NVIDIA/UIUC GPU Teaching Kit – Accelerated Computing

Quick Start Guide

1. Introduction

This guide introduces you to the main teaching content of the **GPU Teaching Kit for Accelerated Computing** and provides basic instructions on accessing other features of the Kit.

NVIDIA co-developed this GPU Teaching Kit with Professor Wen-Mei Hwu from the University of Illinois for a variety of academic disciplines that benefit from accelerated computing. This comprehensive package contains everything needed to teach a full-term curriculum course with GPUs.

The GPU Teaching Kit for Accelerated Computing covers both introductory and advanced accelerated computing topics. The material is useful for teaching parallel programming concepts in other academic disciplines, such as computer architecture, high-performance computing, robotics, machine learning, operating systems, and mathematics. It can also be used by computational domain sciences, such as biology, physics, and chemistry.

All materials are provided in electronic form for ease of use, either as-is or with personal modifications to meet the needs of your particular course.

1.1 Does the Kit include GPU compute resources for labs and projects?

The GPU Teaching Kit includes free tokens for ***NVIDIA online labs*** (see "2.3 NVIDIA GPU Online Labs" below). Additionally, the DLI Teaching Kit comes with codes worth up to ***$125 of Amazon Web Services (AWS) GPU compute credit*** for each student in your course and ***$200 of AWS credit*** for yourself as an instructor. This provides a GPU compute platform to work on the open-ended Labs (see "2.6 Open-ended Labs/solutions" below). Aside from these provided GPU cloud platforms, students must have access to CUDA-capable GPU resources, such as a GPU card, or access to other remote clusters with GPUs.

1.2 Additional Requirements

You must also have the following in order to use the GPU Teaching Kit:

- **CUDA Toolkit:** *Module 2.4: CUDA Toolkit* includes a basic standalone tutorial on the CUDA Toolkit along with some basic labs. You may download the latest Toolkit version from https://developer.nvidia.com/cuda-toolkit.
- **Compatible C compiler:** The CUDA Toolkit documentation lists the supported C compilers and OS requirements for Windows, Linux and Mac OSX. It also includes a useful Quick Start Guide.

NOTE: *You should have received an email invitation to the Teaching Kit's private BitBucket repository that contains both the build scripts and the most recent version of the labs. Please contact NVDLI@nvidia.com if you have not yet received this email invitation or if it has expired.*

2. GPU Teaching Kit Content

Not all GPU Teaching Kit content types apply to every module. For example, *Module 6: Memory Access Performance* does not have a lab because it's a relatively small module. Further, the projects/solutions are not tied to any particular module because they are open-ended and cover any number of module topics.

2.1 Syllabus

The syllabus is available at http://syllabus.gputeachingkit.com/ (and also pointed to by *syllabus_and_videos.html)*. It outlines the module organization, including the content and the associated file name included in each module. Additionally, you can stream or download the lecture recordings (see "2.4 Lecture Recordings" below) as separate .mp4 video files.

2.2 E-Book and Module-mapped Chapters

Included is an official electronic .pdf copy, as well as individual module-mapped .pdf chapters, of *Programming Massively Parallel Processors: A Hands-on Approach, 3rd Edition* by Wen-Mei Hwu and David Kirk. Much of the slide deck and lecture recording content is based on this textbook. Please DO NOT share or distribute these electronic chapters with anyone. Students are encouraged to purchase their own discounted copy (see *EBook Distr Rules and Discounts.pdf*).

2.3 Lecture Slides

The PowerPoint .ppt lecture slides supplement the e-book chapters for in-class lectures. These files contain embedded audio with examples of how you might present the slides, which is accessible in slideshow mode. This can also be useful for students because they can watch the lectures on their own time, thereby adding a "flipped" classroom aspect to your course.

You can disable the audio and/or presentation timing in PowerPoint by selecting **Slideshow** and then deselecting **Play Narrations** and/or **Use Timings**.

2.4 Lecture Recordings

You can stream or download lecture recordings as separate .mp4 video files from http://syllabus.gputeachingkit.com/ (and also pointed to buy *syllabus_and_videos.html).* These recordings contain the same content as the lecture slide shows with the embedded audio. These videos are also individually linked so that you can easily access them via a browser on your own class website for students to view on their own time, thereby adding a "flipped" classroom aspect to your course.

2.5 NVIDIA GPU Online Labs

This Teaching Kit includes access to ***free*** online DLI labs ("Qwiklabs") using GPUs in the cloud - ***a value of up to $30 per person per lab***. These online labs reinforce deep learning concepts presented in the Teaching Kit to students in a more applied manner. Each Qwiklab is a live, hands-on, self-paced learning environment that includes a set of interactive instructions to walk students through applied deep learning concepts. Students must complete each lab within the allotted time.

To enable these labs for your students, please create an account at nvidia.qwiklab.com and send your Qwiklab account email address to NVDLI@nvidia.com with the subject line "GPU Teaching Kit Qwiklab Access". Email instructions will then follow for giving access to your students.

Please see *Online GPU Labs.pdf* for more details.

2.6 Open-ended Labs/solutions

These labs/solutions are designed to be one- to two-week hands-on programming assignments for students, and come as .pdf files as well as solutions in an online repository (see below). Each lab begins with a description of the lab objectives and prerequisites. In most cases, the labs present pseudo-code and/or a solution code template as a starting point.

The GPU Teaching Kit comes with codes worth up to ***$125 of Amazon Web Services (AWS) GPU compute credit*** for each student in your course and ***$200 of AWS credit*** for yourself as an instructor. This provides a GPU compute platform to work on the open-ended Labs To request a code for your students, please send an email to NVDLI@nvidia.com with the subject line "GPU Teaching Kit AWS Access". An Email will follow with your code and instructions for giving access to your students.

The most recent version of the labs, solutions, and build scripts, are located in the Bitbucket repository linked from each lab. ***Additionally, the repository contains a docker image file with the lab solutions and basic instructions for running these using the AWS credits.***

2.7 Quizzes/solutions

Students should be able to answer quiz questions based on the information in the module slides and slide videos. Each question is multiple-choice and includes a rationale for the correct answer.

2.8 Projects/solutions

Projects are designed to be open-ended, multidisciplinary, final semester projects that should take 3-4 weeks to complete. The purpose of the project is to apply data parallelism and CUDA concepts to a more substantial piece of code than possible in the labs. Please see *project_motivate_rubric.pdf* for more details and a sample example grading rubric. The GPU Teaching Kit contains real projects completed by students taking ECE 408: Applied Parallel Programming at UIUC. Some projects require special development tools and libraries not included in this kit, and not all will run completely "out-of-box". Still, they should be useful to motivate students and provide examples of previous successful projects.