Spring 2020: Outline of CSE Standard Course Syllabi

- **Course number**: EECS 600
- **Course title**: GPU Architecture for Scientific Computing
- **Prerequisites**: M.S and Ph.D. students only.
- **Course objectives**:
  1) Draw the general model of Graphics Processing Units (GPUs), describe the function of each of the blocks, define technical terms relevant to the model, and modules. Moreover, they will learn how to use the hardware optimally.
  2) Learn parallel programming fundamentals while focusing on CUDA programming interface. Students in the course and labs will explore cutting-edge technologies of using CUDA in machine learning applications.

**Course description**: The emergence of multi-thread GPUs and the combination of them with multi-core CPUs have made huge computing possible by laptops and facilitated peta-scale computing in clusters with great accuracy, controllability and observability. Algorithms can be implemented 100x faster by GPUs in comparison to CPUs. The motivation of tapping the highest potential of using GPUs has led the generation and development of special C based language programming for GPUs. This course aims to cover the fundamentals of principal components of graphics processing units (GPU) architecture. Then, the course focuses on commodity language (CUDA) programming. CUDA is a parallel computing platform and programming model produced by NVIDIA that provides required libraries for GPU computations while the programming on that can be implemented in popular languages such as C, C++, etc. and be extended to the suitable format. In addition to that, the course introduces and discusses high performance computing on GPUs, parallel nature and programming, performance optimization, graphics pipeline, microarchitectures and network topologies. Finally, the special usages of GPU in machine learning will be analyzed.

- **Time and day of class meetings**: MW 12:45pm – 2:00pm
- **Class meeting location**: Nord 206
- **Instructor name**: Ming-Chun Huang
• Instructor phone number and email and office location:
  Email) ming-chun.huang@case.edu; TEL) 216.368.0397; Office) Glennan 514B

• Instructor office hours: MW 2:00pm – 3:00pm or by appointment

• TA information: TBD

• Text Book:


Reference: CUDA Programming Guide:
  https://developer.nvidia.com/cuda-example

• Grading policy (homework, tests, quizzes, number, dates, percentage contribution to grade, etc.)

  Total 100 points (20% off for any late submission within a week)

  • Midterm and Final (20% for each) – 40%
  • Course Labs (5% for each, w/ reports) – 30%
  • Final Project (w/ a latex style report)– 30%

• Planned topics

  • Overview Graphics Processing Units and Applications
  • GPU-CPU Interactions
  • The Difficulty of Creating Parallel Processing Programs
  • Hardware Multithreading
  • CUDA C programming
  • Memory and Data locality
  • Data parallel execution by referring to CUDA parallel execution model
  • Machine Learning and cuDNN

• Individual Reports (Assignments, Labs, and the Final project)
  • Cover page (report title, team#, student name and ID) and report content should be combined in a single PDF file.

  • Source files related to your writing should be archived and zipped into a single folder,
including: Latex .tex and .bib files, setting files (.cls), figures, etc.

- **Cheating**
  Cheating in no form will be tolerated. All students found to be cheating will be reported.

- **Course Website**
  You will need to download your slides, assignments, final projects, and any other necessary information (such tutorials and miscellaneous supplements) from the course website. It is your responsibility to check the course website for any important announcement.

- **References**
  Internet is a good source for quick info. Nevertheless, all material must be properly referenced. Plagiarism will not be tolerated. Check the materials section of the website for additional handouts that will be necessary to complete the projects.

- **CSE Academic Integrity Statement**

  **Academic Integrity Policy:** All students in this course are expected to adhere to University standards of academic integrity. Cheating, plagiarism, misrepresentation, and other forms of academic dishonesty will not be tolerated. This includes, but is not limited to, consulting with another person during an exam, turning in written work that was prepared by someone other than you, making minor modifications to the work of someone else and turning it in as your own, or engaging in misrepresentation in seeking a postponement or extension. Ignorance will not be accepted as an excuse. If you are not sure whether something you plan to submit would be considered either cheating or plagiarism, it is your responsibility to ask for clarification. For complete information, please go to

  https://students.case.edu/community/conduct/aiboard/policy.html

  **Disability Resources:** ESS Disability Resources is committed to assisting all CWRU students with disabilities by creating opportunities to take full advantage of the University's educational, academic, and residential programs. For further information, please go to

  https://students.case.edu/academic/disability/