

Machine Learning
Artificial Intelligence System Design and Development

Computer Science 601.486/686

Fall 2024 (3 credits)

Syllabus

Instructors: Mark Dredze (mdredze@cs.jhu.edu)

TA/CA: Kaiser Sun (head), Yuqi Li, Yashwanth Nadella, Haonan Zhang

Office hours: Prof Dredze: Mondays 3-4pm, Malone 339

Time: Monday/Wednesday 1:30pm to 2:45pm

Location: Hodson 311

This course is based on the original course developed by Mathias Unberath.

Start of Semester TODO Items

- Sign up for the course Slack channel
 - https://join.slack.com/t/jhu-cs486-fall2024/shared_invite/zt-2p9Izn51v-TQbO9kpWNnO8oB3L3P7G2Q
- Sign up for the course Piazza site
 - Class link: <https://piazza.com/jhu/fall2024/601486686/home>
 - Signup link: <https://piazza.com/jhu/fall2024/601486686>
 - Access code: yit1t8671gn
- Gradescope
 - Course link: <https://www.gradescope.com/courses/837294>
 - Access code: 6JX7WG

Synopsis

Artificial intelligence (AI) has recently seen a substantial increase in popularity, largely fueled by the successes of training deep neural networks (deep learning, DL) that achieve state-of-the-art performance in many problems. These successes are not limited to academic benchmarks but have started to impact our everyday lives through products such as ChatGPT, Amazon Alexa, and Tesla Autopilot. For such AI systems to succeed, several aspects are of key importance: 1) the effect on everyday life, 2) the capabilities of the underlying machine learning algorithm, and 3) the effectiveness of the human-AI interaction.

The potential for employing AI to tackle major societal challenges is enormous. AI can help us address research challenges in climate and sustainability, health and medicine, scientific discovery, education, arts and culture, and governmental policymaking. The success of AI in these areas depends on characterizing the key challenges of each problem, understanding the needs and implications of AI for these problems, and developing an AI system that works harmoniously with humans.

In this project-based course, you will work in teams of 4-5 students to develop AI systems for the public good.

1) Identify a public good challenge where an AI system can contribute towards a solution. 2) Conceptualize and design an AI system (including a rudimentary concept for a user interface to be demo-able, and focusing on the machine learning backend) that successfully improves the targeted scenario. 3) Understand the ethical and societal implications and limitations of the system. 4) Develop the AI system by iteratively refining the demo-able prototype based on feedback received during course presentations.

The course culminates in a final presentation session, where groups will present their AI systems. The course will include designing and implementing a user interface and a machine learning system. However, the focus will be on the system as a whole rather than refining specific components. This includes precise specification of the question to be answered, the needs of the users, selecting suitable datasets and evaluations, and thinking of the experience of the system as a whole.

Prerequisites

Students must have solid training in the theory and practice of machine learning, evidenced by successful completion of at least one of the following courses: EN 601.475/675 Machine Learning, EN 601.464/664 Artificial Intelligence, EN 601.482/682 Machine Learning: Deep Learning, or similar courses.

Students must have advanced software engineering skills.

Experience with human computer interface design, e.g. EN 601.454/654 Augmented Reality, EN 601.290 User Interfaces and Mobile Applications, EN 601.490/690 Introduction to Human Computer Interaction, or EN 601.491/691 Human-Robot Interaction is desirable but not required.

Instructional Material

The learning experience in this course will be dominated by the guided hands-on experience in designing and developing an AI-based system, complemented with status

reports in the form of presentations/demos, discussion sessions, and open feedback rounds. The AI system design process is ignited by lectures during the first weeks of the course. The material will be based on various papers, online resources, case studies, and slides (available online through Piazza/Slack).

Online Resources

Assignments, course material, and links to relevant resources will be posted on Piazza/Slack. Students are encouraged to post any questions and discussions on Piazza as well.

Assignments

The course has 2 forms of assignments.

1. Project-related assignments. These are assignments done as part of the development and execution of your project. They include a project proposal, updates, and a final presentation. They may have an in-class presentation and a written report.
2. Project independent assignments. These assignments are separate from your project. They may have an in-class presentation and a written report.

Late Policy

Assignments must be submitted in time for full credit. If you encounter delays please notify the professor as soon as possible. A late submission within 24 hours may result in a 25% reduction in grade for the assignment. Assignments submitted more than 24 hours late may not be accepted.

Attendance

This is a very interactive class. Attendance is mandatory. You will be allowed 3 absences. Students with 3 or fewer absences will receive the full attendance credit as part of their grade. Please let the instructor know if you anticipate an excused or extended absence.

Grading

- 1) Project
 - a) Full Proposal and report (150)
 - b) Update 1 (75 points)
 - c) Update 2 (125 points)
 - d) Final presentation and report (500)
- 2) Case Study Assignment (100 points)
- 3) Attendance (50 points)

Ethics

The strength of the university depends on academic and personal integrity. In this course, you must be honest and truthful. Ethical violations include cheating on exams, plagiarism, reuse of assignments, improper use of the Internet and electronic devices, unauthorized collaboration, alteration of graded assignments, forgery and falsification, lying, facilitating academic dishonesty, and unfair competition. Report any suspected violations to the instructor. You can find more information about university misconduct policies on the web at these sites:

- Undergraduates:

<https://studentaffairs.jhu.edu/policies-guidelines/undergrad-ethics/>

- Graduate students:

https://provost.jhu.edu/wp-content/uploads/2018/08/Homewood-WSE_KSAS_-WS-E-EP_KSAS-AAP-Graduate-Academic-Misconduct-Policy-2018SU.pdf

Personal Wellbeing

- If you are sick, particularly with an illness that may be contagious, and may require accommodation regarding homework notify the instructor by email but do not come to class. Visit the Health and Wellness Center: 1 East 31 Street, (410) 516-8270.
Also refer to:
<https://studentaffairs.jhu.edu/student-life/student-outreach-support/absences-from-class/>
- All students with disabilities who require accommodations for this course should contact the instructor at their earliest convenience to discuss their specific needs. If you have a documented disability, you must be registered with the JHU Office for Student Disability Services (385 Garland Hall; (410) 516-4720; <https://studentaffairs.jhu.edu/disabilities/>) to receive accommodations.
- If you are struggling with anxiety, stress, depression, or other mental health-related concerns, please consider visiting the JHU Counseling Center. If you are concerned about a friend, please encourage that person to seek out these services. The Counseling Center is located at 3003 North Charles Street S-200 and can be reached at (410) 516-8278 and online at <https://wellbeing.jhu.edu/MentalHealthServices/>.