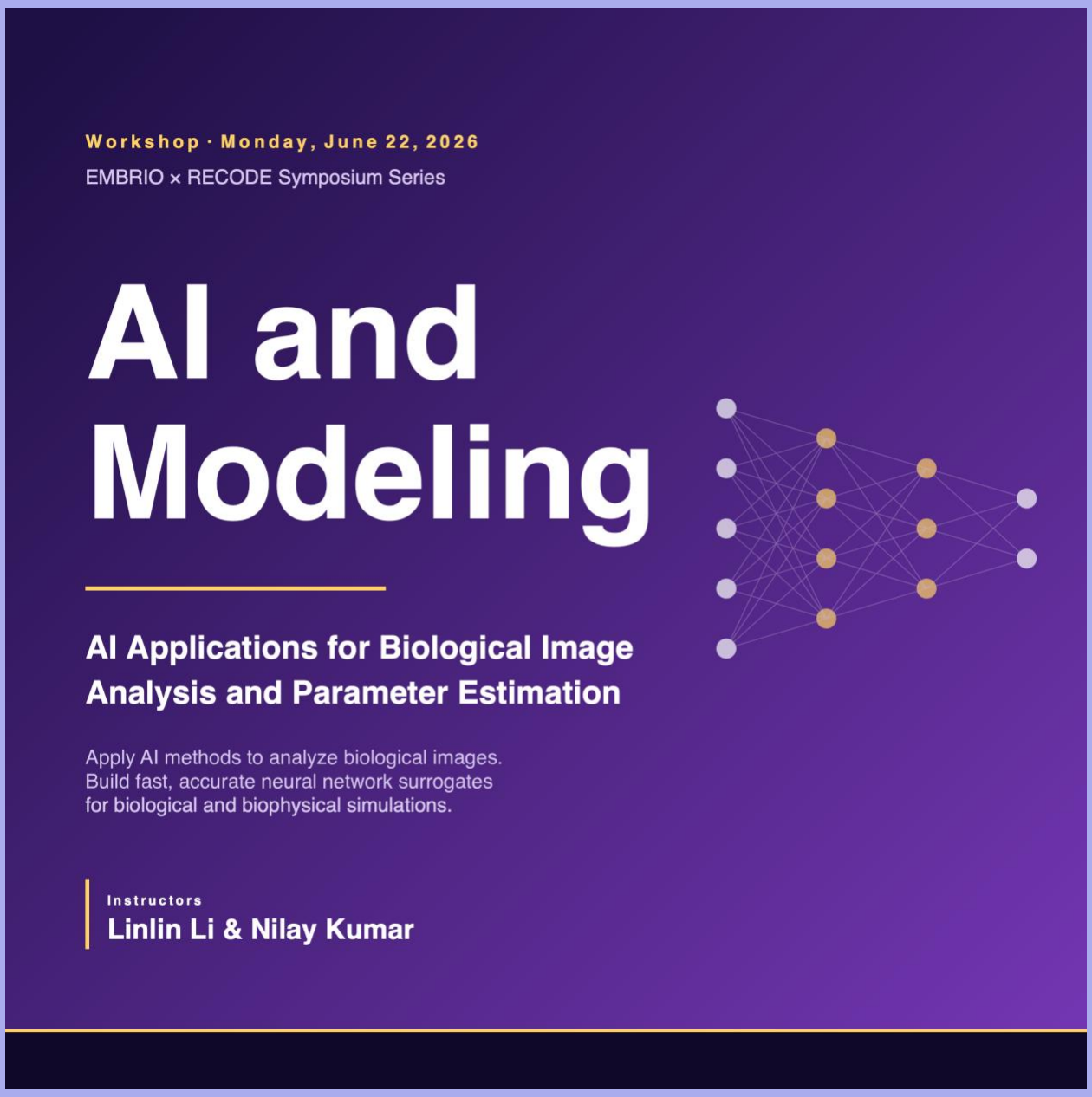

Mini-Workshop: AI Applications for Biological Image Analysis and Parameter Optimization, Monday, June 22nd (1 - 5pm)

This mini workshop will introduce participants to practical AI methods for biological research, with a focus on image analysis using deep learning and CellPose, and parameter optimization using invertible neural networks (INNs) and Bayesian optimization.

Lead instructors: Senior Research Scientists, **Linlin Li and Nilay Kumar,** Purdue University.

Total Duration: 3.5-4.0 hours

Target Audience & Coding Experience

- Graduate students, postdocs, and researchers with basic familiarity with biological data analysis.
- Prior coding experience is helpful but not required.

Tools, Data, and Images

- Google Collab: workshop leaders will provide
- CellPose is https://www.cellpose.org/.
- Bring your image(s) to try out in CellPose
- Bring your own data to try out for modeling

SCHEDULE

Section 1. Deep Learning Basics for Biological Data

Time: 30 minutes

Provide a short conceptual foundation so participants understand the key ideas behind AI methods used later in the workshop.

Section 2. Hands-on Biological Image Analysis with Cellpose

Time: 1 hour 30 minutes

- Give participants practical experience using a deep-learning-based segmentation tool for biological images**.**
- Part A. Introduction to image analysis workflow
- Time: 20 minutes
- Part B. Hands-on Cellpose demo and practice
- Time: 50 minutes
- Part C. Discussion of practical issues and extensions
- Time: 20 minutes

Break

Section 3. AI for Parameter Optimization: INN and Bayesian Optimization

Time: 1 hour

Introduce AI-based strategies for estimating model parameters and efficiently exploring parameter space in biological systems models.

- Part A. Why parameter optimization is hard in biology
  Time: 10 minutes
- Part B. Invertible Neural Networks for parameter inference
  Time: 20 minutes
- Part C. Bayesian optimization

Time: 20 minutes

- Part D. Hands-On time to start working on your own model (or images) with help and feedback.
  Time: 30min+