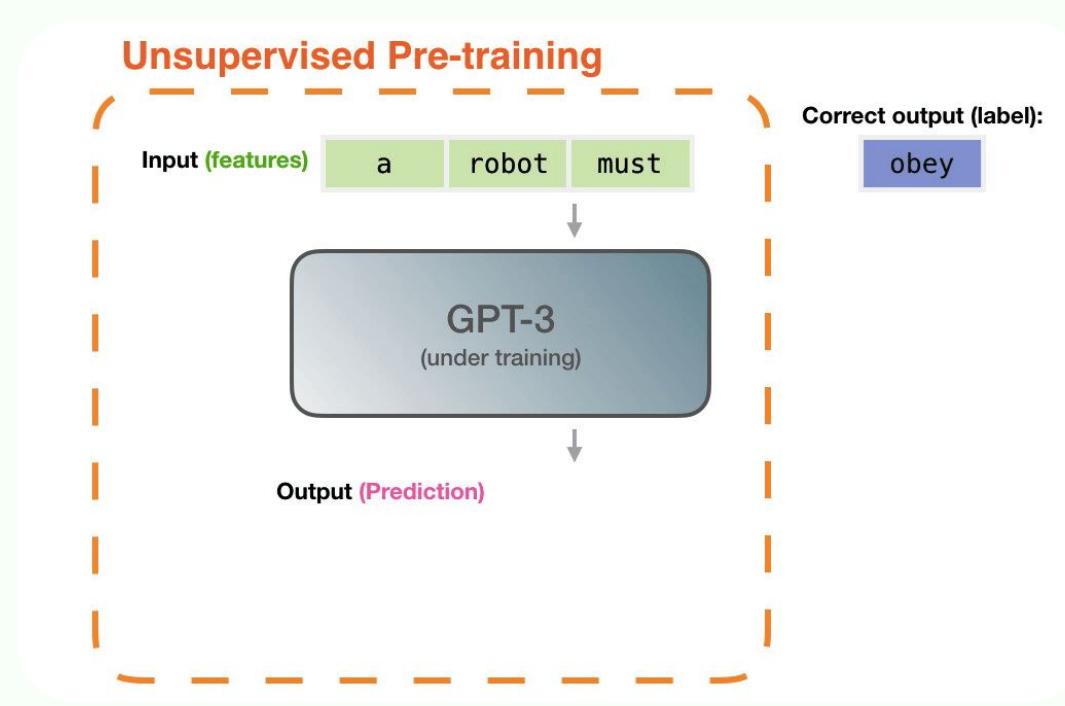
Large Language Models



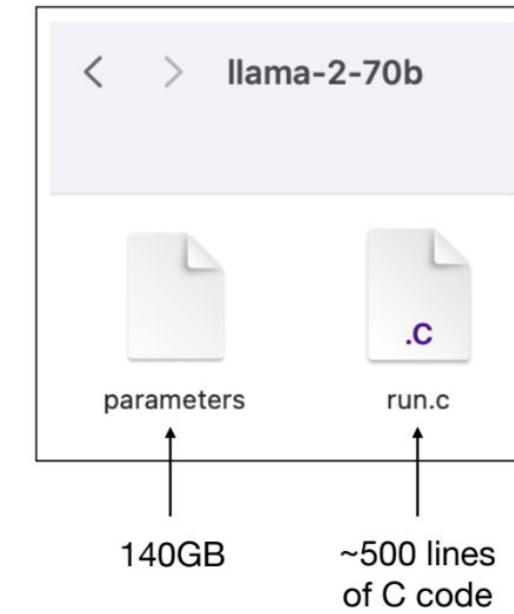
Generated by DALL.E 3

Large Language Models

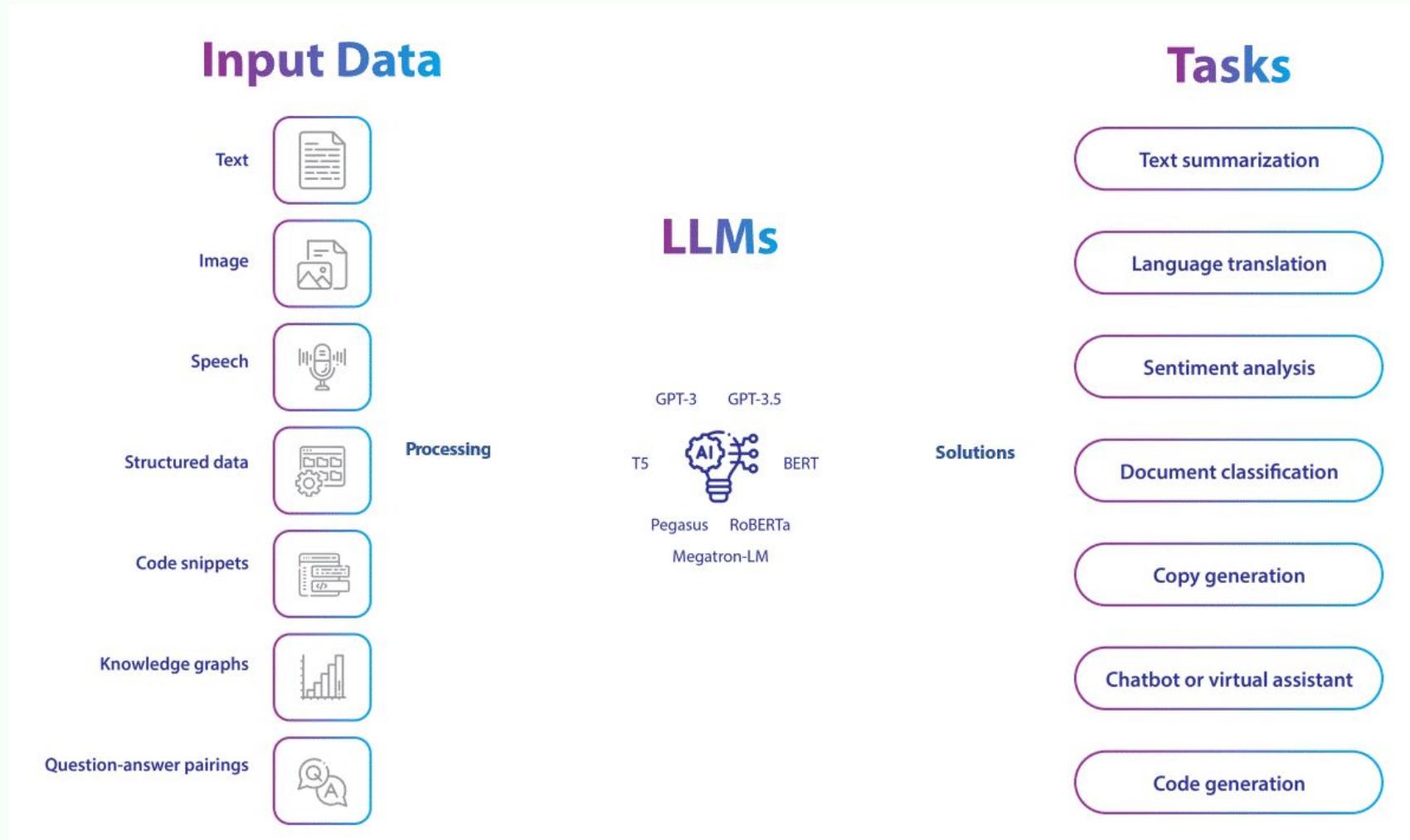
Next-Token-Prediction



Transformer + Weights



How can LLMs help with Biolmaging?



Challenges in Using LLMs

- **Knowledge Cutoff**
- **Hallucination**
- **Bias**
- **Poor Reproducibility**
- ...

How to make LLMs more reliable?



Biomage.IO Chatbot: A Community-Driven AI Assistant for Integrative Computational Bioimaging

Wanlu Lei, Caterina Fuster-Barceló, Gabriel Reder, Arrate Muñoz-Barrutia
and Wei Ouyang



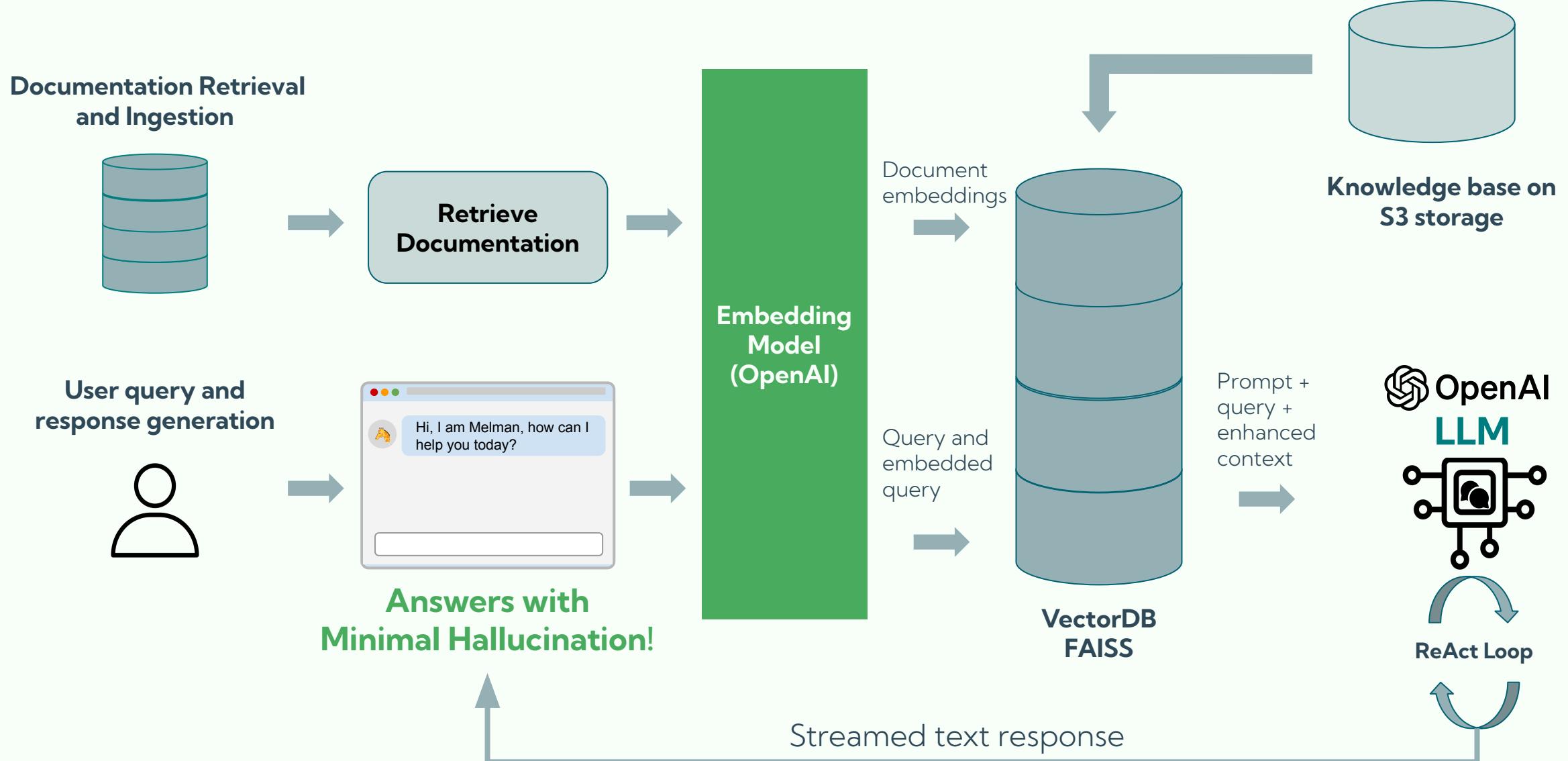
Instituto de Investigación Sanitaria Gregorio Marañón

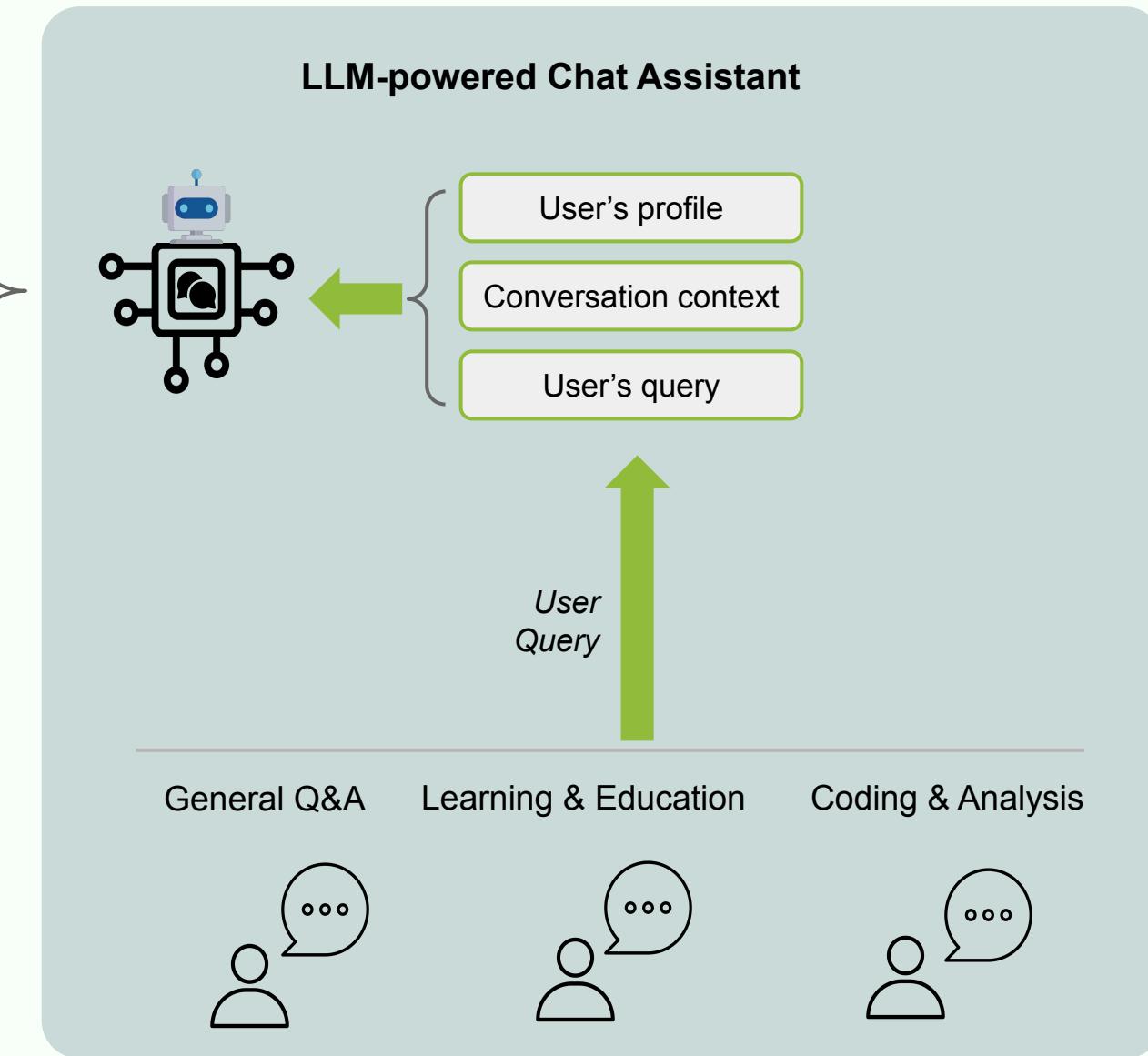
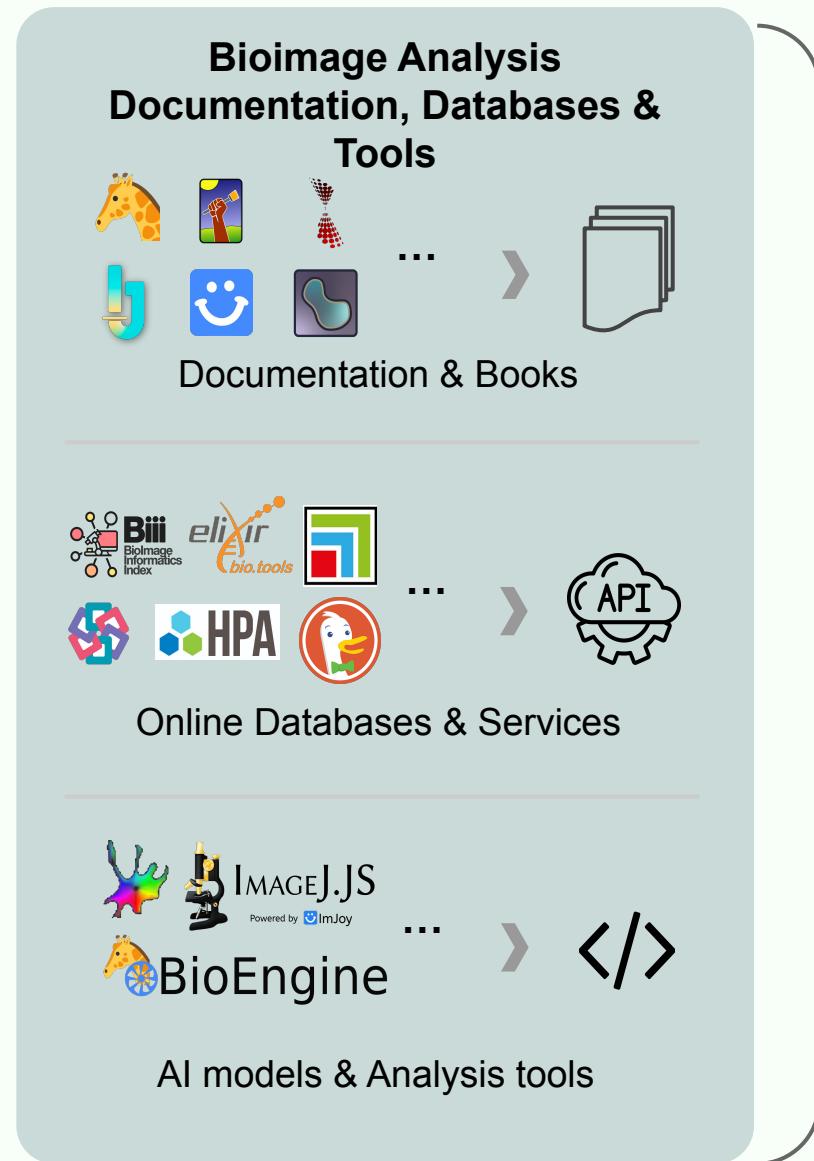


<https://doi.org/10.48550/arXiv.2310.18351>

Key Idea: Retrieved Augmented Generation (RAG)

Using RAG to augment LLMs with a Community Knowledge Base





Biolimage.IO

ChatBot Assistants

Biolimage Seeker (Melman)

An assistant specializing in searching through **bioimage analysis tools**, including the Biolimage Model Zoo, the Biolimage Archive, [bii.eu](#), and others, to provide **comprehensive support** in bioimaging.

Biolimage Tutor (Nina)

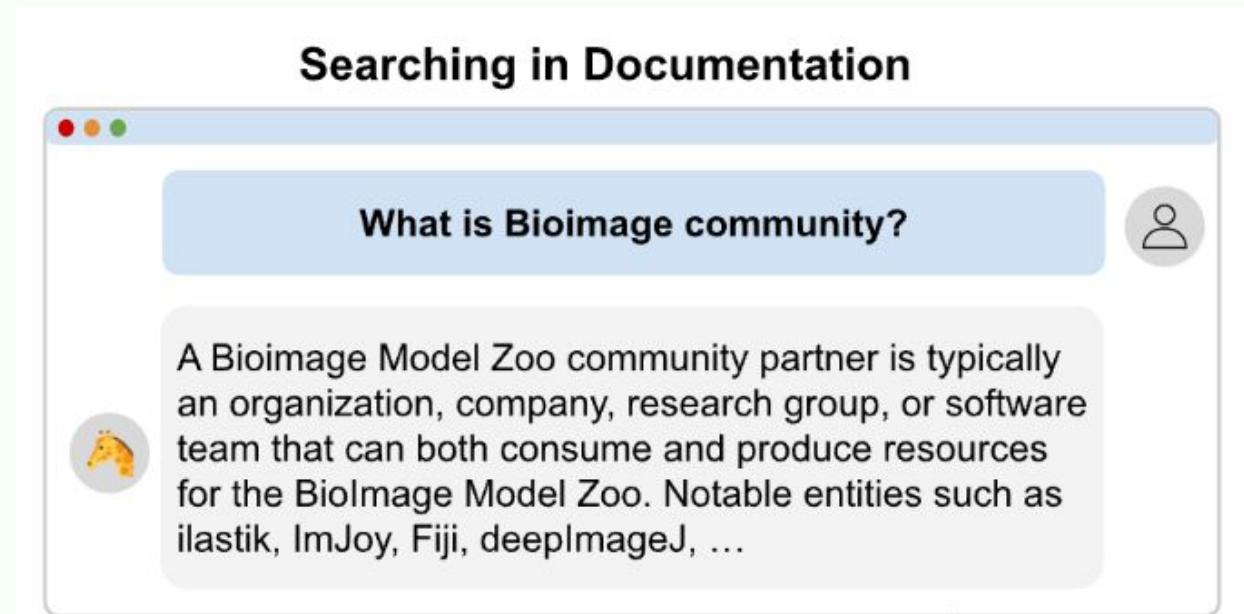
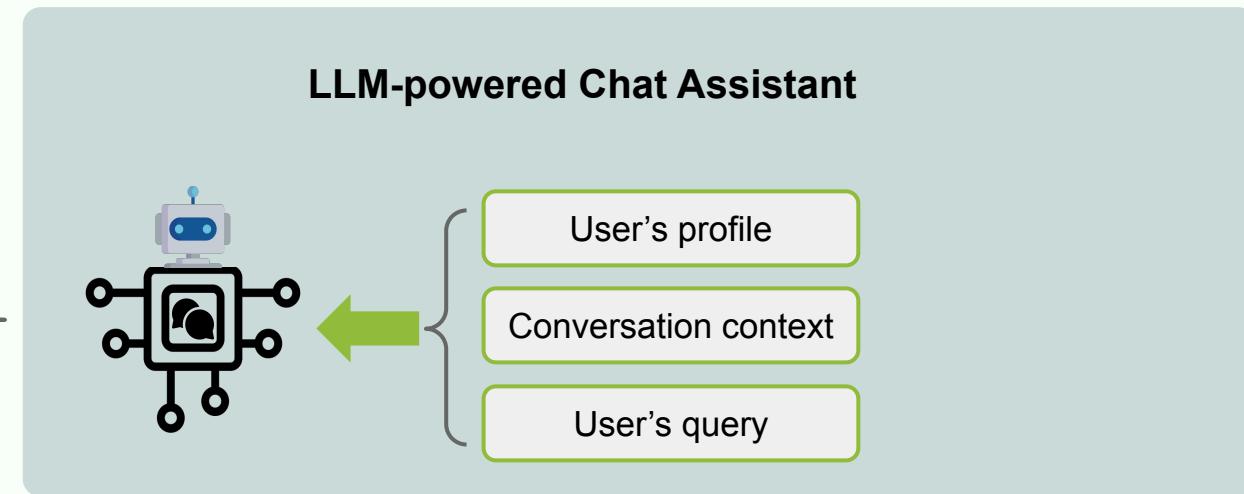
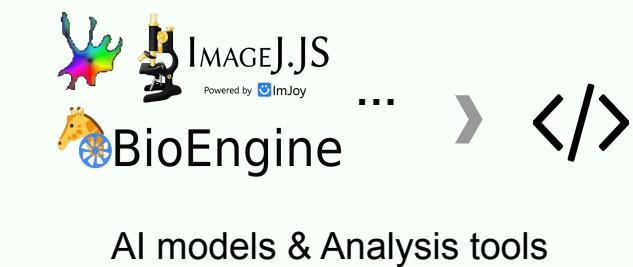
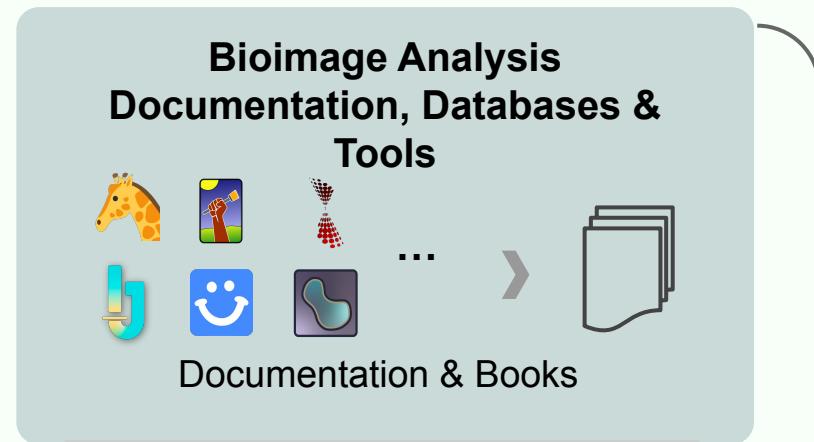
Your tutor for **learning about bioimage analysis and AI**. Nina is the perfect guide, offering detailed explanations and support throughout your learning journey.

Biolimage Analyst (Bridget)

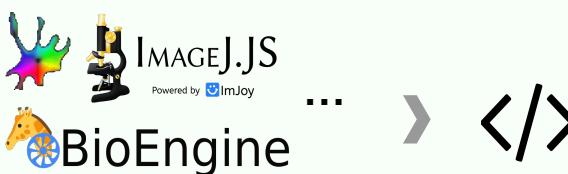
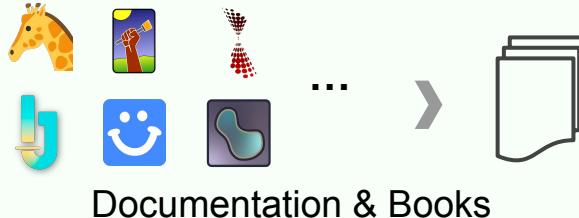
Offers tools to **analyze your images directly** or helps you construct a Python pipeline for advanced image processing tasks.

Biolimage GPT (Skyler)

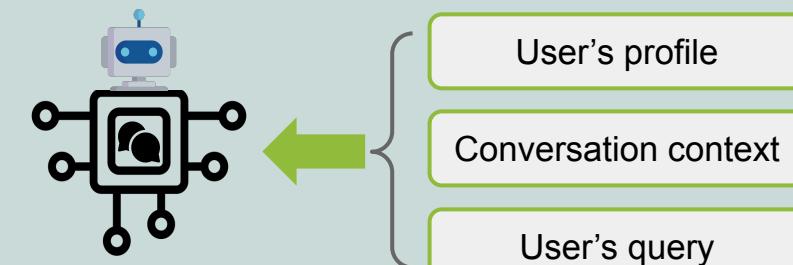
Facilitates the **integration of bioimaging tools and workflows**, making it easier to apply advanced analysis techniques in your research



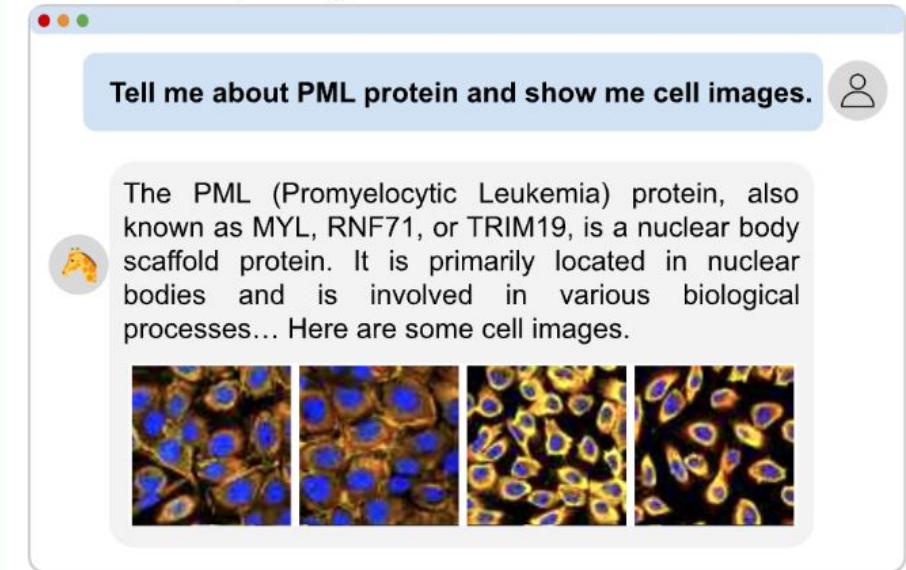
Bioimage Analysis Documentation, Databases & Tools

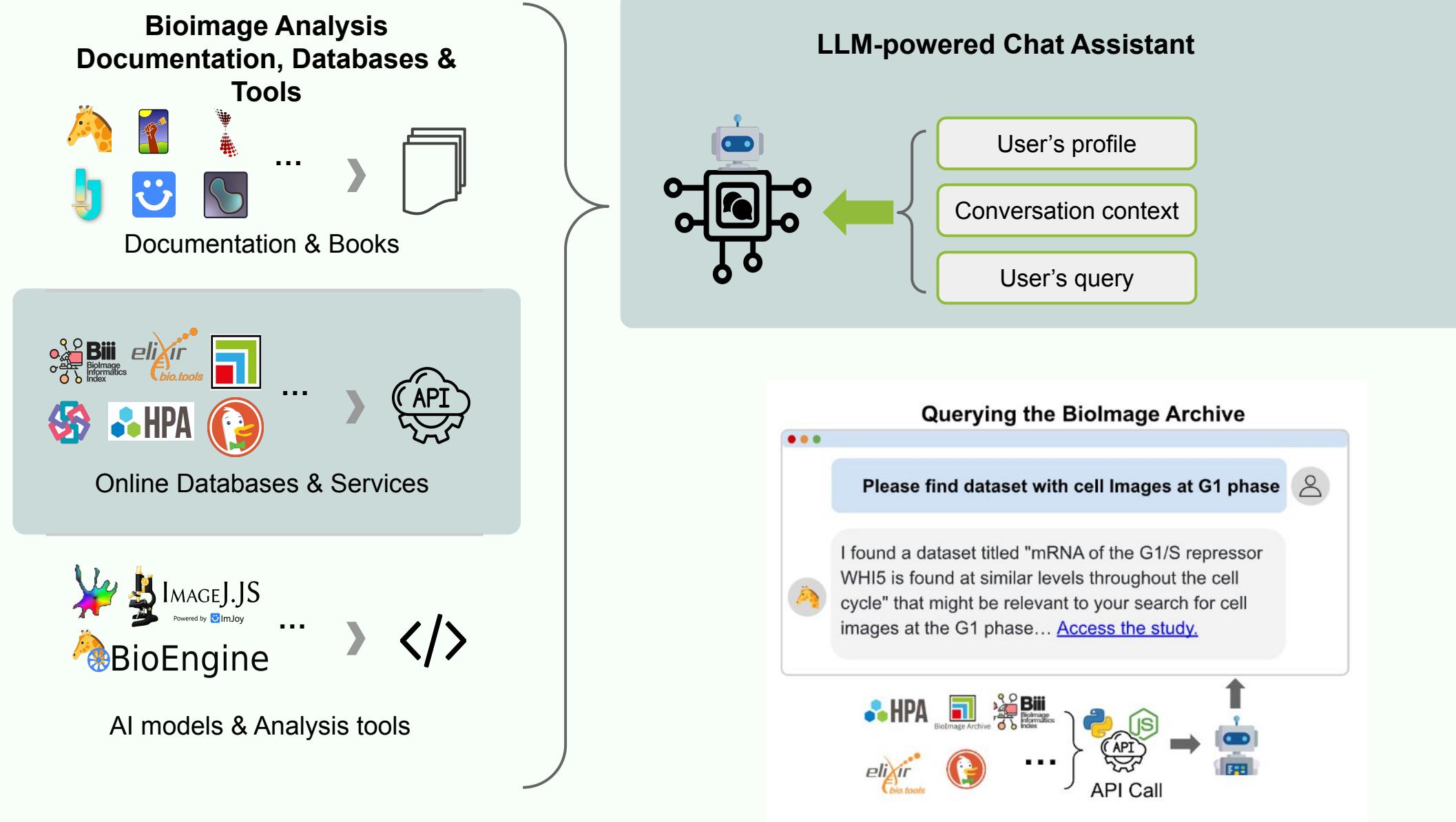


LLM-powered Chat Assistant



Exploring the Human Protein Atlas





BiolImage.IO Chatbot

bioimage.io/chat/?server=https://ai.imjoy.io&service_id=MBCLjcKhJBdfLbmkGSYGbM/bVoohsqW5x8hoshD7kxdV8:bioimageio-chatbot

Hi there! I'm Melman. I am help you navigate the bioimaging tools and provide information about bioimaging. How can I help you today?

Ready to chat! Type your message and press enter!

A

Send Edit Profile Reset Feedback Options

Warning: BiolImage.IO Chatbot can make mistakes. Consider checking important information.

Tips: Customize your profile to get personalized answers based on your background.

If you find our chatbot helpful for you, please consider cite us: arXiv 2310.18351

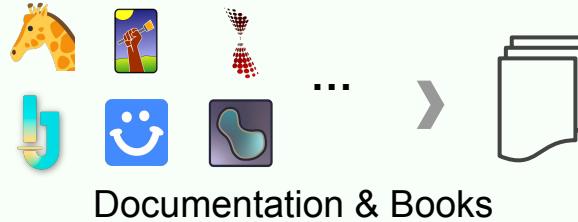
AI4Life

Disclaimer for BiolImage.IO Chatbot

Github bioimageio-chatbot 0.1.97

pypi package 0.1.97

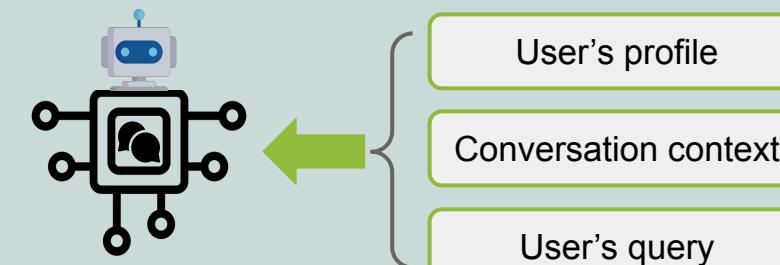
Bioimage Analysis Documentation, Databases & Tools



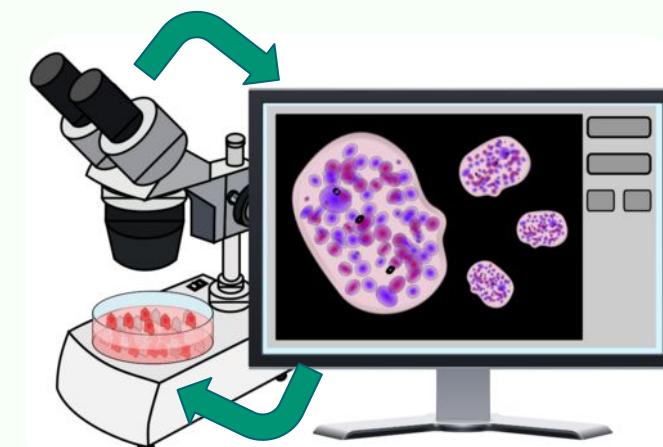
AI models & Analysis tools



LLM-powered Chat Assistant



Automated Image Analysis & Smart Microscopy



Biolmage.IO Chatbot

bioimage.io/chat/?assistant=Bridget

New Chrome available :

Biolmage Analyst (Bridget) ▾

Hi there! I'm Bridget, I can help you with your image analysis tasks. Please mount your data folder and let me know how I can assist you today.

Ready to chat! Type your message and press enter!

Send Mount Files Code Interpreter Edit Profile Reset Feedback Options

Warning: Biolmage.IO Chatbot can make mistakes. Consider checking important information.

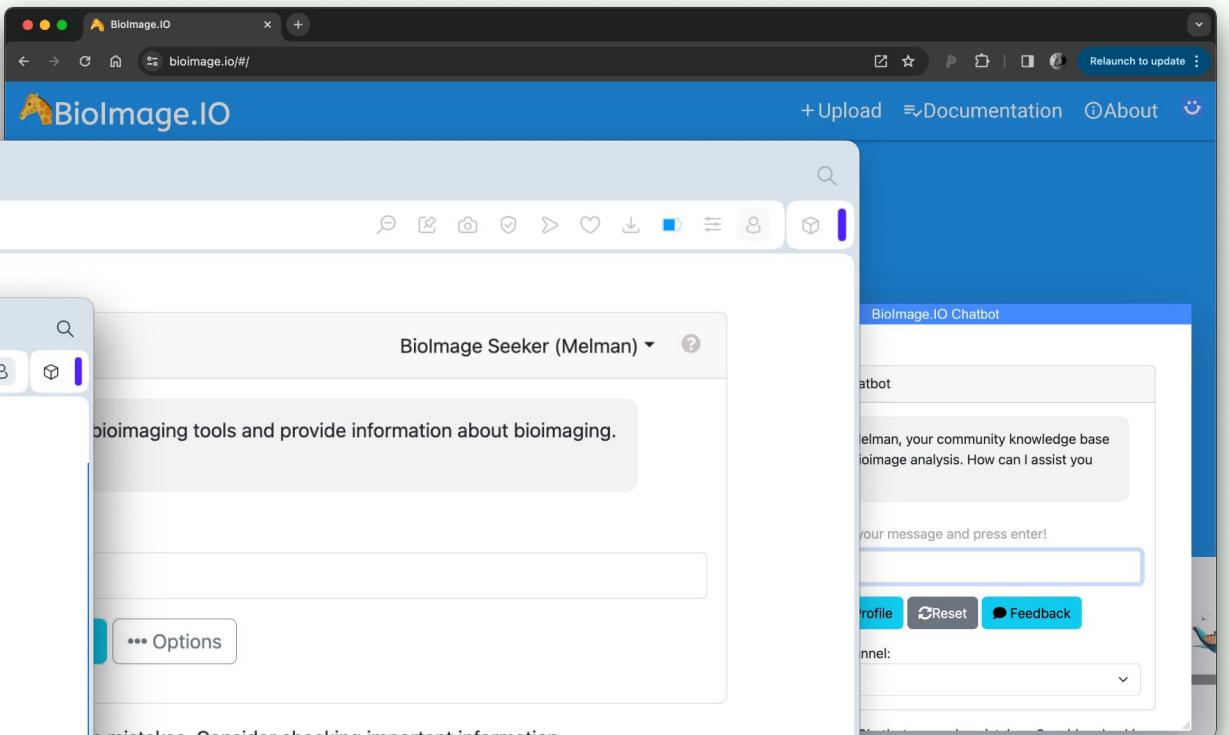
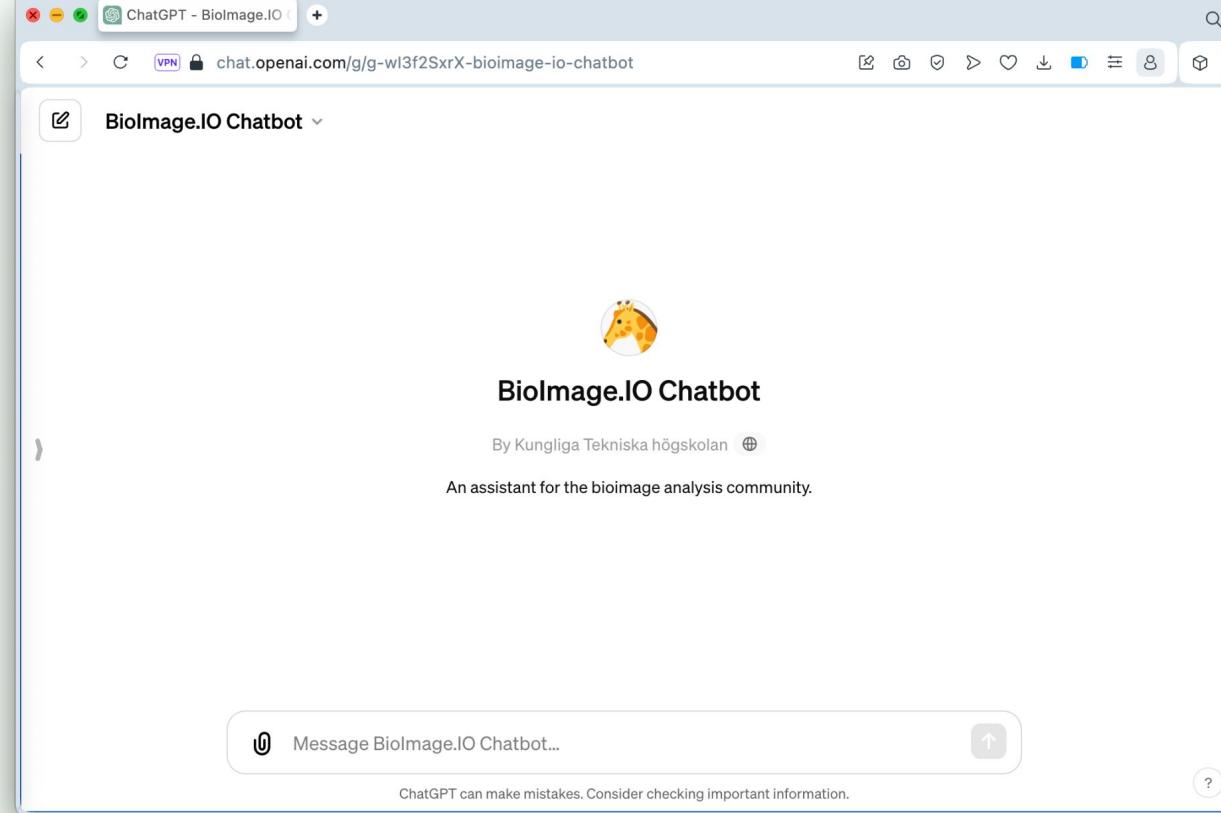
Tips: Customize your profile to get personalized answers based on your background.

If you find our chatbot helpful for you, please consider cite us: arXiv 2310.18351

AI4Life

[Disclaimer for Biolmage.IO Chatbot](#)

How can you access it?



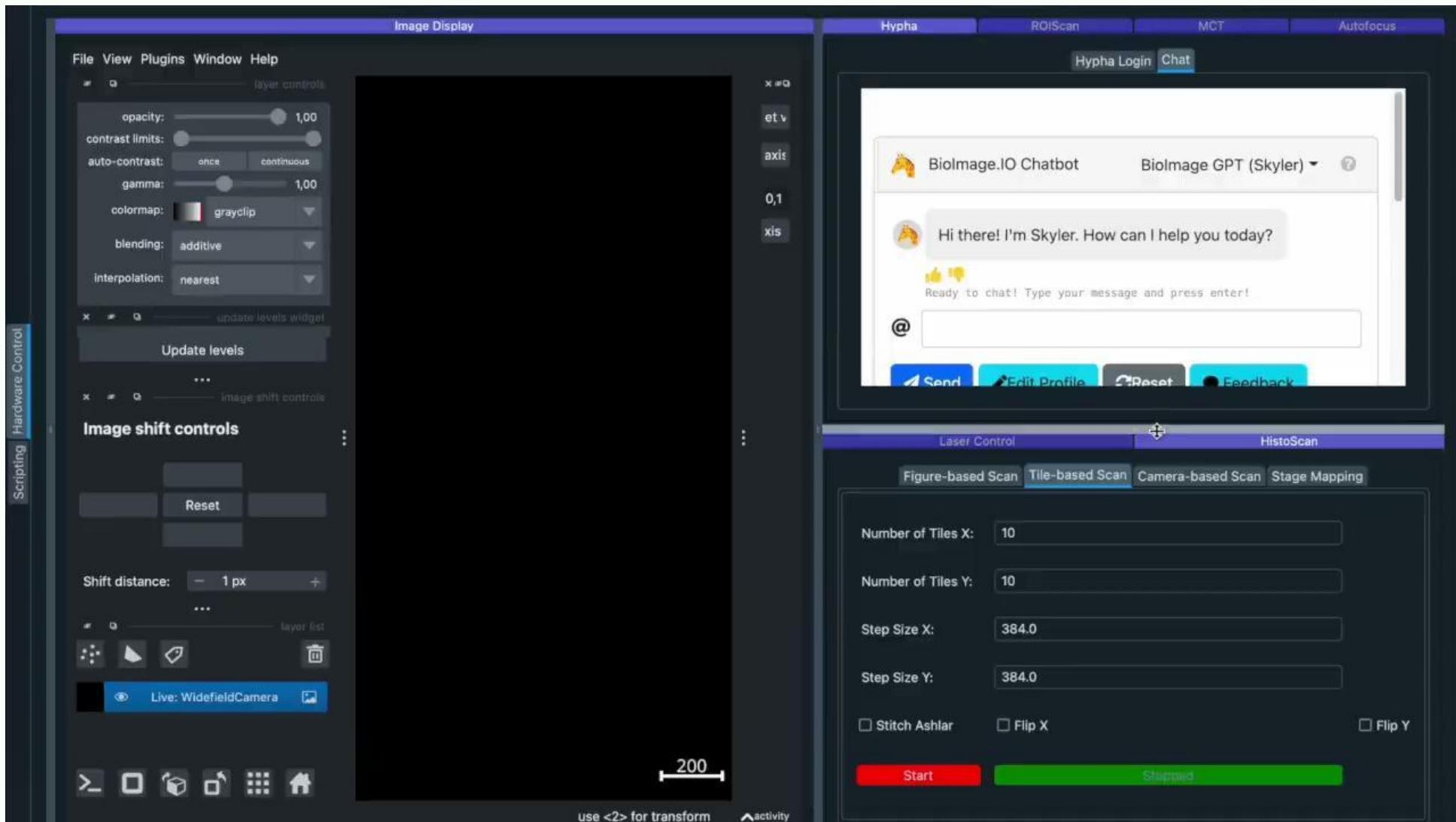
Custom ChatGPT Assistant

Live Demos!

Benedict Diederich, Leibniz-IPHT Jena

Songtao Cheng, KTH

Live Demo for Chatbot Controlled OpenUC2



Example: Chatbot extension for Controlling Microscopes

Biolmage.IO Chatbot

Hi there! I'm Melman, your community knowledge base assistant for bioimage analysis. How can I assist you today?

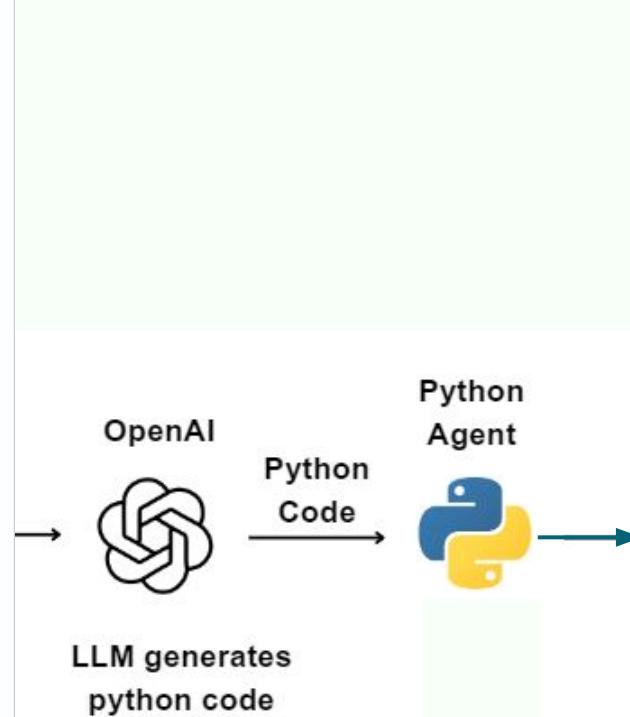
Ready to chat! Type your message and press enter!

Hi, please move 5000,0,0 along the X, Y, and Z axis and take a picture. Then move back and snap a picture.

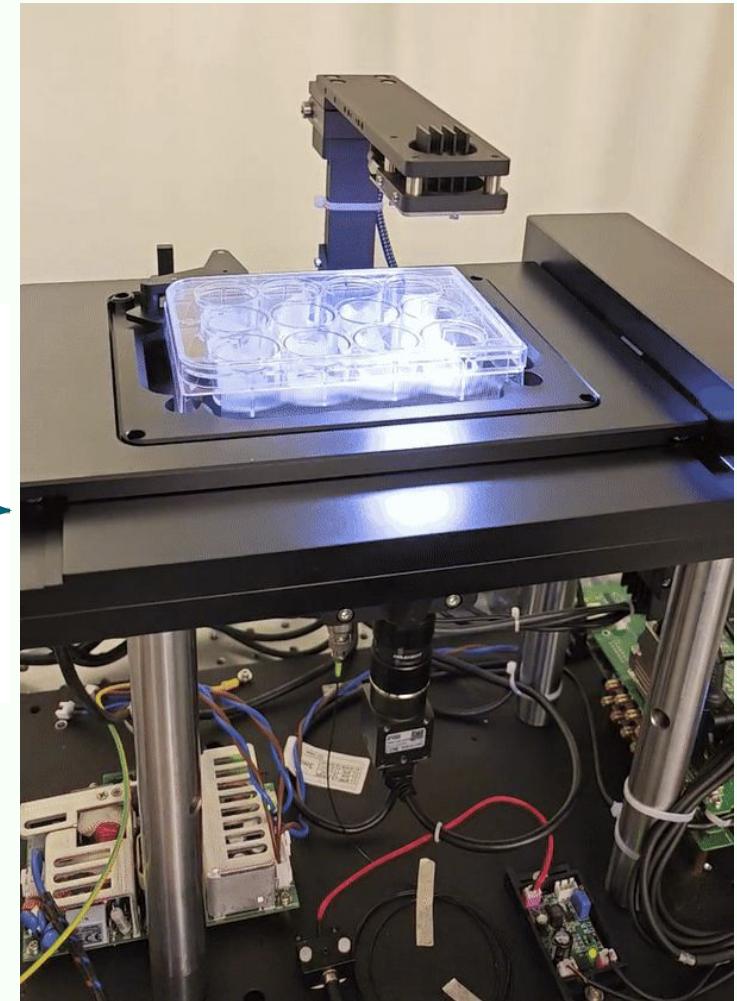
Send **Edit Profile** **Reset** **Feedback**

Knowledge Base Channel:
auto

Tips: Customize your profile to get personalized answers based on your background.



[Try it here](#)



Try it yourself!

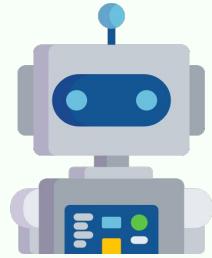
<https://bioimage.io/chat/>

Biolimage.IO Chatbot Extensions

A Community-driven Chatbot

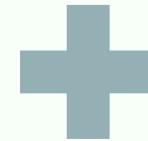
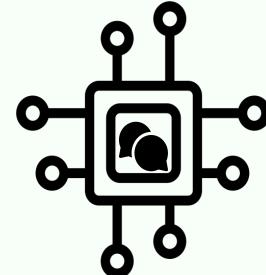
Wanlu Lei, Ericsson & KTH

AI Agent



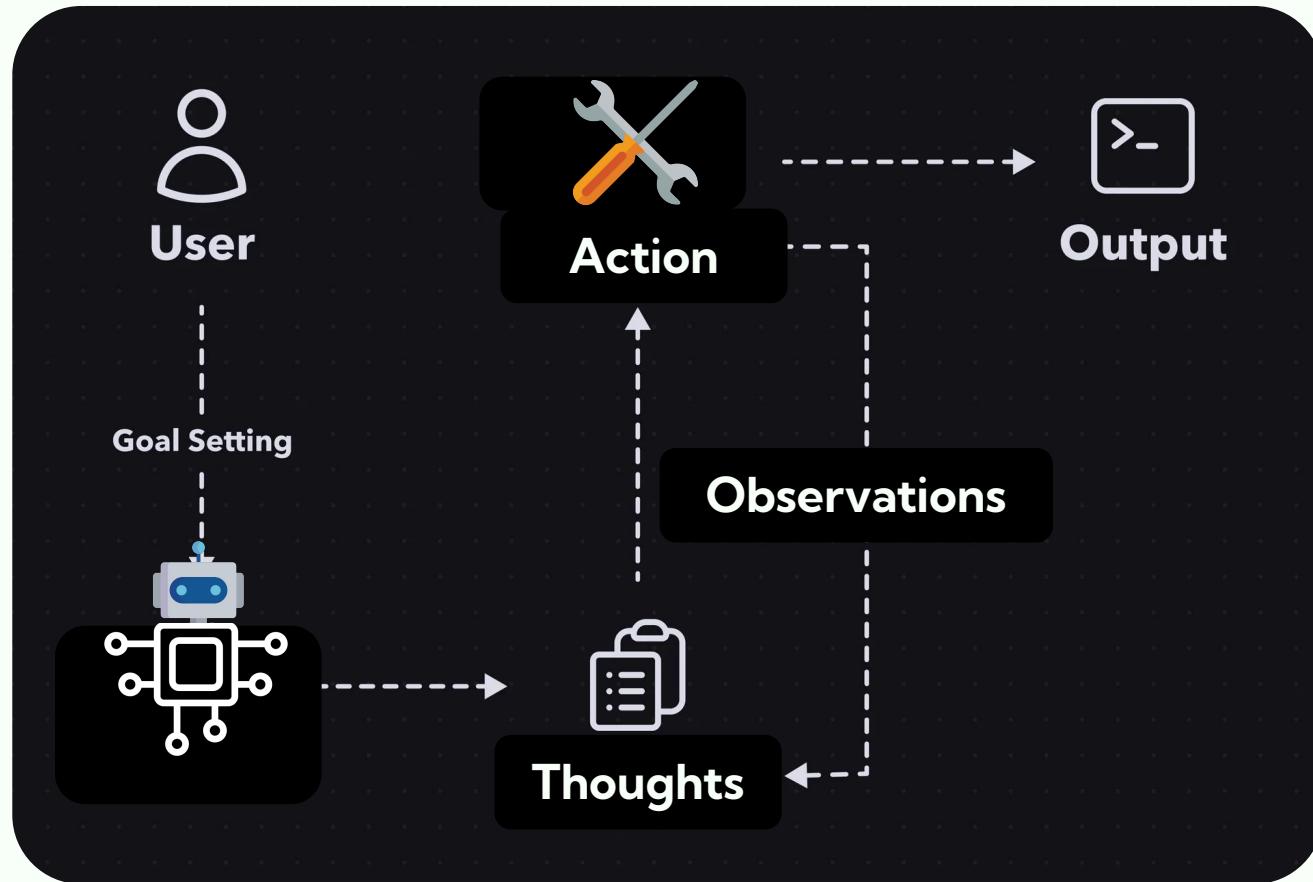
Biolmage.IO Chatbot

LLM



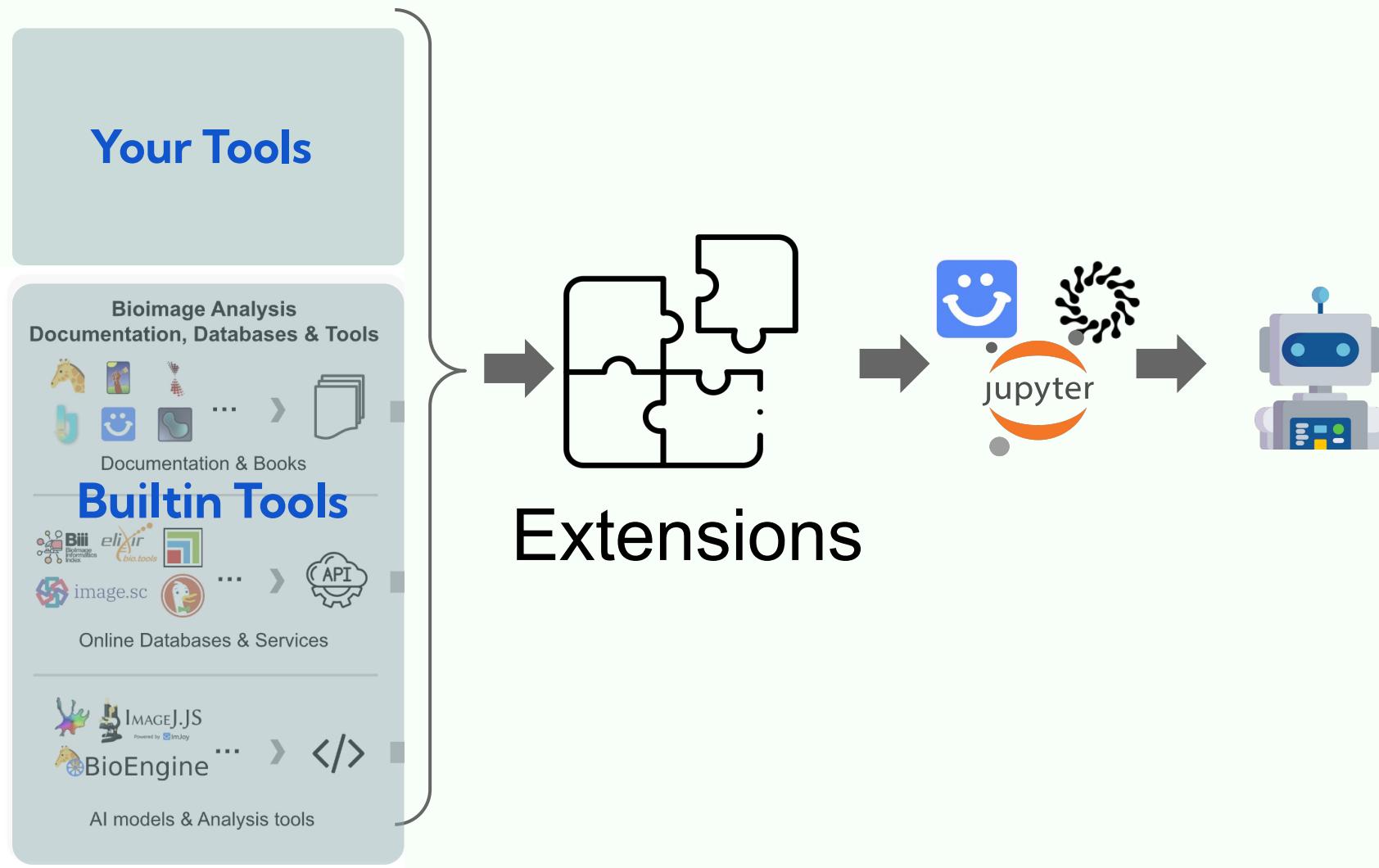
Tools

ReAct Loop & Agentic Workflow



Yao et. al, 2023 <https://arxiv.org/abs/2210.03629>

BioImage.IO Chatbot Extension Framework



Your Tools

Bioimage Analysis
Documentation, Databases & Tools



Documentation & Books

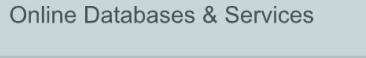
Builtin Tools

BiiB
Bioimage Informatics
Index

elisIR
bio.tools

image.sc

AI



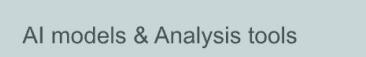
API

Online Databases & Services

IMAGEJ JS

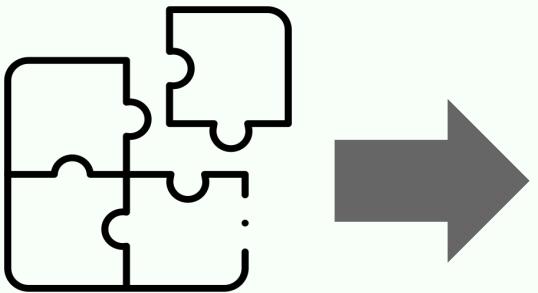
Powered by ImJoy

BioEngine



AI models & Analysis tools

Extensions



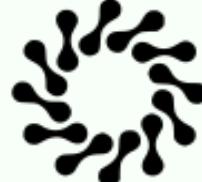
Two Ways for Building Extensions

Option 1: ImJoy Plugins

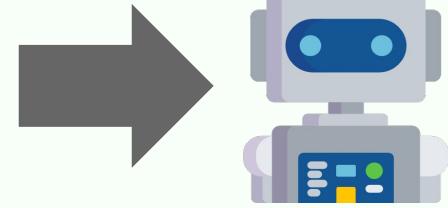


For web and client side tools
E.g. UI, image viewer

Option 2: Hypha Services



For cloud and native tools
E.g. Microscope control, AI models



Microscopy Control Extension

Metadata

Id, name, description...

Tool Functions

```
{  
    move_stage(x, y, z),  
    snap_image(exposure)  
    ...  
}
```

Tool Schema

Tool Functions

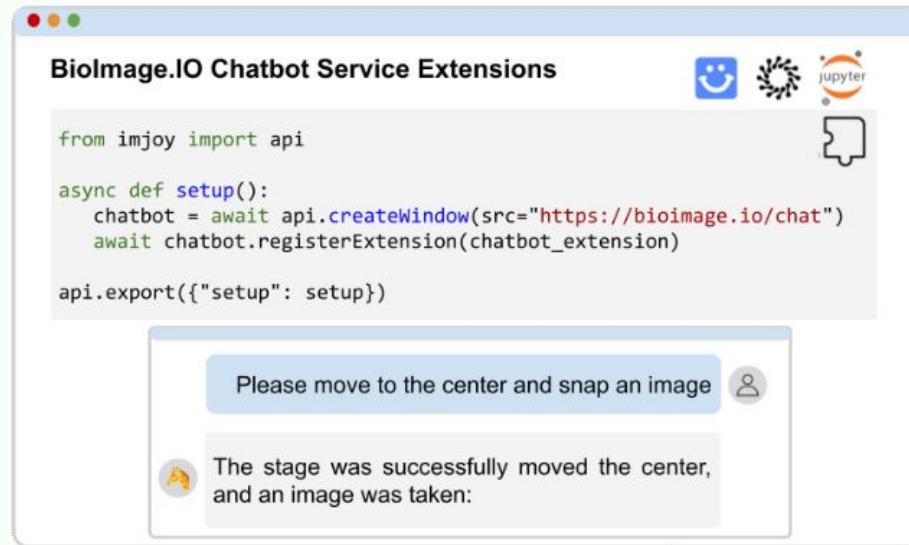
```
async def move_stage(kwargs):  
    config = MoveStageInput(**kwargs)  
    print(config.x, config.y)  
  
    return "success"  
  
async def snap_image(kwargs):  
    config = SnapImageInput(**kwargs)  
    print(config.exposure)  
    await api.showDialog(src="https://bioimage.io")  
    return "success"
```

Tool Schema

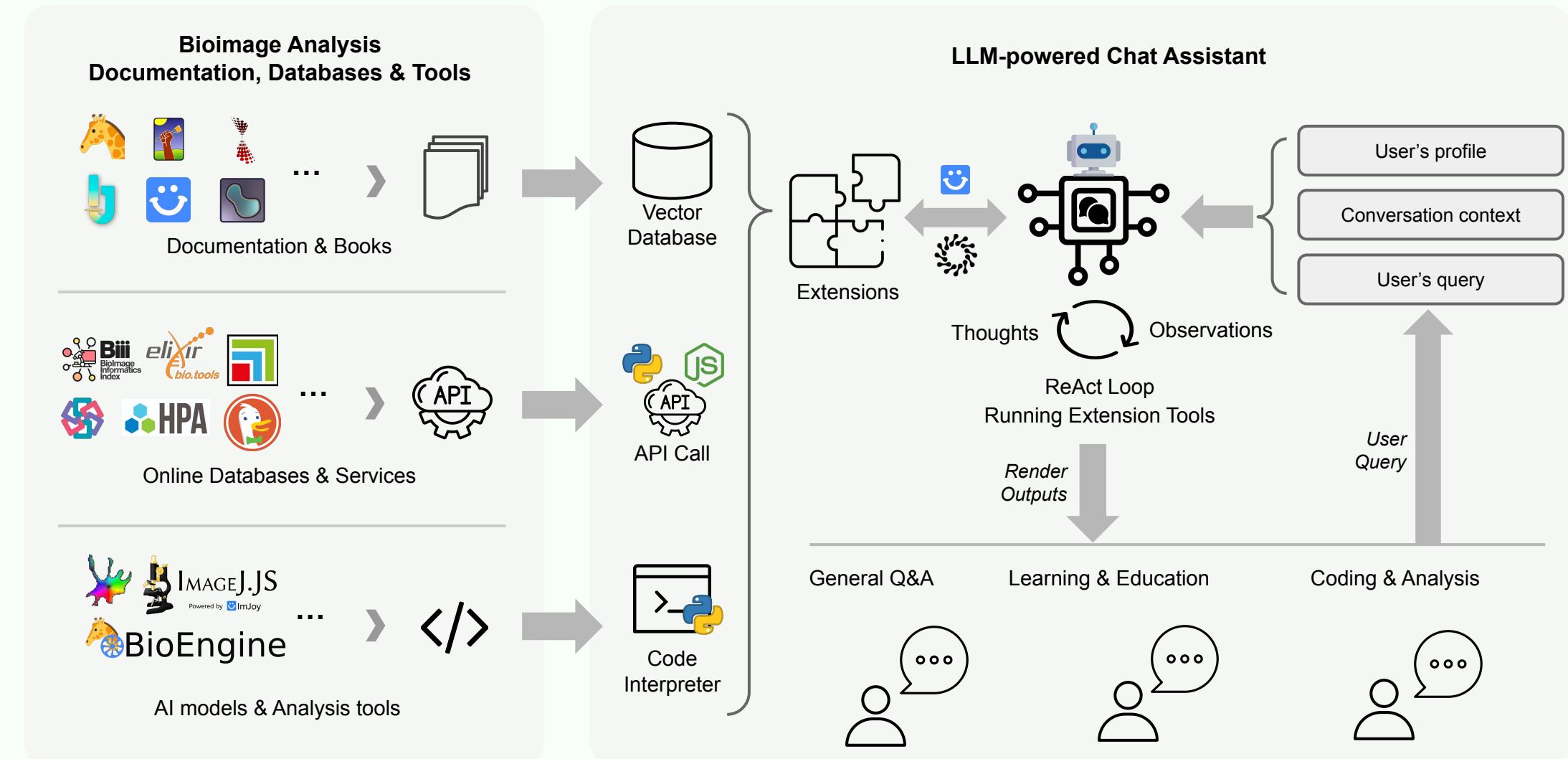
```
from pydantic import BaseModel, Field  
  
class MoveStageInput(BaseModel):  
    """Move the microscope stage"""\n    x: float = Field(..., description="x offset")\n    y: float = Field(..., description="y offset")  
  
class SnapImageInput(BaseModel):  
    """Move the microscope stage"""\n    exposure: float = Field(..., description="exposure time")  
  
def get_schema():  
    return {  
        "move_stage": MoveStageInput.schema(),  
        "snap_image": SnapImageInput.schema()  
    }
```

Hands on: Develop BioImage.IO Chatbot Extensions

[Click to Open in Chrome](#)
(Incognito mode!)

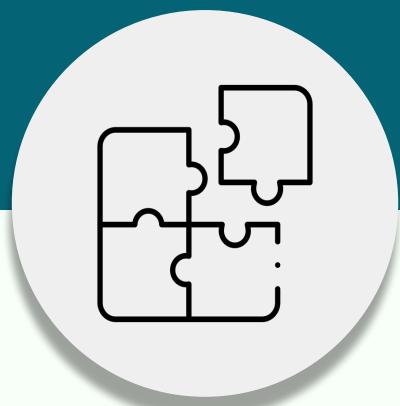


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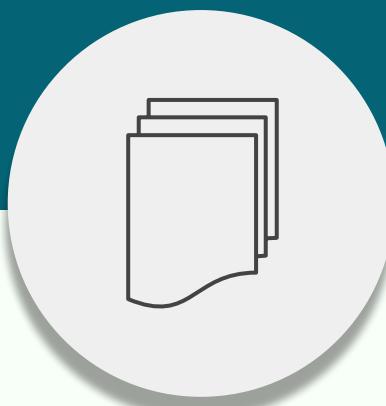


Contributing to the Biolmage.IO Chatbot

<https://github.com/bioimage-io/bioimageio-chatbot>



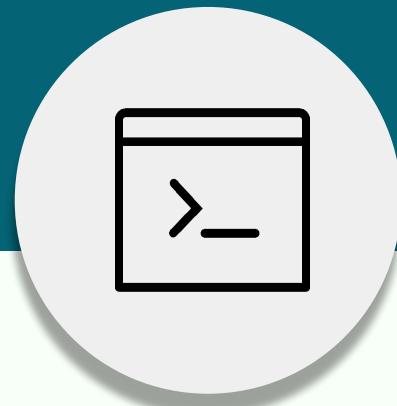
Developing Extensions



**Adding Tool
Documentation**



**Feedback and User
Experience**



**Sending PR to our GitHub
project**

