CS4100
artificial intelligence

Summer 2 2024, Khoury College, Northeastern University
Lectures: Mon - Thu, 9:50 am - 11:30 am, Richards 458

Instructor: Raj Venkat
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Course Webpage: venkat.prof/CS4100
Virtual TA Office Hours and 24/7 Q&A: Campuswire (instead of Piazza)
Written Submissions: Gradescope
Code Submissions: See HW instructions

Contents

1 Overview

1.1 Course Description

Computers are incredibly dumb. However, they can be programmed to appear incredibly clever using some fancy mathematics. This introductory course on Artificial Intelligence covers:

- search, planning, constraint-satisfaction problems and games
- how to work with uncertainty in the environment
- ML, reinforcement learning, NLP, and recent developments
- ethical questions about the use of AI

1.2 Textbook(s)

My course content is curated from several different sources, many of them not textbooks. However, you will find the following texts useful. Except for the first book in this list, the remaining are made freely available online by the respective authors.

- Artificial Intelligence: A Modern Approach, Pearson
- Artificial Intelligence 2E: Foundations of Computational Agents, Cambridge University Press
- Mathematics for Machine Learning, Cambridge University Press
- Dive into Deep Learning, Forthcoming at Cambridge University Press

1.3 Tentative Lecture Plan

- Introduction, history of AI, some philosophy
- The vocabulary of AI, problem formulation and search
- Uniform cost search, hill-climbing, beam
- Heuristics, A*, branch & bound, genetic algorithms
- Games, minimax, alpha-beta pruning
- Constraint satisfaction problems, backtracking
- Non-deterministic environments, expectiminimax
- Markov models, hidden Markov models
- Markov decision processes
- Reinforcement learning
- Supervised & unsupervised ML
- Natural language processing
- Deep learning, large language models
- Deep reinforcement learning
- Computer vision & adversarial ML
- Ethics in AI

1.4   Components & Grading

Grades will be based on the following split over course load:

- **Project: 40%** (presentation, final report, modular and reusable code in GitHub repo)
- **Programming Assignments: 30%** (3 assignments, NOT equally weighted)
- **Problem Sets: 20%**
- **Labs: 10%** (graded for completion)

Final grades will be assigned based on the following scale
(note open and closed intervals):

A	[93, 100]
A-	[90, 93)
B+	[87, 90)
B	[82, 87)
B-	[80, 82)
C+	[77, 80)
C	[72, 77)
C-	[70, 72)
D+	[67, 70)
D	[62, 67)
D-	[60, 62)
F	[0, 60)

Natural rounding will be used, i.e., percentages $\geq x.5$ get rounded up to the next integer, $x + 1$ (94.5 becomes 95, 94.4 does not). I reserve the right to curve grades at the end of the semester. While not guaranteed, if a curve is applied, it will necessarily be in students' favor.

2   Class Policies

2.1   Homework Submissions & Grading

- All written submissions and labs must be submitted to Gradescope by 6:00 pm Eastern on the due date. Written submissions must be in PDF format.
- All programming submissions must be uploaded according to assignment instructions by 6:00 pm Eastern on the due date.
- All written solutions **must** be typed (i.e., no scans of handwritten assignments will be accepted). Scanned figures are only permitted where explicitly specified in the assignment instructions. Any such figures must be clear and perfectly legible.
- The use of LaTeX is highly encouraged, but not mandatory. `Overleaf` is an excellent browser-based LaTeX editor with real-time compilation capabilities. Once you've created an account, you might find `this template` useful to get started on Overleaf. You'll need to create a copy of the template in your Overleaf projects to get edit access.

- It is encouraged that you work with your classmates on the homework problems, but keep discussions at a conceptual level. **If you do collaborate, you must write all solutions by yourself, in your own words, and are strictly forbidden from sharing any written solutions or code. You must list all of your collaborators on your submission.** The TAs and instructors reserve the right to ask you to explain your solutions.
- **Grading** All grades, including programming assignments, will be released via Gradescope.
- **Regrade Requests** All regrade requests must be submitted within 1 week of receiving your grade. Requests for all submissions must be submitted from within Gradescope. Requests submitted via email will almost certainly be missed.

2.2   Policy on the use of Generative AI

- For programming submissions, students may freely use any AI tool available to them, as long as they are appropriately cited (a code comment will suffice). I believe that it is imperative that students learn how to use these tools effectively and correctly, while also learning how to properly test and verify code generated by these tools. The challenges you will encounter on the way are part of the learning experience. I recommend not using generative AI to assist with labs.
- Students may **not** use generative AI to complete problem sets and written portions of homework assignments. These are intended to test students' ability to demonstrate mastery of techniques learnt in the course by a) presenting sound and rigorous theoretical analysis, and b) critically analyzing code. Any indication of the use of AI tools in the written submissions will constitute a violation of academic integrity.
- The use of AI to rephrase **sentences** and improve writing clarity, etc. - while an acceptable use case - makes it difficult for instructors to discern whether the entire answer was AI-generated. Therefore, if AI is used in this manner, students are **required** to submit an additional appendix at the end of their submission with their corresponding originally written answers. The submission of such an appendix is aimed only at helping me understand the usage patterns of AI tools. Points will **not** be taken off for using AI to improve writing.

2.3   Late Policy

- As a general rule, students are expected to submit work on time. However, each student is given one 'freebie' - a no-questions-asked 3-day extension to a single homework of their choice. The freebie is intended to be a fallback in case of genuine emergencies where coordinating with the instructor may not be feasible. Unused days may not be carried forward to future assignments. Be wise in how you use this. The freebie may **not** be used for labs, presentations, or submissions related to the final project.
- Once the freebie is used, I will generally not grant further extensions, except in the case of limited and verifiable emergency situations, or University and DRC-sanctioned accommodations. It is imperative that you communicate with me early on if circumstances permit. Timely submissions are the only way for me to get you timely feedback.
- In case you have exhausted your freebie, and feel like you will be unable to submit an assignment in time, reach out to me. Depending on your circumstances, I may not give you an extension, but I will certainly offer you the right resources to help you make the best of your assignment. My only goal is to help you succeed.

2.4 Academic Integrity

- Please familiarize yourself with `Northeastern University's Academic Integrity Policy`.
- Sharing of code in any form (including posting on Campuswire) is strictly forbidden. Searching for solutions online is okay, with appropriate citations in code comments. You may not ask TAs or the instructor to help debug code that was found online.
- Any violation of academic integrity (as outlined by homework policies above) will result in an OSCCR report being filed against you.
- Additional penalties, including but not restricted to failing the course without the option to withdraw may be levied against you at the discretion of the instructor.
- Recognize that most violations are often easily avoided by simply acknowledging any difficulties you may be having with the course, and seeking help from your course instructors in a timely fashion. We're here to help you learn.

2.5 Classroom Environment

- To create and preserve a classroom atmosphere that optimizes both teaching and learning, all participants share a responsibility in creating a civil and non-disruptive forum for the discussion of ideas. Students are expected to conduct themselves at all times in a manner that does not disrupt teaching or learning.
- Your comments to others should be constructive and free from any harassing or disrespectful statements. You are encouraged to disagree with other students and the instructor, but such disagreements need to be respectful and be based on facts and documentation (rather than prejudices and personalities).
- The instructor reserves the right to interrupt conversations that deviate from these expectations. Repeated unprofessional or disrespectful conduct may result in a lower grade or more severe consequences. Part of the learning process in this course is respectful engagement of ideas with others.

2.6 Software

We will use Python 3 for all programming assignments. Assignments may require you to push code to github repositories. The following resources may come in useful:

- `Prof Felix Muzny's Computational Thinking in Python`
- `Learn Python 3`
- `GitHub Quickstart`

If you have limited or no Python or GitHub experience, please reach out to the TAs or the instructor early in the semester. This will enable us to work with you and provide additional guidance in a timely manner.

3   Office Hours & the TA Team

Campuswire, the platform we're using for 24/7 Q&A, also has built-in video chatrooms with queue management, which will be used for any listed virtual office hours. TAs may offer a mix of in-person and hybrid office hours; timings and locations will be updated on the course website.

Instructor - Raj

- In-person, Richards 238, Monday - Thursday, 11:40 pm - 12:30 pm.
- To schedule appointments outside of office hours, visit `my appointments page`.
- If you decide to swing by on a whim and my office door is open, feel free to bug me.

Teaching Assistants

- Ashwin Bharadwaj (`bharadwaj.ash@northeastern.edu`)
- Nihira Golasangi (`golasangi.n@northeastern.edu`)
- Kishore Sampath (`sampath.ki@northeastern.edu`)
- Mrudula Acharya (`acharya.mr@northeastern.edu`)
- Esha Bharat Acharya (`acharya.e@northeastern.edu`)

4   Campus Resources

4.1   Healthcare, Counseling, and Wellness

Your health and well-being are paramount, above any and all course deliverables. There is a wide range of support services on campus to ensure your success, and I encourage you to reach out to resources as appropriate.

- `University Health and Counseling Services`
- `Find@Northeastern`
- `WeCare`
- `Support Groups and Workshops`

4.2   Title IX

- Title IX of the Education Amendments of 1972 protects individuals from sex or gender-based discrimination, including discrimination based on gender identity, in educational programs and activities that receive federal financial assistance.
- Northeastern's Title IX Policy prohibits Prohibited Offenses, which are defined as sexual harassment, sexual assault, relationship or domestic violence, and stalking. The Title IX Policy applies to the entire community, including students, faculty, and staff of all genders.
- If you or someone you know has been a survivor of a Prohibited Offense, confidential support and guidance can be found through `University Health and Counseling Services` staff and `Center for Spiritual Dialogue and Service` clergy members. By law, those employees are not required to report allegations of sex or gender-based discrimination to the University.

- Alleged violations can be reported non-confidentially to the Title IX Coordinator within `The Office for University Equity and Compliance` by either filling out the online `Discrimination Complaint Form`, via email to the OUEC (less secure) at `titleix@northeastern.edu` and/or through `NUPD` (Emergency 617-373-3333; Non-Emergency 617-373-2121). Reporting Prohibited Offenses to NUPD does NOT commit the victim/affected party to future legal action.
- Faculty members are considered "responsible employees" at Northeastern, i.e., they are required to report all allegations of sex or gender-based discrimination to the Title IX Coordinator. In case of an emergency, please call NUPD's emergency line (617-373-3333) or 911 as appropriate. Please visit the `Title IX webpage` for a complete list of reporting options and resources both on-campus and off-campus.

4.3   Disability Resources

Students with disabilities who wish to receive academic services and/or accommodations should visit the `Disability Resource Center` at 20 Dodge Hall, or call 617-373-2675. If you have not already done so, please provide your letter from the DRC to your instructor early in the semester so that they can arrange those accommodations.