CS 8803 Spring 2025: Special Topics in Differentiable and Probabilistic Programming

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Course Summary:
CS 8803 is a special topics graduate course on both Differentiable and Probabilistic Programming Languages. We will study how mathematical ideas of differentiation and statistical inference can be automated at the level of the programming language. We will then explore how one can statically analyze these programming languages to reason about the mathematical properties satisfied by the differentiable or probabilistic program. We will additionally study how these techniques can be applied towards problems in a variety of research areas including machine learning, graphics, and scientific computing. This course also strives to study how these ideas cut across the full computational stack, hence we will cover papers ranging from high-level algorithms all the way down to the architectural level.

Course Expectations
Students are expected to attend lecture, ask questions, present papers and complete a course project.

Desired Outcome:
By the end of this course the desired outcome is that students will have developed an understanding of the fundamentals of probabilistic and differentiable programming languages and what current state of the art research problems exist in this area. The goal of this course is also for students to make progress towards one of those open research problems (of their choosing) in the form of a course project. While publishing a course-project as a conference or journal paper represents a best-case scenario, that outcome is *not* necessary to obtain an A for this course.

Grading
Paper Review: 20% - Every student must write a review for every paper using the template provided.

Presentation: 20% - Students will present 1-2 times throughout the semester. A paper presentation will take the duration of an entire class period and will include discussion with the audience.

Attendance: 10%

Project: 50% - The project is designed to be done in groups of 1-2 students. The grading will be commensurate with the size of the team (e.g., the expectations for a project of 2 students will be higher than the expectation for a project of a single student).

There will also exist opportunities for bonus points periodically throughout the semester.

Students are *not* graded on a curve against each other, hence it is possible for multiple students to receive good grades, indeed that is the hope!

Academic Integrity
Georgia Tech aims to cultivate a community based on trust, academic integrity, and honor.
Students are expected to act according to the highest ethical standards.

For information on Georgia Tech's Academic Honor Code, please visit http://www.catalog.gatech.edu/policies/honor-code/ or http://www.catalog.gatech.edu/rules/18/.
Any student suspected of cheating or plagiarizing on a quiz, exam, or assignment will be reported to the Office of Student Integrity, who will investigate the incident and identify the appropriate penalty for violations.

Policy on using LLMs
Do not use Large Language Models (LLMs) like ChatGPT for any paper review or project report or to make slides. An important part of the paper reviews are to develop *your* writing ability.

Accommodations for Students with Disabilities
If you are a student with learning needs that require special accommodation, contact the Office of Disability Services at (404) 894-2563 or http://disabilityservices.gatech.edu/, as soon as possible, to make an appointment to discuss your special needs and to obtain an accommodations letter.
Please also e-mail the instructor as soon as possible in order to set up a time to discuss your learning needs.

Student-Faculty Expectations Agreement
At Georgia Tech we believe that it is important to strive for an atmosphere of mutual respect, acknowledgement, and responsibility between faculty members and the student body. See http://www.catalog.gatech.edu/rules/22/ for an articulation of some basic expectation that you can have of me and that I have of you. In the end, simple respect for knowledge, hard work, and cordial interactions will help build the environment we seek. Therefore, I encourage you to remain committed to the ideals of Georgia Tech while in this class.

Miscellaneous
Please feel free to reach out to the instructor at any point with questions or concerns. My goal is for every student to succeed in this course!