C S 4013/5013: Artificial Intelligence

University of Oklahoma
Spring 2025

General Information and Course Schedule

Lecture Time: Tues/Thurs, 10:30-11:45 AM
Lecture Location: Sarkeys Energy Center, Room N0202
Class format: In-person
Materials delivery: All materials will be posted on Canvas. Announcements and discussions will be shared via Canvas or email or Teams.
Submission System: All assignments should be submitted via Gradescope

Course Staff and Office Hours

Note: Please refer to the appropriate TA for Homework or Project help. See any of the course staff for other questions.

Instructor

Golnaz Habibi (golnaz@ou.edu)
Office Hours: Tuesdays/Thursdays 1PM-2PM and upon request, Location (TBD)
Zoom meeting during office hours for instructor is available **upon request**:
https://oklahoma.zoom.us/j/9123772842.
For other times, please contact the instructor.

Teaching Assistants

For grading questions: Daniel Vargas and Daniel Perez
For question on Jetbots (final project), please reach out Daniel Vargas

Course Description

This course introduces fundamental knowledge for designing an intelligent agent who lives in an environment with or without adversarial/cooperative agents. The environment would be observable or partially observable. The agent makes decision under uncertainty to reach its goal or accomplish its mission (e.g., maximizing its score). Course covers broad topics in AI such as Markov Decision Process, Reinforcement Learning, Search techniques, Game Theory, and Bayesian Networks. The course also introduces basics topics on computer vision, self-driving cars and game theory. Graduate section of the course includes a final project in which students will have hands-on robotic experience during their final project and racing cars in a miniaturized city environment.

Course Objectives

At the end of the semester, student learns...

- how to design an agent with the ability of searching in a maze environment, with and without adversarial opponent.
- basics on decision making under uncertainty and reinforcement learning
- state estimation using particle filtering
- how to classify handwritten numbers and detect objects in an image using machine learning techniques.
- how to apply basic AI to different problems in planning and perception

Summary

Topics covered in this course:

- Search techniques (A*, DFS, BFS, UCS)
- Adversarial Search and Game Theory (stochastic and deterministic)
- Constraints Satisfaction Problem (CSP)
- Decision making and planning under uncertainty (Markov Decision Process)
- Reinforcement Learning
- Probability and Bayesian Network for inference
- Hidden Markov Model and Particle Filtering
- Machine learning basics focus on Logistic regression and Naïve Bayes
- Convolutional Neural Networks: basics and applications
- Advanced topics: computer vision, self-driving cars, Robotics, Large Language Models
- Ethical AI and Trustworthy AI

Prerequisites

Courses:

4013: (CS2413 or CS2414 and CS 2813 or MATH 2513)

5013: ((CS2413 or CS2414 and CS 2813 or MATH 2513) or CS 5005) and graduate standing

Programming Skills: All the projects are in **Python**. The students are expected to have skill and experience in Python programming before taking this class.

Textbook (recommended): Reading assignments refer to AIMA., 4th edition unless otherwise specified.

Course assignment submission and grading system:

This class uses Gradescpoe for the submission and grading. Although the materials will be found in canvas page, but student should submit their work in Gradescoe only. Any submission outside the gradescope is not allowed and wont be graded.

Course Communication

Join the course team in Microsoft Teams: the code to join is ju80vyc

Students are encouraged to pose their questions in the class group in Teams. Your discussion may be helpful for other students. Course staff will try to check the Teams and discussion section periodically, but for a quicker response, you should ask your questions from the instructors during office hours. Answering questions outside of the office hours may be delayed. For any questions regarding the course (HW, projects, grading, material, etc) you can reach out the instructor via email or canvas or during office hours. You can also request for regrading in Gradecope.

Course Assessments

Homework

This course includes six-seven Homework assignments. Homework should be done and submitted **individually**. Students may discuss in groups but they should submit only their own work. There is a self-assessment homework that you have to take. Although it is not graded, it is mandatory and it evaluates your

Projects

The course has five main projects (and Project 0 as a warmup) based on Python programming. There will be an extra project for students in section CS5013. Except Project 0 which **must be done individually**, you may work on projects in groups of 1-2. The deadline to finalize your group is **January 20 at 11:59 PM**. Projects are usually due on Fridays unless otherwise specified. If you do not find a partner and would like to work in a group, you need to let the course staff know in advance and they will help you find a project partner. Note that grading standards are the same for all project submissions, even if you decide to do your projects individually. Students may discuss projects across groups, but they MAY NOT COPY the code from each other unless they are in the same group. The course staff will provide the instructions for each project, which is posted in Canvas.

Final Project (5013 section only)

This project involves training a robotic car (JetBot.) to follow the roads in a miniaturized city. In the last week of the class, the students will demonstrate their work and compete with other teams. This final project for the graduate section will be done in groups of three. The deadline to finalize your Final Project group is . If you cannot find a team, please let the staff know in advance and we find a team for you.

Midterms and Final Exams

Exams are open book and open notes, but you are not allowed to use any electronic devices such as cell phone, laptop, tablet, etc) excepting accommodations.

Pop-up Quizzes

There are set of quizzes during the class. Please make sure you attend the class consistently to take quizzes. **You need to bring your laptop to take your quiz on canvas.**

Homework Assignment Grading Policy

The homework with lowest grade will be dropped. Please see the tables in the next page for reviewing the weights for grading

Late Policy (Homework and Projects)

There are the total of five grace days that you can use for your homework and projects (up 2 days for each HW/project). After consuming your grace limit for each assignment, your grade is penalized by 15% for each day late. HW/Projects submitted 5 days after deadline will not be accepted. Use your grace days wisely and try to finish your assignments on time.

Grading Weights: Section 4013

Midterms and Quizzes	25%
Projects	20%
Homework	20%
Final Exam	35%

Grading Weights: Section 5013

Midterms and Quizzes	25%
Projects	20%
Homework	20%
Final Exam	30%
Final Project	5%

Score-Grade Conversion

Score	**Grade**
≥90	A
[80,90)	B
[70,80)	C
[60,70)	D
<60	F

University Policies

Copyright Syllabus Statement for In-Person or Online Courses

Sessions of this course may be recorded or live-streamed. These recordings are the intellectual property of the individual faculty member and may not be shared or reproduced without explicit, written consent of the faculty member. In addition, privacy rights of others such as students, guest lecturers, and providers of copyrighted material displayed in the recording may be of concern. Students may not share any course recordings with individuals not enrolled in the class or upload them to any other online environment.

Foods and drinks in the class

Food /drink are not permitted in the classroom or lab, with the exception of covered water bottles, which may be used sparingly in these locations and the cap immediately returned to the bottle after each drink.

Academic Integrity and Honesty

Copying another's work for homework and project assignments, or possession of unauthorized electronic computing or communication devices in the testing area, is the course violation and grounds for penalties in accordance with school policies.

Please see OU's academic integrity website.

Academic honesty is incredibly important within this course. Cheating is strictly prohibited at the University of Oklahoma, because it devalues the degree you are working hard to get. As a member of the OU community, it is your responsibility to protect your educational investment by knowing and following the rules. For specific definitions on what constitutes cheating, review the Student's Guide to Academic Integrity.

Religious Observance

It is the policy of the University to excuse the absences of students that result from religious observances and to reschedule examinations and additional required classwork that may fall on religious holidays, without penalty. [See Faculty Handbook 3.15.2]

Reasonable Accommodation Policy

The University of Oklahoma (OU) is committed to the goal of achieving equal educational opportunity and full educational participation for students with disabilities. If you have already established reasonable accommodations with the Accessibility and Disability Resource Center (ADRC), please submit your semester accommodation request through the ADRC as soon as possible and contact me privately, so that we have adequate time to arrange your approved academic accommodations.

If you have not yet established services through ADRC, but have a documented disability and require accommodations, please complete ADRC's pre-registration form to begin the registration process. ADRC facilitates the interactive process that establishes reasonable accommodations for students at OU. For more information on ADRC registration procedures, please review their Register with the ADRC web page. You may also contact them at (405)325-3852 or adrc@ou.edu, or visit www.ou.edu/adrc for more information.

Note: disabilities may include, but are not limited to, mental health, chronic health, physical, vision, hearing, learning and attention disabilities, pregnancy-related. ADRC can also support students experiencing temporary medical conditions.

Title IX Resources and Reporting Requirement

The University of Oklahoma faculty are committed to creating a safe learning environment for all members of our community, free from gender and sex-based discrimination, including sexual harassment, domestic and dating violence, sexual assault, and stalking, in accordance with Title IX. There are resources available to those impacted, including: speaking with someone confidentially about your options, medical attention, counseling, reporting, academic support, and safety plans. If you have (or someone you know has) experienced any form of sex or gender-based discrimination or violence and wish to speak with someone confidentially, please contact OU Advocates (available 24/7 at 405-615-0013) or University Counseling Center (M-F 8 a.m. to 5 p.m. at 405-325-2911)

Because the University of Oklahoma is committed to the safety of you and other students, and because of our Title IX obligations, I, as well as other faculty, Graduate Assistants, and Teaching Assistants, are mandatory reporters. This means that we are obligated to report gender-based violence that has been disclosed to us to the Institutional Equity Office. This means that we are obligated to report gender-based violence that has been disclosed to us to the Institutional Equity Office. This includes disclosures that occur in: class discussion, writing assignments, discussion boards, emails and during Student/Office Hours. You may also choose to report directly to the Institutional Equity Office. After a report is filed, the Title IX Coordinator will reach out to provide resources, support, and information and the reported information will remain private. For more information regarding the University's Title IX Grievance procedures, reporting, or support measures, please visit Institutional Equity Office at 405-325-3546.

Adjustments for Pregnancy/Childbirth Related Issues

Should you need modifications or adjustments to your course requirements because of documented pregnancy-related or childbirth-related issues, please contact your professor or the Accessibility and Disability Resource Center at 405/325-3852 as soon as possible. Also, see the Institutional Equity Office FAQ on Pregnant and Parenting Students' Rights for answers to commonly asked questions.

Emergency Protocol

During an emergency, there are official university procedures that will maximize your safety.

- **Severe Weather:** If you receive an OU Alert to seek refuge or hear a tornado siren that signals severe weather.
  1. Look for severe weather refuge location maps located inside most OU buildings near the entrances
  2. Seek refuge inside a building. Do not leave one building to seek shelter in another building that you deem safer. If outside, get into the nearest building.
  3. Go to the building's severe weather refuge location. If you do not know where that is, go to the lowest level possible and seek refuge in an innermost room. Avoid outside doors and windows.
  4. Get in, Get Down, Cover Up
  5. Wait for official notice to resume normal activities.

Additional Weather Safety Information is available through the Department of Campus Safety.

- **The University of Oklahoma Active Threat Guidance**

  The University of Oklahoma embraces a Run, Hide, Fight strategy for active threats on campus. This strategy is well known, widely accepted, and proven to save lives. To receive emergency campus alerts, be sure to update your contact information and preferences in the account settings section at one.ou.edu.

1. RUN: Running away from the threat is usually the best option. If it is safe to run, run as far away from the threat as possible. Call 911 when you are in a safe location and let them know from which OU campus you're calling from and location of active threat.
2. HIDE: If running is not practical, the next best option is to hide. Lock and barricade all doors; turn of all lights; turn down your phone's volume; search for improvised weapons; hide behind solid objects and walls; and hide yourself completely and stay quiet. Remain in place until law enforcement arrives. Be patient and remain hidden.
3. FIGHT: If you are unable to run or hide, the last best option is to fight. Have one or more improvised weapons with you and be prepared to attack. Attack them when they are least expecting it and hit them where it hurts most: the face (specifically eyes, nose, and ears), the throat, the diaphragm (solar plexus), and the groin.

Please save OUPD's contact information in your phone.
NORMAN campus: For non-emergencies call (405) 325-1717. For emergencies call (405) 325-1911 or dial 911.
TULSA campus: For non-emergencies call (918) 660-3900. For emergencies call (918) 660-3333 or dial 911.

- **Fire Alarm/General Emergency:** If you receive an OU Alert that there is danger inside or near the building, or the fire alarm inside the building activates:
  1. LEAVE the building. Do not use the elevators.
  2. KNOW at least two building exits 3.
  3. ASSIST those that may need help 4.
  4. PROCEED to the emergency assembly area
  5. ONCE safely outside, NOTIFY first responders of anyone that may still be inside building due to mobility issues.
  6. WAIT for official notice before attempting to re-enter the building. Please visit OU Fire Safety on Campus

Mental Health Support Services

If you are experiencing any mental health issues that are impacting your academic performance, counseling is available at the University Counseling Center (UCC). The Center is located on the second floor of the Goddard Health Center, at 620 Elm Rm. 201, Norman, OK 73019. To schedule an appointment call (405) 325-2911. For more information, please visit University Counseling Center.

Pre-Finals Week Policies

Pre-finals week will be defined as the seven calendar days before the first day of finals. Faculty may cover new course material throughout this week. For specific provisions of the policy please refer to OU's Final Exam Preparation Period policy. During pre-finals week, all normal class activities will continue; however, no assignment, test, or examination accounting for more than 3% of the course grade may be assigned, unless it is assigned in advance of pre-finals week and worth less than 10%, or scheduled at least 30 days prior if worth more than 10%. No activity or field trip may be scheduled that conflicts with another class. There are some exceptions and nuances, so please review the Final Exam Policies prior to designing your course schedule.

Course Schedule (Subject to Change)

Please note that this is the initial schedule, and it is subject to change and the instructor has this right to change this schedule during the semester

Week	Date	Lecture	Recommended Readings	Homework	Project
1	1/14	1 – Introduction Intelligent Agent and rationality	Ch. 1, 2 (AIMA 4th)	HW0 - math diagnostic HW1 out -Search	Project 0 (warm-up)
	1/16	2 – Reflex/Planning Agent, Uninformed Search	Ch. 2,3		
2	1/21	3 – Uninformed Search , Informed Search	Ch. 3, 4	HW0 due- (1/17)	P0 due (1/20) P1-search out
	1/23	4- Informed search (A*)	Ch. 5		
3	1/28	5 – Adversarial Search and introduction to game theory, minimax, alpha-beta pruning	Ch. 5, & Ch. 16 (optional)	HW 1 due (1/31) HW2 -Adversarial search out	
	1/30	6 – Expectimax, stochastic games	Ch. 6		
4	2/4	7 – CSP I	Ch. 6		P1 due P2 out (Adversarial search)
	2/6	8 – CSP II	Ch. 17		
5	2/11	9 – MDP I	Ch. 17	HW 2 due HW3 (CSP) out	
	2/13	10 – MDP II	Ch. 22		
6	2/18	11 – RL I	Ch. 22		P2 due P3 out -MDP/RL
	2/20	12 – RL II	Ch. 22		
7	2/25	13- RL III	Ch. 12	HW3 due HW4 (MDP/RL) out	
	2/27	14 – Probability	Ch. 13		
8	3/4	15 – Bayesian Net I	Ch. 13		P3 due P4 out – Bayesian, PF
	3/6	16 – Bayesian Net II	Ch. 13		
9	3/11	17 – Bayesian Net III	Ch. 13		
	3/13	Midterm I – Search , Adversarial search, CSP			
10	3/18	Spring Break (no class)			
	3/20	Spring Break (no class)			
11	3/25	18 – HMM and Particle Filtering	Ch. 14	HW5 (Bayesian, HMM, ,PF) out HW4 due	P5 out (ML) P4 due (4/5)
	3/27	19 – Decision Network VPI	Ch. 16		
12	4/1	20 – ML I	Ch. 19		
	4/3	21 – ML II	Ch. 21		

Week	Date	Lecture	Recommended Readings	Homework	Project
13	4/8	22 – MLIII	Ch. 21	HW5 due	P5 due
	4/10	23 – ML and Computer Vision and Robotics	Ch. 25, 26	HW6 (Decision Network, ML) out	
14	4/15	24 – Advanced topics: LLM (e.g., ChatGPT)			
	4/17	Midterm II – MDP, RL, HMM, particle filtering, Bayesian Net			
15	4/22	25– Ethical AI		HW6 due	
	4/24	26 – Guest Lecturer			
16	4/29	27- TBD			Final project presentation
	5/1	28 – Class Conclusion, Future of AI			

Final exam is on May 7th at 8 AM, it will cover topics in ML and Decision Networks

Extra questions from topics covered in Midterms are included and can help midterm grades