2024 NSF-Sponsored Training Program on Deep Learning Systems in Advanced GPU Cyberinfrastructure

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

Part 1: Lectures for All Trainees	
Monday, 05/13/2024: "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
Tuesday, 05/14/2024: "GPU Architectures and CUDA Programming" (Tong Shu)	
8:30 AM - 10:30 AM	Architectures of state-of-the-art GPUs (e.g., NVIDIA Hopper architecture of H100)
10:30 AM - 12:30 PM	Memory and data locality in CUDA programming with hands-on exercises
Wednesday, 05/15/2024: "Deep Learning on GPUs" (Tony Luo)	
8:30 AM - 10:30 AM	PyTorch and Multi-layer perceptron (MLP) with hands-on exercises
10:30 AM - 12:30 PM	GPU-based PyTorch with hands-on exercises
Monday, 05/20/2024: "Popular Types of Deep Learning Models" I (Tony Luo)	
8:30 AM - 10:30 AM	Convolutional neural network (CNN) with hands-on exercises
10:30 AM - 12:30 PM	Physics-informed neural network (PINN) with hands-on exercises
Tuesday, 05/21/2024: "Popular Types of Deep Learning Models" II (Tong Shu)	
8:30 AM - 10:30 AM	Graph neural networks (GNNs)
10:30 AM - 12:30 PM	Transformers
Wednesday, 05/22/2024: "Resource-Aware Deep Learning Model Exploration on GPUs" (Tong Shu)	
8:30 AM - 10:30 AM	Neural architecture search (NAS) and Neural Network Intelligence (NNI) system
10:30 AM - 12:30 PM	Resource-aware NAS and deep learning system performance prediction
Part 1: Lectures for Computer Science and Engineering (CSE) Trainees	
Thursday, 05/16/2024: "Advanced CUDA Programming" (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
Friday, 05/17/2024: "CUDA Programming for Deep Learning Applications" (Xin Liang)	
8:30 AM - 10:30 AM	Implementing MLP using CUDA
8:30 AM - 10:30 AM	Optimizing MLP on advanced GPUs
Thursday, 05/23/2024: "CUDA Libraries" (Iraklis Anagnostopoulos)	
8:30 AM - 10:30 AM	Fundamentals of cuBLAS and cuDNN with hands-on exercise
10:30 AM - 12:30 PM	Importance of NCCL for scaling with hands-on exercise
Friday, 05/24/2024: "CUDA Performance Analysis and Deep Learning on TPUs" (Iraklis Anagnostopoulos)	
8:30 AM - 10:30 AM	System analysis with NVIDIA Nsight Systems and Nsight Compute
10:30 AM - 12:30 PM	Optimization of Neural Networks and exploration on TPUs
Part 1: Lectures for Geoscience (GS) Trainees	
Thursday, 05/16/2024: "PINN-Based Space Environment Nowcast" I (Daoru Han)	
8:30 AM - 10:30 AM	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
Friday, 05/17/2024: "PINN-Based Space Environment Nowcast" II (Daoru Han)	
8:30 AM - 10:30 AM	PINN-based data analytics: verification and validation, Monte Carlo simulations, and uncertainty quantification
10:30 AM - 12:30 PM	Hands-on exercises: 1) space plasma charging of lunar surface and 2) levitation of charged dust grains under plasma environment.
Thursday, 05/23/2024: "CNN-based Hydrological Connectivity Modeling" I (Ruopu Li)	
8:30 AM - 10:30 AM	Introduction to hydrological connectivity modeling problems
10:30 AM - 12:30 PM	CNN-based classification model development with hands-on exercises
Friday, 05/24/2024: "CNN-based Hydrological Connectivity Modeling" II (Ruopu Li)	
8:30 AM - 10:30 AM	CNN-based drainage crossing feature object detection
10:30 AM - 12:30 PM	CNN-based object detection hands-on exercises
Part 2 (05/24/2024 - 05/31/2024): Project and Invited Talks for All Trainees	
Four talks in total on 05/28/2024, 05/29/2024, 05/30/2024, and 05/31/2024	
One hour per talk	Presented by scientists from national laboratories and multinational corporations
Interdisciplinary Collaborative Project in 3-Student Teams (2 in CSE and 1 in GS) from 05/24 to 05/31	
05/24 - 05/31	Project completed by trainees under trainers' advising
6/7, 1-1:30 & 6-8 PM	Demonstration, presentation, and evaluation
06/01, 1:00 PM	Focus group organized by Dr. Harvey Henson