Approximate Computing
EEL 4930   Section xxxx

Class Periods: Days of week, period, and corresponding time of day
Location: Classroom location
Academic Term: Fall 2020

Instructor:
Gregory Stitt
gstitt@ufl.edu
352-392-5348
Office Hours: Days of week, hours available, office location

Teaching Assistant/Peer Mentor/Supervised Teaching Student:
Please contact through the Canvas website
  • Name, email address, office location, office hours
  • Name, email address, office location, office hours

Course Description
With the end of Dennard Scaling and Moore’s Law, computer hardware and software must find creative new ways to meet the rapidly increasing demands of future applications without relying on additional transistors. Approximate computing is a promising strategy for solving this problem by sacrificing acceptable amounts of accuracy for significant improvements in performance and energy. In this course, we will cover a wide range of emerging approximation strategies in both software and hardware. The course will be taught in a seminar style, with students presenting the majority of the work from existing research papers. (3 credits)

Course Pre-Requisites / Co-Requisites
  • EEL 3701C (Specifically, familiarity with muxes, registers, ALUs, finite state machines)
  • Fundamentals of programming (e.g., basic C/C++, Python, and/or Java)

Course Objectives
The objectives of this course are learn, understand, and extend existing work on approximate computing. Specific objectives include approximate hardware structures, approximation algorithms, approximate compiler optimizations, dependence relaxing, specialized approximation languages and frameworks, and machine-learning strategies for approximation.

Materials and Supply Fees
n/a

Professional Component (ABET):
This course consists of 1.5 credits of Engineering Design and 1.5 credits of Engineering Science

Relation to Program Outcomes (ABET):
The table below is an example. Please consult with your department’s ABET coordinator when filling this out.

<table>
<thead>
<tr>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. An ability to identify, formulate, and solve engineering problems by applying principles of engineering, science, and mathematics.</td>
</tr>
<tr>
<td>2. An ability to apply both analysis and synthesis in the engineering design process, resulting in designs that meet desired needs.</td>
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<table>
<thead>
<tr>
<th>Coverage*</th>
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<tbody>
<tr>
<td>Medium</td>
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<tr>
<td>Medium</td>
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</tbody>
</table>
3. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.

4. An ability to communicate effectively with a range of audiences

5. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.

6. An ability to recognize the ongoing need for additional knowledge and locate, evaluate, integrate, and apply this knowledge appropriately.

7. An ability to function effectively on teams that establish goals, plan tasks, meet deadlines, and analyze risk and uncertainty

Required Textbooks and Software
No textbooks are required. Slides, papers, and code will be provided to students.

Recommended Materials
n/a

Course Schedule
Week 1: Introduction to Approximate Computing, Survey of Existing Techniques
Week 2-3: Approximate Algorithms
Week 4: Approximate Hardware, Midterm 1
Week 5-6: Compiler approximations
Week 7-8: Neural Net approximations, Universal Approximation Theorem
Week 9: Symbolic Regression, Midterm 2
Week 10: PANDORA
Week 11-12: FPGA-Acceleration of Symbolic Regression
Week 13-14: Languages for Approximation
Week 15: Determination of Acceptable Error

Attendance Policy, Class Expectations, and Make-Up Policy
Attendance is required. Each student expected to participate in discussion of research papers and potential extensions of existing research. Excused absences must be in compliance with university policies in the Graduate Catalog (https://catalog.ufl.edu/graduate/regulations/) and require appropriate documentation.

Evaluation of Grades

<table>
<thead>
<tr>
<th>Assignment</th>
<th>Total Points</th>
<th>Percentage of Final Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Midterms (2)</td>
<td>100 each</td>
<td>15% each (30% total)</td>
</tr>
<tr>
<td>Final</td>
<td>100</td>
<td>15%</td>
</tr>
<tr>
<td>Class Presentations*</td>
<td>100 each</td>
<td>40%</td>
</tr>
<tr>
<td>Class Participation</td>
<td>100</td>
<td>15%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>100%</td>
</tr>
</tbody>
</table>
* Number of presentations will depend on enrollment.

This course is co-listed with the graduate class. The homework portion of the graduate section will involve additional work and more advanced concepts with respect to the undergraduate section. The exams will also involve additional questions for the graduate section with respect to the undergraduate section. The graduate and undergraduate sections will be graded separately, for which the graduate section has additional problems and different weights for all problems.

**Grading Policy**

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

More information on UF grading policy may be found at: [https://catalog.ufl.edu/graduate/regulations/](https://catalog.ufl.edu/graduate/regulations/)

**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/](https://gatorevals.aa.ufl.edu/students/). 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/](https://ufl.bluera.com/ufl/). Summaries of course evaluation results are available to students at [https://gatorevals.aa.ufl.edu/public-results/](https://gatorevals.aa.ufl.edu/public-results/).

**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/](https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/)) 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

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](http://www.counseling.ufl.edu/cwc), 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](mailto:title-ix@ufl.edu), 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/](http://www.police.ufl.edu/).

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](https://lss.at.ufl.edu/help.shtml).

**Career Resource Center**, Reitz Union, 392-1601. Career assistance and counseling. [https://www.crc.ufl.edu/](https://www.crc.ufl.edu/).

**Library Support**, [http://cms.uflib.ufl.edu/ask](http://cms.uflib.ufl.edu/ask). 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/](https://teachingcenter.ufl.edu/).

**Writing Studio, 302 Tigert Hall**, 846-1138. Help brainstorming, formatting, and writing papers. [https://writing.ufl.edu/writing-studio/](https://writing.ufl.edu/writing-studio/).

**Student Complaints Campus**: [https://care.dso.ufl.edu](https://care.dso.ufl.edu).