CE395/495: Embedded Artificial Intelligence

Syllabus – Spring 2025

Course Staff

Instructor

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Overview

Artificial Intelligence is seeing rapid growth in almost all industries and is becoming pervasive throughout our lives. AI aims to equip our computers with intelligence to complete tasks much like a human-being. In addition to developing models and methods to robustly perform these tasks, it is important to consider how to deploy these methods on different classes of platforms and scenarios. The topics covered in this course center on the theme of bringing intelligent perception, analysis, and understanding through artificial intelligence away from data centers and the cloud and onto mobile and edge devices that are often directly interacting with the physical environment or in the palms of our hands. Examples of such platforms include smartphones, wearables, drones, robots, and much more.

This course is research-oriented and based on papers and research findings from top-tier venues. Students will learn key principles, research trends, and the state-of-art in mobile and embedded intelligence. Additionally, students will learn and gain experience in paper reading, paper writing, public presentation, and carrying out original research through weekly paper readings, paper presentations, critiques, class discussions, and a class project on an original idea. For the class project, students will ideally generate (or make significant progress) and present publishable results by the end of the term.

Location and Time

Lecture time: 11:00 AM - 12:20 PM Central, Tuesdays and Thursdays
Location: Tech L440

Communication

All course materials will be posted to Canvas including grades.

Class Structure

Presentations

Each class, 2-3 students will present (~15-20 minutes) a research paper from the reading list, or of their choosing with approval from the instructor. After the presentation, there will be a class discussion about the paper. Everyone in the class is expected to participate across all papers, and the presenter will guide the discussion, answer clarifying questions, etc.

Summaries

After every week (two lectures), students will write a summary of their own views of the research topics discussed. For these, students should summarize existing methods, representative papers, and limitations. The most important part of these summaries is to include personal opinions of papers and the field (e.g., what you believe are some of the weaknesses and potential future directions).

Final Project

These are open-ended and are a chance for you to try your hand at research or learn about a specific topic through writing a survey paper. They will be performed in groups of 1-3 students (larger groups are possible with approval). There will be a mid-project report (~1 page), final presentation, and a final report (research project: ~4 pages, survey paper: ~6 pages). For research projects, you are free to tackle any problem related to embedded AI, broadly defined. You can use any platform you wish (e.g., Raspberry Pi, Arduino, MCU, your own computer). Feel free to look around online for inspiration.

Schedule

The course schedule is available on the Canvas homepage for the course. Be aware that it is subject to change, although warnings will be given to students for any major changes.

Grades

Percentage grades will be converted to letter grades using the standard letter grade system (93% A, 90% A-, 87% B+, etc.). However, these grade bins may be moved at the instructor's discretion for the advantage of students. Note that the percentage grade displayed by Canvas is not always accurate and may not take late penalties into account, as described below.

Each category of assignment has a total value, which is divided evenly between assignments.

Category	Total Value
Project	40%
Paper Presentation	20%

Homework	20%
Participation	20%

Late Policy

Homework, proposals, and final project can only be submitted late with prior approval from the instructor. If you are having an issue preventing you from completing some part of the class on time, please contact the instructor as soon as possible and we will work together on a solution. Particularly for issues outside of the student's control, such as major injury, sickness, or family emergency, deadlines can be shifted without penalty if you contact the instructor.

Academic Integrity

Students in this course are required to comply with the policies found in the booklet, "Academic Integrity at Northwestern University: A Basic Guide". All papers submitted for credit in this course must be submitted electronically unless otherwise instructed by the professor. Your written work may be tested for plagiarized content. For details regarding academic integrity at Northwestern or to download the guide, visit:
https://www.northwestern.edu/provost/policies/academic-integrity/index.html

Any form of cheating, including improper use of content generated by artificial intelligence, constitutes a violation of Northwestern's academic integrity policy.

Support for Wellness and Mental Health

Northwestern University is committed to supporting the wellness of our students. Student Affairs has multiple resources to support student wellness and mental health. If you are feeling distressed or overwhelmed, please reach out for help. Students can access confidential resources through the Counseling and Psychological Services (CAPS), Religious and Spiritual Life (RSL) and the Center for Awareness, Response and Education (CARE). Additional information on all of the resources mentioned above can be found here:
- https://www.northwestern.edu/counseling/
- https://www.northwestern.edu/religious-life/
- https://www.northwestern.edu/care/

Sickness and Common Sense

Generally, if you are sick do not attend class. Instead contact your instructor as soon as possible and we'll figure out a way to handle the situation. I expect all students to use their discretion and make good choices for the community.

Accessibility

I believe in providing reasonable accommodation that allow for full access to learning for all. Please contact me for anything that might have an impact on your participation in this course (documented disability, language challenges, absences due to religious observations, etc.).

Northwestern University is committed to providing the most accessible learning environment possible for students with disabilities. Should you anticipate or experience disability-related barriers, please contact AccessibleNU to move forward with the university's established accommodation process (accessiblenu@northwestern.edu; 847-467-5530). If you already have established accommodation with AccessibleNU, please let me know as soon as possible, preferably within the first two weeks of the term, so we can work together to implement your disability accommodation. Disability information, including academic accommodations, is confidential under the Family Educational Rights and Privacy Act.

Should you need them, additional campus resources are available, including, but not limited to:
- Accessible NU: www.northwestern.edu/accessiblenu/
- CAPS: www.northwestern.edu/counseling/index.html
- Student Enrichment Services: www.northwestern.edu/enrichment/

Diversity and Inclusion

I consider this classroom to be a place where you will be treated with respect, and I welcome individuals of all ages, backgrounds, beliefs, ethnicities, genders, gender identities, gender expressions, national origins, religious affiliations, sexual orientations, ability—and other visible and nonvisible differences. All members of this class are expected to contribute to a respectful, welcoming, and inclusive environment for every other member of the class.

Northwestern is committed to fostering an academic community respectful and welcoming of persons from all backgrounds. To that end, the policy on academic accommodations for religious holidays stipulates that students will not be penalized for class absences to observe religious holidays. If you will observe a religious holiday during a class meeting, scheduled exam, or assignment deadline, please let me know as soon as possible, preferably within the first two weeks of class. If exams or assignment deadlines on the syllabus fall on religious holidays you observe, please reach out so that we can discuss that coursework.

This course will also include a mix of undergraduates and graduate students with differing backgrounds in embedded systems, computer science, and electrical engineering. Do not feel discouraged by this. Each student will bring a different aspect of their knowledge to discussions, and we'll all be contributing towards increasing each other's understanding.

Course Details Subject to Change

Please note that the specifics of this course syllabus are subject to change in the case of unforeseen circumstances. Instructors will notify students of any changes as soon as possible. Students will be responsible for abiding by the changes.