Billion Transistor Computer Architecture

EEL 6935 (Section 23691)

Class Periods: T | Period 4 (10:40 AM – 11:30 AM), R | Period 4-5 (10:40 AM – 12:35 PM)

Location: CHE 0316

Academic Term: Spring 2020

Instructor:

Tao Li

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(352) 392-9510

Office Hours: T, 1:00 PM – 2:30 PM, LAR 339D

Teaching Assistant/Peer Mentor/Supervised Teaching Student:

Please contact through the Canvas website

*   N/A

Course Description

Heterogeneous systems with programmable hardware accelerators seek to fulfill the promise of continued performance and energy-efficiency gains in the era of a slowing Moore's Law, larger problem sizes and an increased focused on energy-efficiency. These factors have caused hardware acceleration to become ubiquitous in today's computing world and critically important in computing's future. This course will explore some of the current research and industrial landscape of programmable hardware accelerators. This course qualitatively and quantitatively examines computer design tradeoffs for the architectures of programmable accelerators. We will learn about the architectures for these systems and study, for example, why different applications need very different accelerators to improve performance and energy efficiency. We will delve deeply into the architectures and modern models of modern massively parallel accelerators like GPUs and ML accelerators.

Course Pre-Requisites / Co-Requisites

EEL 5764 Computer Architecture

Course Objectives

(1) To learn and understand the latest industries R&D trends and academic research in the fields of computer architecture and system design; (2) To learn how to conduct innovative, high-quality research.

Required Textbooks and Software

- There is no required textbook.
- Reading material will be distributed during the class.

Course Schedule

Week 1:	Introduction
Week 2:	GPU Programming
Week 3:	GPU Microarchitecture
Week 4:	GPU Architecture and Memory
Week 5:	Advanced Topics on GPU
Week 6:	Introduction to Deep Learning (DL)
Week 7:	DL Accelerator Architecture
Week 8:	DL Accelerator Architecture Optimization
Week 9:	No Class (Spring Break)
Week 10:	Advanced Topics on DL Accelerator Architecture Design
Week 11:	Paper Discussion and Presentation
Week 12:	Paper Discussion and Presentation
Week 13:	Paper Discussion and Presentation
Week 14:	Paper Discussion and Presentation
Week 15:	Paper Discussion and Presentation

Week 16:   Final Review

Attendance Policy, Class Expectations, and Make-Up Policy

Class attendance is required and will be monitored by the instructor. Excused absences must be in compliance with university policies in the Graduate Catalog (https://catalog.ufl.edu/graduate/regulations/ (Links to an external site.)) and require appropriate documentation.

Evaluation of Grades

Assignment	Total Points	Percentage of Final Grade
Homework	100	10%
Paper Review	100	20%
Paper Presentation	100	20%
Class Participation	100	10%
Proposal & Presentation	100	40%
		100%

Grading Policy

Percent	Grade	Grade Points
90.0 - 100.0	A	4.00
87.0 - 89.9	A-	3.67
84.0 - 86.9	B+	3.33
81.0 – 83.9	B	3.00
78.0 - 80.9	B-	2.67
75.0 - 79.9	C+	2.33
72.0 – 74.9	C	2.00
69.0 - 71.9	C-	1.67
66.0 - 68.9	D+	1.33
63.0 - 65.9	D	1.00
60.0 - 62.9	D-	0.67
0 - 59.9	E	0.00

More information on UF grading policy may be found at: https://catalog.ufl.edu/graduate/regulations/ (Links to an external site.)

Students Requiring Accommodations

Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565, https://www.dso.ufl.edu/drc) by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodation. Students with disabilities should follow this procedure as early as possible in the semester.

Course Evaluation

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at https://gatorevals.aa.ufl.edu/students/ (Links to an external site.). Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via https://ufl.bluera.com/ufl/ (Links to an external site.). Summaries of course evaluation results are available to students at https://gatorevals.aa.ufl.edu/public-results/ (Links to an external site.).

University Honesty Policy

UF students are bound by The Honor Pledge which states, "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment." The Honor Code (https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/ (Links to an external site.)) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

Commitment to a Safe and Inclusive Learning Environment

The Herbert Wertheim College of Engineering values broad diversity within our community and is committed to individual and group empowerment, inclusion, and the elimination of discrimination. It is expected that every person in this class will treat one

another with dignity and respect regardless of gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture.

If you feel like your performance in class is being impacted by discrimination or harassment of any kind, please contact your instructor or any of the following:

- Your academic advisor or Graduate Program Coordinator
- Robin Bielling, Director of Human Resources, 352-392-0903, rbielling@eng.ufl.edu
- Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, taylor@eng.ufl.edu
- Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, nishida@eng.ufl.edu

Software Use

All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

Student Privacy

There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see: https://registrar.ufl.edu/ferpa.html (Links to an external site.)

Campus Resources:

Health and Wellness

U Matter, We Care:

Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact umatter@ufl.edu so that the U Matter, We Care Team can reach out to the

student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.

Counseling and Wellness Center: http://www.counseling.ufl.edu/cwc (Links to an external site.), and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

Sexual Discrimination, Harassment, Assault, or Violence

If you or a friend has been subjected to sexual discrimination, sexual harassment, sexual assault, or violence contact the **Office of Title IX Compliance** (Links to an external site.), located at Yon Hall Room 427, 1908 Stadium Road, (352) 273-1094, title-ix@ufl.edu

Sexual Assault Recovery Services (SARS)

Student Health Care Center, 392-1161.

University Police Department at 392-1111 (or 9-1-1 for emergencies), or http://www.police.ufl.edu/ (Links to an external site.).

Academic Resources

E-learning technical support, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu. https://lss.at.ufl.edu/help.shtml (Links to an external site.).

Career Resource Center, Reitz Union, 392-1601. Career assistance and counseling. https://www.crc.ufl.edu/ (Links to an external site.).

Library Support, http://cms.uflib.ufl.edu/ask (Links to an external site.). Various ways to receive assistance with respect to using the libraries or finding resources.

Teaching Center, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring. https://teachingcenter.ufl.edu/ (Links to an external site.).

Writing Studio, 302 Tigert Hall*, 846-1138. Help brainstorming, formatting, and writing papers. https://writing.ufl.edu/writing-studio/ (Links to an external site.).

Student Complaints Campus*: https://care.dso.ufl.edu (Links to an external site.).

On-Line Students Complaints*: http://www.distance.ufl.edu/student-complaint-process (Links to an external site.).