

2023 NSF-sponsored Workshop on Deep Learning Systems in Advanced GPU Cyberinfrastructure

Table 1: Tentative Timetable (CST) for the Online Training Workshop

| Week 1 (07/24/2023 - 07/28/2023): Lectures for All Trainees | |
|---|--|
| Monday: “Deep Learning Training and Inference on GPUs” (Tony Luo) | |
| 8:30 AM - 10:30 AM | Multi-layer perceptron (MLP) and PyTorch with hands-on exercises |
| 10:30 AM - 12:30 PM | GPU-based PyTorch with hands-on exercises |
| 1:30 PM - 3:30 PM | Convolutional neural network (CNN) with hands-on exercises |
| 3:30 PM - 5:30 PM | Physics-informed neural network (PINN) with hands-on exercises |
| Tuesday: “Resource-Aware Deep Learning Model Exploration on GPUs” (Tong Shu) | |
| 8:30 AM - 10:30 AM | Introduction to neural architecture search |
| 10:30 AM - 12:30 PM | Neural Network Intelligence (NNI) system with hands-on exercises on GPUs |
| 1:30 PM - 3:30 PM | Introduction to resource-aware neural architecture search |
| 3:30 PM - 5:30 PM | Graph convolutional network (GCN) for latency prediction of deep learning inference |
| Wednesday: “GPU Architectures and Basic CUDA Programming” (Tong Shu) | |
| 8:30 AM - 10:30 AM | Heterogeneous data parallel computing in CUDA programming with hands-on exercises |
| 10:30 AM - 12:30 PM | Multi-dimensional grids and data in CUDA programming with hands-on exercises |
| 1:30 PM - 3:30 PM | Architectures of state-of-the-art GPUs (e.g., NVIDIA Hopper architecture of H100) |
| 3:30 PM - 5:30 PM | Memory and data locality in CUDA programming with hands-on exercises |
| Week 1: Lectures for Computer Science and Engineering (CSE) Trainees | |
| Thursday: “CUDA Libraries, Kernel Profiler and Performance Analysis Tool” (Iraklis Anagnostopoulos) | |
| 8:30 AM - 10:30 AM | Fundamentals of cuBLAS and cuDNN with hands-on exercises |
| 10:30 AM - 12:30 PM | Importance of NCCL and NCCL2 for scaling with hands-on exercises |
| 1:30 PM - 3:30 PM | System analysis and visualization with NVIDIA Nsight Systems with hands-on exercises |
| 3:30 PM - 5:30 PM | CUDA kernel monitoring and debugging with NVIDIA Nsight Compute with hands-on exercises |
| Friday: “Advanced CUDA Programming for Deep Learning Applications” (Xin Liang) | |
| 8:30 AM - 10:30 AM | Advanced CUDA optimization with hands-on exercise |
| 10:30 AM - 12:30 PM | Tensor core introduction with hands-on exercise |
| 1:30 PM - 3:30 PM | Implementing MLP using CUDA |
| 3:30 PM - 5:30 PM | Optimizing MLP on advanced GPUs |
| Week 1: Lectures for Geoscience (GS) Trainees | |
| Thursday: “CNN-based Hydrological Connectivity Modeling” (Ruopu Li) | |
| 8:30 AM - 10:30 AM | Introduction to hydrological connectivity modeling problems |
| 10:30 AM - 12:30 PM | Data-driven CNN model development with hands-on exercises |
| 1:30 PM - 3:30 PM | CNN-based drainage feature object detection with hands-on exercises |
| 3:30 PM - 5:30 PM | U-Net model for identifying other types of hydrological features |
| Friday: “PINN-Based Space Environment Nowcast” (Daoru Han) | |
| 8:30 AM - 10:30 AM | Introduction to space environment modeling: background, motivation, and review of techniques |
| 10:30 AM - 12:30 PM | Data-driven PINN-based surrogate model generation: high-fidelity models, input parameters, output quantities of interest, and implementation to PINN |
| 1:30 PM - 3:30 PM | PINN-based data analytics: verification and validation, Monte Carlo simulations, and uncertainty quantification |
| 3:30 PM - 5:30 PM | Hands-on exercises: 1) space plasma charging of lunar surface and 2) levitation of charged dust grains under plasma environment. |
| Week 2 (07/31/2023 - 08/04/2023): Project and Invited Talks for All Trainees | |
| Four talks from Monday to Thursday | |
| One hour per day | Presented by computer scientists from national laboratories and multinational corporations (one talk in each day) |
| Interdisciplinary Collaborative Project in 3-person teams (2 in CSE and 1 in GS) from Monday to Friday | |
| Mon. - Fri. | Project completed by trainees under trainers’ advising |
| Fri. pm. | Demonstration, presentation, and evaluation |