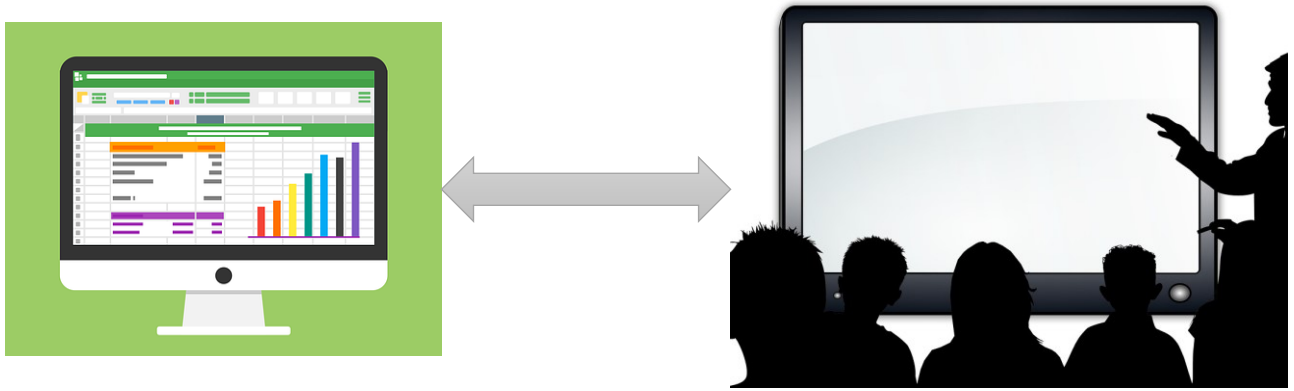
Online visualization-based modules for data science education in chemical engineering

Joseph Menicucci, Raghuram Thiagarajan, Srinivas Rangarajan

Lehigh University

Online modules for interactive visualization



Online interactive visualization-based modules can supplement classroom instruction

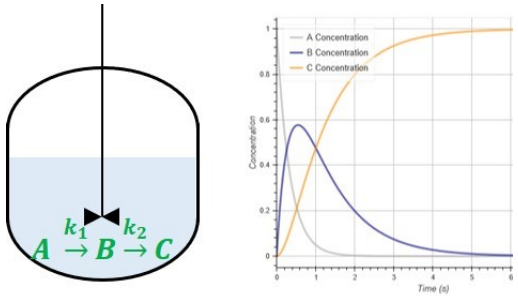
- *Instructors can facilitate enquiry-based self-learning of scientific concepts*
- *Offer open-ended problems that promotes critical and entrepreneurial thinking*
- *Can be used to "game-ify" classroom activities*
- *Easy to access and use*
- *CAChE grant allowed us to develop multiple data science modules*

Online modules for interactive visualization

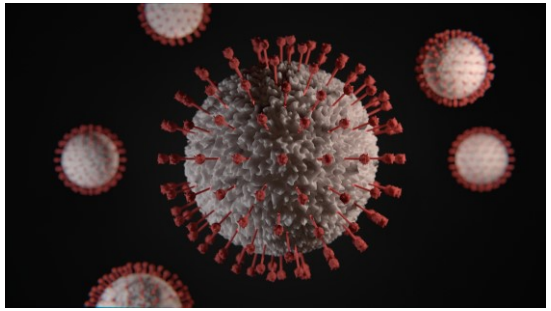
- ***Student-led creation of online modules***
  - *Undergrad students from various majors have contributed to six modules*

https://srrweb.cc.lehigh.edu/app/

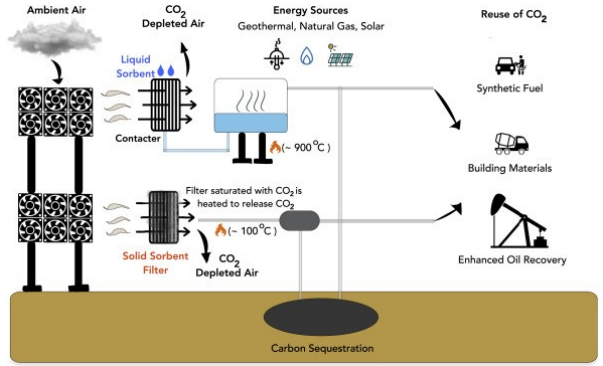
Reaction kinetics



Infectious diseases



Direct air capture



Evaporative cooling

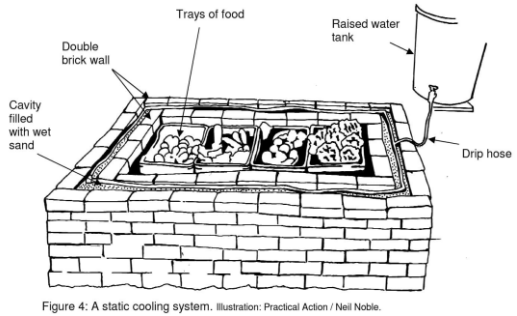


Figure 4: A static cooling system. Illustration: Practical Action / Neil Noble.

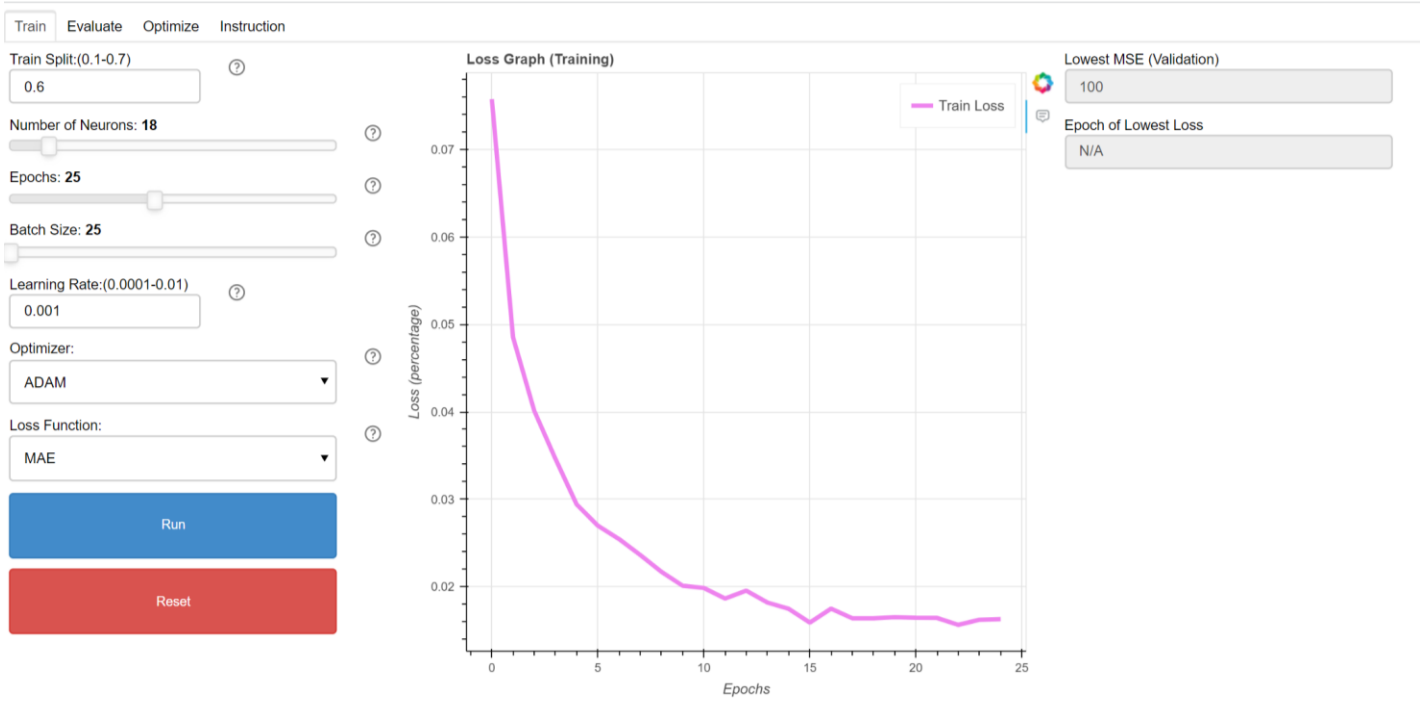
Catalysis data analysis

Algae bioreactor

Data-driven digital twin of a photobioreactor

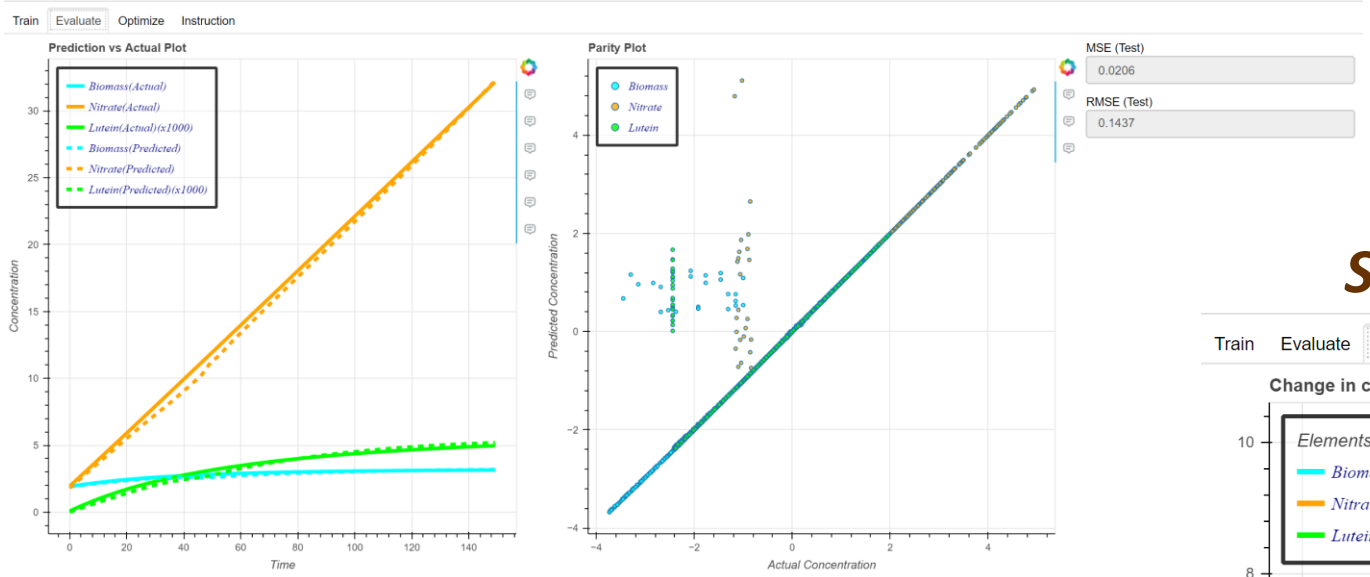
Photobioreactor (Lutein production)

Step 1: Training on synthetic data (eventually expt data)

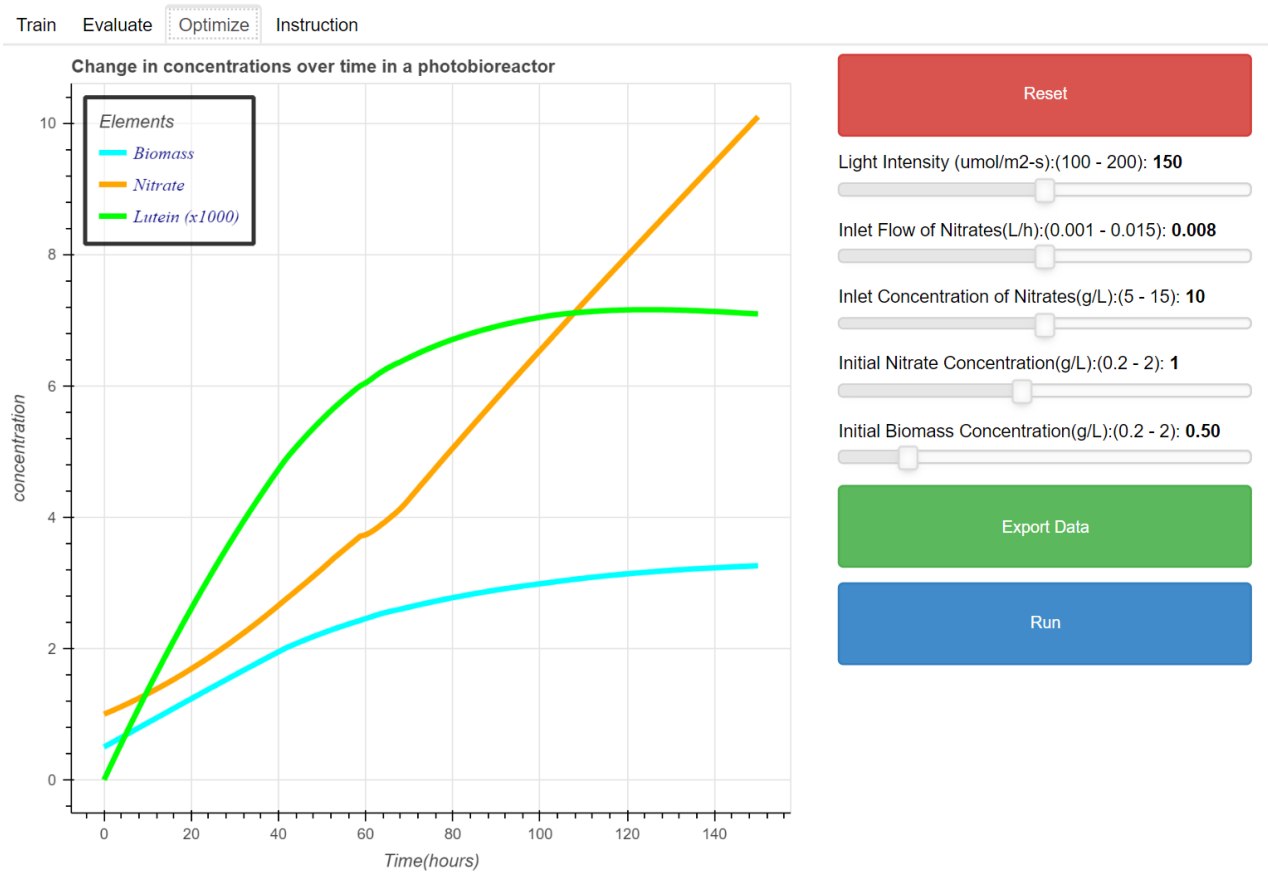


Data-driven digital twin of a photobioreactor

Step 2: Evaluate the model against test data



Step 3: Optimize process using model



Biodegradability module (Demo)

Future directions:

- *More data science modules (PINNs, Active learning, Equation discovery)*
- *Hosting modules on the web (running into bandwidth issues)*

Acknowledgements

- **CACHE Corp**
- **Lehigh Mountaintop initiative**
- **NSF (CAREER)**