Special Problems Course Syllabus

Course Information

Course Prefix and Number: CSE-8903-W15
Instructor: Kai Wang (kwang692@gatech.edu)
Credit Hours: 1 – 12 credits (each credit will count as 3 hours of weekly workload)

Course Description

This course provides academic credit for graduate-level independent research under the direction of a faculty member. Students will engage in advanced computational science research, exploring intersections of machine learning, continuous and discrete optimization, and applied domains such as healthcare or social impact. The specific scope, methodological approaches (e.g., algorithmic development, mathematical modeling, data pipeline architecture), and direction of the studies are determined by the student in consultation with the course instructor to align with current state-of-the-art research initiatives.

Course Learning Outcomes

By enrolling in this course, students will:

- **Critically Evaluate Literature:** Analyze and synthesize advanced academic literature in optimization and machine learning (such as decision-focused learning or restless multi-armed bandits) to identify novel research gaps and formulate formal problem statements.

- **Develop Technical Architectures:** Design, implement, and optimize complex computational models or algorithmic frameworks (e.g., FMP-M, FMP-C, or diffusion models) using Python and relevant deep learning libraries.

- **Execute Empirical Research:** Formulate and execute rigorous empirical experiments—particularly applied to complex, high-stakes environments like clinical health data or resource allocation—and evaluate algorithmic performance using advanced quantitative metrics.

- **Produce Academic Artifacts:** Synthesize research findings into high-quality technical artifacts, such as formal reports typeset in LaTeX or academic posters, demonstrating the ability to communicate complex computational methodologies to a specialized research community.

Required Course Materials

No textbooks or materials are required. Resources for research are determined in consultation with the instructor.

Grading Policy

Assessment Category	Weight
Research Progress & Technical Execution	40%
Participation & Communication	30%
Final Deliverable	30%

Research Progress & Technical Execution (40%)

Evaluates the student's consistent progress on agreed-upon research objectives. This includes the quality, efficiency, and documentation of technical work, such as developing, testing, and maintaining Python codebases, data pipelines, or experimental setups. Students are expected to demonstrate increasing autonomy and resourcefulness in troubleshooting technical obstacles.

Participation & Communication (30%)

Assesses the student's active engagement and reliability. This includes arriving prepared for weekly 1:1 mentoring meetings, actively participating in KOALA lab group discussions, and maintaining professional, clear communication regarding research updates, setbacks, and milestones.

Final Deliverable (30%)

Students must synthesize their semester's work into a formal academic format. This requirement can be fulfilled by submitting a comprehensive final research report (formatted in LaTeX) detailing the project's background, methodology, and preliminary results, or by delivering a formal presentation to the research group at the end of the term.

Letter Grade Translation

A (90 – 100%): Excellent. The student consistently exceeded expectations in all categories, demonstrated significant independent thought, and produced high-quality, reproducible work.

B (80 - 89%): Good. The student met all project expectations, maintained steady progress, and completed a solid final deliverable, though may have required more frequent guidance.

C (70 - 79%): Satisfactory. The student completed the minimum requirements of the project but struggled with consistent progress, communication, or the quality of the technical execution.

D (60 - 69%): Passing. The student's performance was consistently below expectations, with significant gaps in attendance, effort, or deliverable quality.

F (Below 60%): Failure. The student failed to meet the basic obligations of the research agreement.

Attendance Policy

This course does not include scheduled class meetings. The frequency and format of student–faculty contact are determined by mutual agreement and are consistent with the number of credit hours for which the student is enrolled.

Academic and Research Honesty/Integrity Statement

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. Review the Student Code of Conduct and the Academic Honor Code, especially Appendix A: Graduate Addendum to the Academic Honor Code.

Students are expected to perform research in an ethical and responsible manner. All Doctoral and Master's Thesis students are required to take the Responsible Conduct of Research training, and it is expected that students abide by the principles taught in that training while performing research.

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.

Allegations of scientific or scholarly misconduct are handled in accordance with the procedures outlined by the Policy for Responding to Allegations of Scientific or Other Scholarly Misconduct.

Core IMPACTS

Not applicable

Accommodations for Students with Disabilities

If you are a student with learning needs that require special accommodation, contact the Office of Disability Services as soon as possible to make an appointment to discuss your special needs and to obtain an accommodations letter. Please also e-mail me as soon as possible in order to set up a time to discuss your learning needs.

Student-Faculty Expectations

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. The Student-Faculty Expectations articulates some basic expectations that you can have of me and that I have of you. Additional information for research-related work is given in The Expectations of Advisors and Advisees. 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.