model_ELISA

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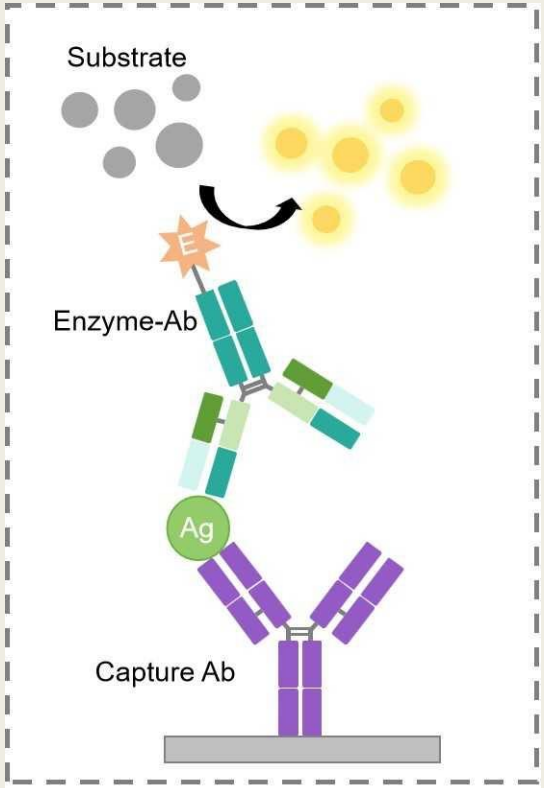
BIOEN 537

Background



Direct sandwich ELISA

https://www.antibody-creativebiolabs.com/sandwich-elisa-with-streptavidin-biotin-detection.htm

- An **enzyme-linked immunosorbent assay** or ELISA is used to identify and/or quantify proteins.
- There are multiple different varieties of ELISAs, however one of the most commonly used is the **direct sandwich ELISA**.
- Given its detection abilities, it is highly useful for diagnosing various diseases from immune system disorders to infections.

ELISA development and optimization requires researchers to perform benchtop experiments that are often cumbersome and necessitate many experiments

Problem

This tool allows the user to mimic sandwich ELISA component relationships with ease

Solution

User cases:

Use case #1

Identifying which components are in excess

Use case #2

Seeing how temperature changes affect each step by altering kinetic constants

Use case #3

Determining when steady state occurs to find minimum reaction time

Users:

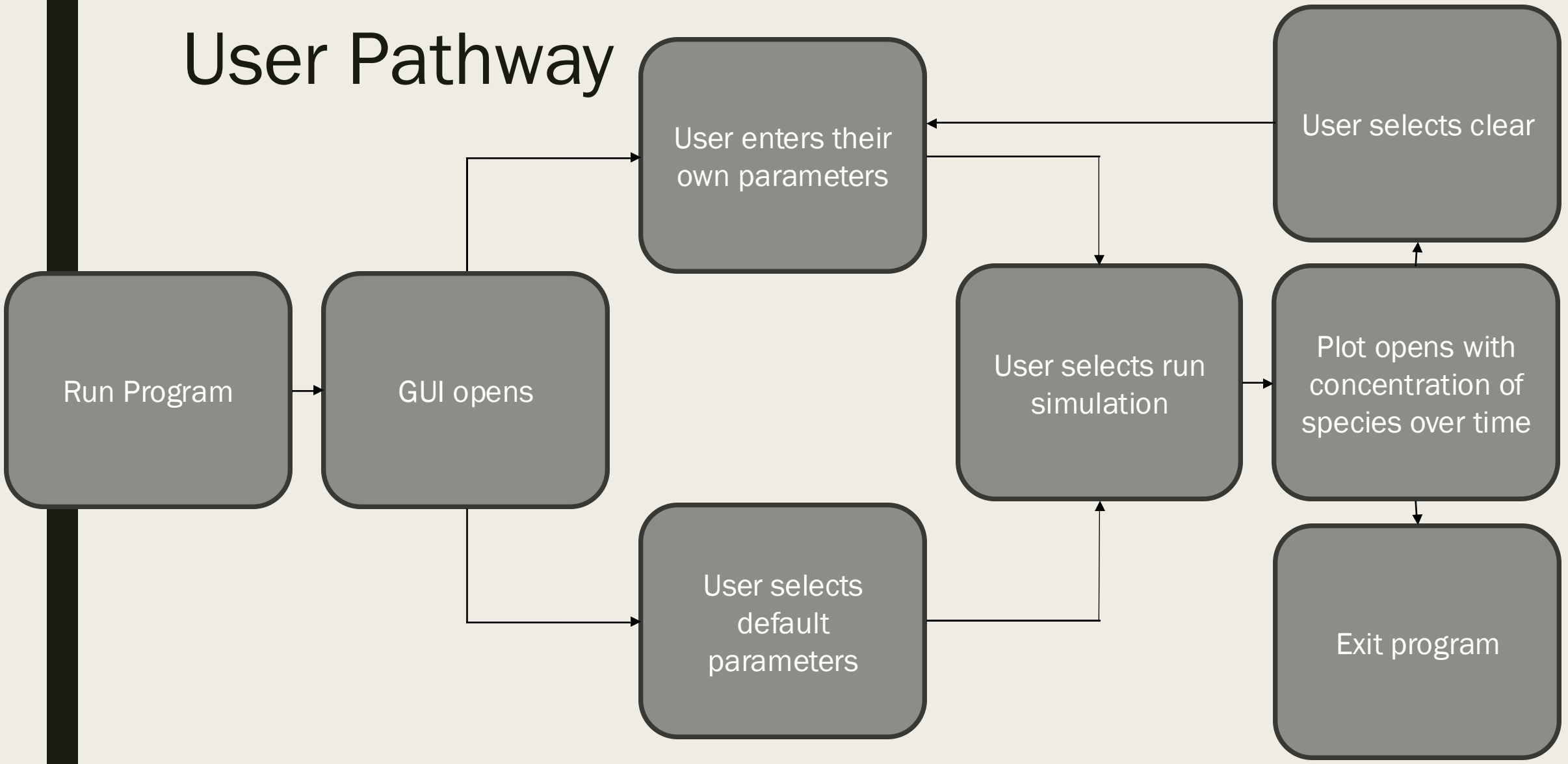
Users #1

<u>For lab use:</u>
Researchers with a general knowledge of sandwich ELISAs and assay development. Generally, these users are predicted to have programming experience in python.

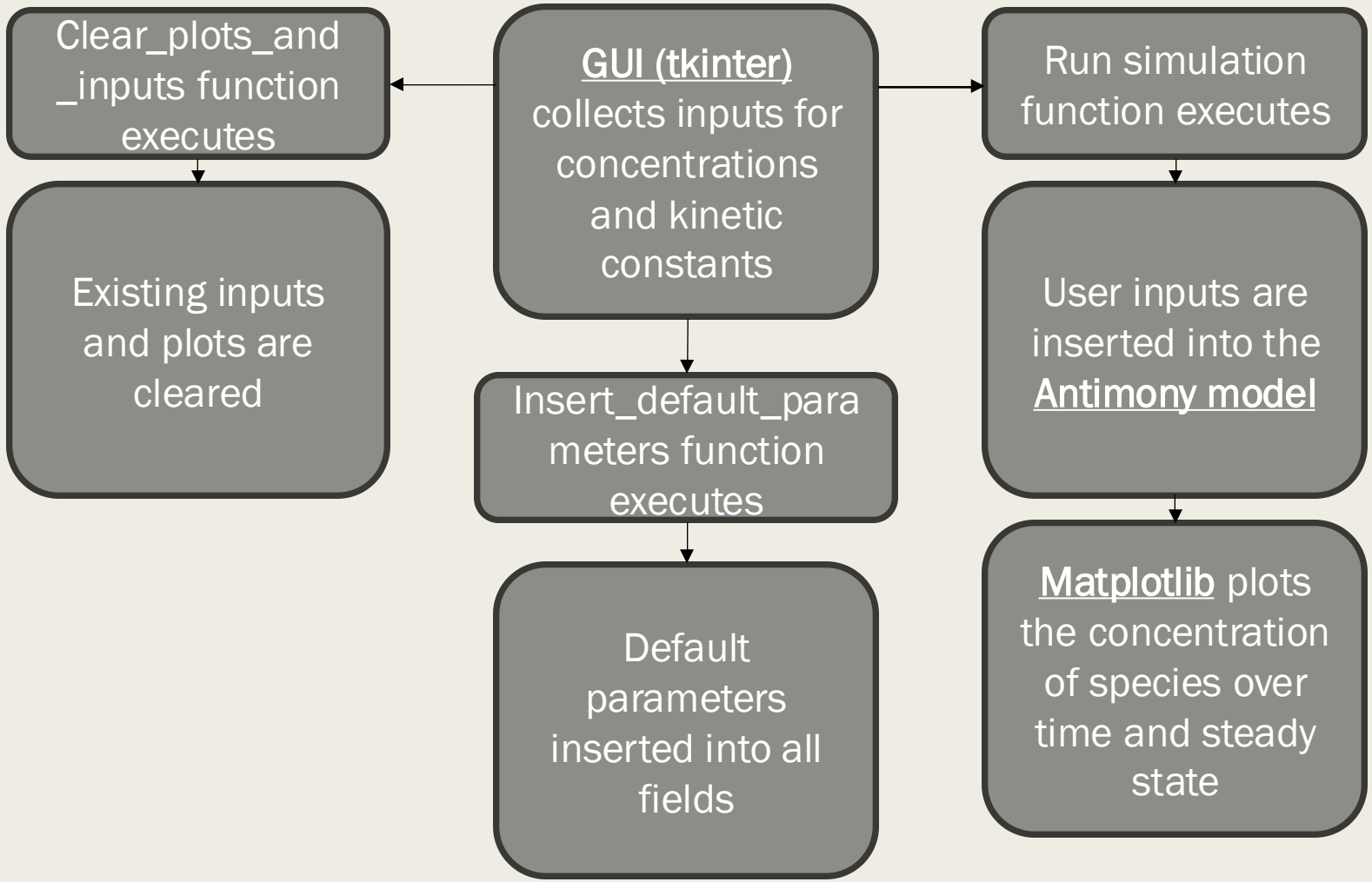
User #2

<u>For education purposes:</u>
Users with minimal python knowledge who want to use the package to learn more about how an ELISA works.

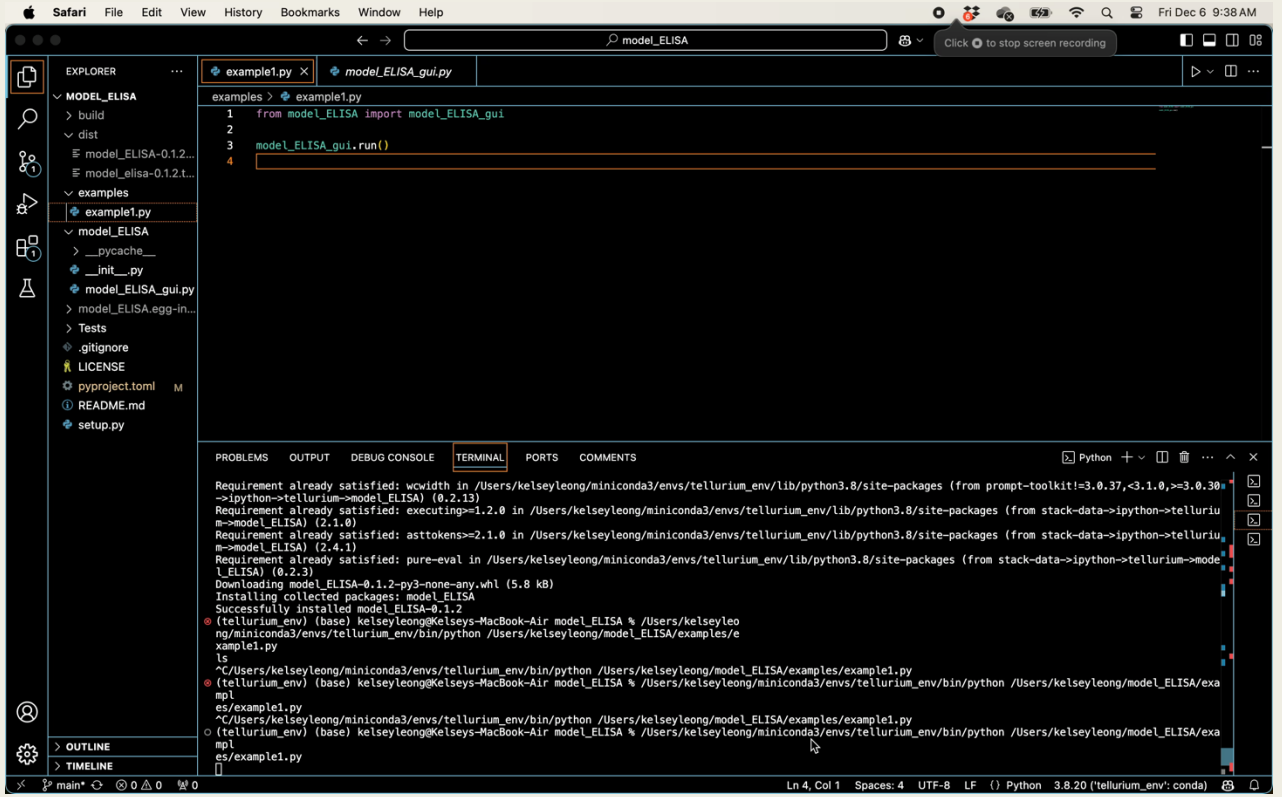
User Pathway



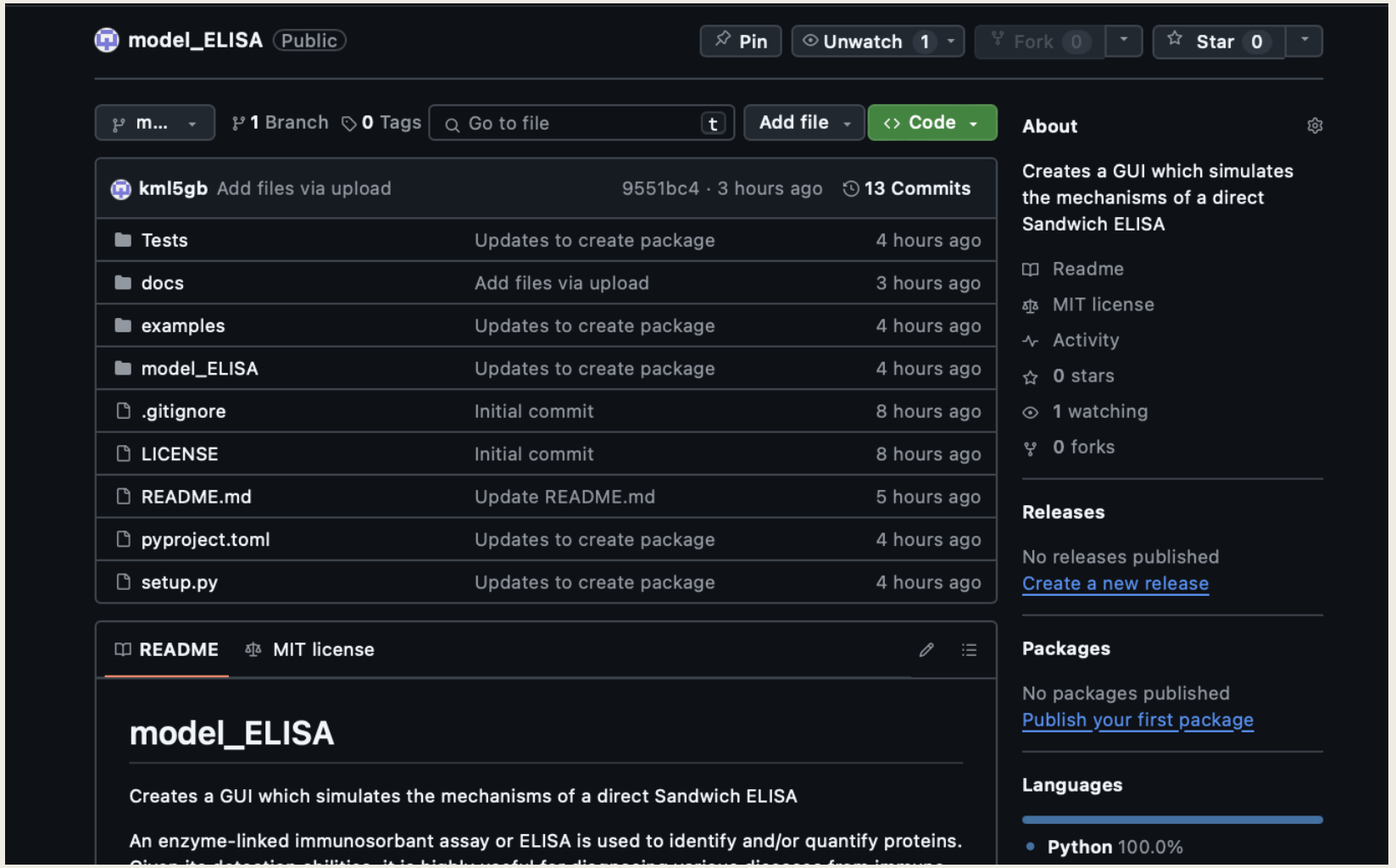
Design


Clear_plots_and _inputs function executes
Existing inputs and plots are cleared
GUI (tkinter) collects inputs for concentrations and kinetic constants
Insert_default_parameters function executes
Default parameters inserted into all fields
Run simulation function executes
User inputs are inserted into the Antimony model
Matplotlib plots the concentration of species over time and steady state

Demo


Safari File Edit View History Bookmarks Window Help
Fri Dec 6 9:38 AM
model_ELISA
Click to stop screen recording
EXPLORER
MODEL_ELISA
build
dist
model_ELISA-0.1.2...
model_elisa-0.1.2.t...
examples
example1.py
model_ELISA
__pycache__
__init__.py
model_ELISA_gui.py
model_ELISA.egg-in...
Tests
.gitignore
LICENSE
pyproject.toml M
README.md
setup.py
example1.py
model_ELISA_gui.py
examples > example1.py
1 from model_ELISA import model_ELISA_gui
2
3 model_ELISA_gui.run()
4
PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL PORTS COMMENTS
Python
Requirement already satisfied: wcwidth in /Users/kelseyleong/miniconda3/envs/tellurium_env/lib/python3.8/site-packages (from prompt-toolkit!=3.0.37,<3.1.0,>=3.0.30->ipython->tellurium->model_ELISA) (0.2.13)
Requirement already satisfied: executing>=1.2.0 in /Users/kelseyleong/miniconda3/envs/tellurium_env/lib/python3.8/site-packages (from stack-data->ipython->tellurium->model_ELISA) (2.1.0)
Requirement already satisfied: asttokens>=2.1.0 in /Users/kelseyleong/miniconda3/envs/tellurium_env/lib/python3.8/site-packages (from stack-data->ipython->tellurium->model_ELISA) (2.4.1)
Requirement already satisfied: pure-eval in /Users/kelseyleong/miniconda3/envs/tellurium_env/lib/python3.8/site-packages (from stack-data->ipython->tellurium->model_ELISA) (0.2.3)
Downloading model_ELISA-0.1.2-py3-none-any.whl (5.8 kB)
Installing collected packages: model_ELISA
Successfully installed model_ELISA-0.1.2
(tellurium_env) (base) kelseyleong@Kelseys-MacBook-Air model_ELISA % /Users/kelseyleong/miniconda3/envs/tellurium_env/bin/python /Users/kelseyleong/model_ELISA/examples/example1.py
ls
^C/Users/kelseyleong/miniconda3/envs/tellurium_env/bin/python /Users/kelseyleong/model_ELISA/examples/example1.py
(tellurium_env) (base) kelseyleong@Kelseys-MacBook-Air model_ELISA % /Users/kelseyleong/miniconda3/envs/tellurium_env/bin/python /Users/kelseyleong/model_ELISA/examples/example1.py
^C/Users/kelseyleong/miniconda3/envs/tellurium_env/bin/python /Users/kelseyleong/model_ELISA/examples/example1.py
(tellurium_env) (base) kelseyleong@Kelseys-MacBook-Air model_ELISA % /Users/kelseyleong/miniconda3/envs/tellurium_env/bin/python /Users/kelseyleong/model_ELISA/examples/example1.py
OUTLINE
TIMELINE
main*
Ln 4, Col 1 Spaces: 4 UTF-8 LF Python 3.8.20 ('tellurium_env': conda)

Github repo: https://github.com/kml5gb/model_ELISA.git



Lessons learned and future work

Lessons learned

- First time creating a GUI -> tkinter
- Gained more experience working with Tellurium
- First time using unittest to test a program
- Learned proper code documentation
- Gained more experience debugging

Future work

- Add more advanced kinetics/variables to more closely mimic the relationships
- Expand the simulation to more types of ELISAs
- Add additional functionality to the GUI as I continue to use it in my lab
- Add more functionality in case of user errors