Summer Student Project Openings

Generative AI-Accelerated Physics Simulations for Interdisciplinary Scientific Machine Learning

Supervisor: Dr. Xiao Xue and Professor Peter Coveney
Centre for Computational Science and Department of Computer Science,
University College London

Project Overview

This summer project offers an exciting opportunity to explore the frontiers of scientific machine learning in modeling complex dynamical systems. A limited number of selected students will join ongoing research at UCL's Centre for Computational Science, contributing to efforts that investigate how data-driven generative models influence the long-term behaviour and statistical fidelity of simulations across domains—from fundamental fluid dynamics to multiscale blood flow modeling. This project aims to uncover and mitigate the subtle challenges posed by high-dimensional, physically grounded simulations.

Background

Generative modeling of numerically simulated data—particularly over long time horizons—faces fundamental challenges arising from the inherent limitations of floating point arithmetic. These limitations can introduce subtle yet significant deviations that compound over time, especially in systems governed by complex or chaotic dynamics. As a result, generative models may fail to capture essential long-term structures and statistical properties of the underlying physical system, undermining their reliability for scientific prediction and discovery.

Objectives

The internship will focus on the following goals:

- Understanding the physical meaning of the targeted dynamical systems.
- Develop and evaluate baseline machine learning models for physics-based simulations.
- Post-process scientific results.
- Optionally investigate state-of-the-art generative models for scientific machine learning.

Skills and Tools

Students will gain experience in:

- Programming (Python and PyTorch)
- Cutting-edge scientific machine learning techniques
- Data analysis and scientific reporting
- Potential for high-impact journal publications

Internship Details

- **Who can apply:** Senior undergraduate, master's, or PhD students, including those with a UK study permit.
- **Deadline:** 20.05.2025
- **Duration:** 02.06.2025 to 05.09.2025 (exact dates flexible)
- **Location:** Centre for Computational Science, University College London (hybrid options may be considered)
- **Funding:** A limited number of stipends are available; self-funded students are also welcome to apply
- **Supervision:** Dr. Xiao Xue and Prof. Peter Coveney

Ideal Candidate

This opportunity is suitable for motivated undergraduate or postgraduate students who have experience in video generation, large language model, computer science, physics, mathematics, fluid mechanics, or other related background. Programming experience with PyTorch and a basic understanding of numerical simulations are beneficial but not required.

How to Apply

Please email Dr. Xiao Xue (x.xue@ucl.ac.uk) and Professor Peter Coveney (p.v.coveney@ucl.ac.uk) with the following documents:

- A brief CV (highlighting your skills and experience related to machine learning)
- Academic transcript

  Informal inquiries are welcome.