

C S 4013/5013: Artificial Intelligence

Spring 2023

University of Oklahoma

Course Syllabus

Course general information:

Lecture location: Sarkeys Energy Center, Room N0202

Zoom link (upon request):

<https://oklahoma.zoom.us/j/9123772842>

Note: zoom link for office hours for homework/projects are different, please make sure you follow the zoom link provided for TAs in this homepage.

Lecture time: T/Th 10:30-11:45 AM CST

Midterm exam: 3/9/23 - 10:30-11:50 AM , Sarkeys Energy Center, Room N0202

Final Exam: 5/10/23, 8-10 AM, Sarkeys Energy Center, Room N0202

Midterm Exam review sessions:

Review sessions for midterms will be held in person in DEH 420 on:

- Wednesday March 1st at 9-11 and Friday March 3rd at 2-4 next week
- Monday March 6th and Wednesday 8th at 2-4

Discussion session by Sinaro (it is replaced by review session in the weeks of Feb 27-March 10)

- Mondays 12:30-1:30, DEH 345
- Wednesdays 10-11, DEH 326

Final Exam review sessions: TBD

Course website: <https://canvas.ou.edu/courses/272982>

Course Materials: all the materials will be posted on Canvas

Course Announcement and discussions: canvas and course email

Course Staff and office hours:**Instructor:**

Golnaz Habibi (golnaz@ou.edu)

Office hours: Devon Energy Hall, Tuesdays and Thursdays 9-10, DEH 235 and Thursdays 12-1 in zoom and in person (upon request)

zoom meeting during office hours for instructor is available at:

<https://oklahoma.zoom.us/j/9123772842>

For other times, please contact the instructor.

TA for Projects:

Jacob Ingram (jacob.d.ingram-1@ou.edu)

(When messaging Jacob on Mondays and Wednesdays, please expect longer response times when messaging outside of his office hours)

Office Hours for projects:

Mondays/Wednesdays/Fridays: 9 - 11 am, location: DEH 225 (please knock before entering)

TA for HomeWorks:

Sinaro Ly (sinaro.ly-1@ou.edu)

Office Hours for homeworks:

Tuesdays/Thursdays: 1:30-3:30 PM (location:DEH 345 and

<https://oklahoma.zoom.us/j/93851202607?pwd=cEYwc0Q1UEFKQktBaU1abWtuTU9vUT09>)

Course Description:

This course introduces fundamental knowledge for designing an intelligent and autonomous agent who lives in an environment with fully observable or partially observable settings and with/without adversarial agents and the agent needs to make decision to reach its goal or accomplish its mission (e.g., maximize its score). Each autonomous system has three main modules of perception, planning, and control, The focus of the course is topics on planning/decision making as well as agent's perception (learning based methods and statistical methods). The course also introduces basics topics on computer vision, self-driving cars and game theory.

Course Summary:

Topics covered in this course:

- Search techniques for an intelligent agent with and without adversary agent (e.g., A*, DFS, BFS, UCP)
- Decision making and planning in fully observable and partially observable environments (MDP, POMDP)
- Machine learning basics focus on Logistic regression and Naïve Bayes, statistical learning and HMM
- Particle Filtering
- Convolutional Neural Networks: basics and applications
- Introduction to other Deep Learning Models: Autoencoders
- Imitation learning and Reinforcement Learning
- AI for self-driving cars
- AI for Games
- AI for computer vision

Course Objective:

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 estimate using particle filtering
- how to classify the handwritten numbers and detect the objects in an image by using machine learning techniques.
- how to apply basic AI to different problem in planning and perception

Course Prerequisites:

(CS2413 or CS 5005) and (CS 2813 or CS 4005 or MATH 2513)

Important: All the projects are in Python. The students are expected to have skill and experience in Python programming

Textbook (required):

Reading assignments refer to [AIMA](#), 4th edition unless otherwise specified.

Projects:

The course has five main projects (+ project 0 as warmup) based on Python programming. There will be an extra project for student of section CS5013. Except project 0 which must be done individually, you can work on projects in groups of 1-2. The Deadline to finalize your group is **January 27 at 11:59 PM**. projects are usually due on Fridays unless otherwise specified.

Note that if you decide to do you project individually, your grading would not be easier and no exception for that. Students can discuss in groups, but they **SHOULD NOT COPY** the codes from each other unless they are in the same group. All the students are required to submit the project individually even if they are working in a team, specifying the team members. Each

The course staff provide the instruction for each project which is posted in Canvas.

Homework:

This course has 8-10 homework which should be submitted individually. Students can discuss in groups but they should submit their assignments individually in their own words. Homeworks are usually due on Wednesdays unless otherwise specified.

Late policy for the homework and projects and grading:

There are the total of seven grace days that you can use for your homework and projects (up 2 days for each HW/project). After that your grade is penalized by 15% for each day late. Use your grace days wisely and try to finish your assignments on time.

The HW with lowest grade will be dropped.

Midterm and Final Exams:

Exams are closed book and closed notes, closed phone and any other electronic devices (laptop, tablet, etc).

- For midterm exam, you can bring one piece of paper (could be two-sided) of cheat sheet.
- For final exam, you can bring two pieces of cheat sheet.

Communication:

Students are encouraged to pose their questions in discussion sections so it may be helpful for other students as well. For any questions regarding the course (HW, projects, grading, material, etc) you can reach out the course staff via email or canvas or during office hours.

Course Evaluation:

Midterm: 20%

Projects: 25 %

Homework: 20%

Final Exam: 35%

Score-grade conversion:

Score-grade
conversion

Score	Grade
>=90	A
80-89	B
70-79	C
60-69	D
<60	F

OU's academic integrity:

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](#).

Accommodations:

Any student with a disability should contact the instructor so that reasonable accommodations may be made for that student.

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 me as soon as possible to discuss. Generally, modifications will be made where medically necessary and similar in scope to accommodations based on temporary disability. Please see <http://www.ou.edu/eoo/faqs/pregnancy-faqs.html> for commonly asked questions.

Title IX Resources

For any concerns regarding gender-based discrimination, sexual harassment, sexual misconduct, stalking, or intimate partner violence, the University offers a variety of resources, including advocates on-call 24.7, counseling services, mutual no contact orders, scheduling adjustments and disciplinary sanctions against the perpetrator. Please contact the Sexual Misconduct Office 405-325-2215 (8-5) or the Sexual Assault Response Team 405-615-0013 (24.7) to learn more or to report an incident.

Holidays:

It is the policy of the University to excuse the absences of students that result from religious observances and to provide without penalty for the rescheduling of examinations and additional required class work that may fall on religious holidays.

Related Documents:

Students should also read the related documents on [Replacement Assignments or Extensions](#) and [Discussions of Scores and Grades](#).

Foods and drinks in the class:

Food and 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.

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.

Links: [Severe Weather Refuge Areas](#), [Severe Weather Preparedness](#)

- **Armed Subject/Campus Intruder:** If you receive an OU Alert to shelter-in-place due to an active shooter or armed intruder situation or you hear what you perceive to be gunshots: 1. GET OUT: If you believe you can get out of the area WITHOUT

encountering the armed individual, move quickly towards the nearest building exit, move away from the building, and call 911. 2. HIDE OUT: If you cannot flee, move to an area that can be locked or barricaded, turn off lights, silence devices, spread out, and formulate a plan of attack if the shooter enters the room. 3. TAKE OUT: As a last resort fight to defend yourself.

Links: [OU Emergency Preparedness](#), [Responding to Gunshots](#)

- **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. ASSIST those that may need help 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.

Links: [OU Fire Safety on Campus](#)

Tentative course schedule (subject to change)

Week	Date	Lecture	Readings	Homework	Project
1	Tu 1/17	1 – Introduction Intelligent Agent and rationality	Ch. 1 & 2 (text book)	HW0 - math diagnostic (optional)	Project 0 (warmup), due Wednesday 1/25, 11:59 PM
	Th 1/19	2- Uninformed Search	Ch. 3 (text book)		
2	Tue 1/24	3 - (DFS, BFS) , Uniform Cost Search - Dijkstra , informed search A* , heuristic search	Ch. 3 (text book)	HW 1 (search and rational agent), due	Project 1 (search), due Friday 2/3

Tentative course schedule (subject to change)

Week	Date	Lecture	Readings	Homework	Project
	Th 1/26	4-graph search, Local Search	Ch. 4 (text book)	Tuesday 1/31 Discussion session on search	
3	Tue 1/31	5- Adversarial Search and introduction to game theory, , minmax, alpha-beta pruning	Ch. 5 (text book)	HW 2 (adversarial Search, stochastic game), due Tues 2/7	Project 2 (adversarial search) out , due on Friday 2/17
	Th 2/2	6- Expectimax, stochastic games	Ch. 5, 16 (optional)		
4	Tue 2/7	7- Constraint Satisfaction Problems (CSP) I	Ch. 6 (text book)	Discussion session on game search	
	Thurs 2/9	8- Constraint Satisfaction Problems II	Ch. 6 (text book)	HW 3 (CSP), due Tuesday 2/14	
5	Tues 2/14	9- Constraint Satisfaction Problems III	Ch. 17 (text book)	Discussion session on CSP	
	Thurs 2/16	10- Markov Decision Process I	Ch. 17 (text book)	HW 4 (MDP), due Wednesday 2/22	
6	Tue 2/21	11- Markov Decision Process II	Ch. 17 (text book)	Discussion session on MDP	

Tentative course schedule (subject to change)

Week	Date	Lecture	Readings	Homework	Project
				HW 5 (RL), due Tuesday 2/28	
	Thurs 2/23	12- Markov Decision Process II	Ch. 17 (text book)		
7	Tue 2/28	13- Reinforcement Learning I	Ch 26	Discussion session on RL Midterm Exam Review	
	Th 3/2	13- Reinforcement Learning II	Ch 26		
8	Tue 3/7	15- Reinforcement Learning , Epsilon greedy midterm review	Ch 26	Midterm Exam Review	
	Th 3/9	Midterm Exam			
9	Tu 3/14	Spring Break (no classes)			
	Th 3/16	Spring Break (no class)			

Tentative course schedule (subject to change)

Week	Date	Lecture	Readings	Homework	Project
10	Tu 3/21	16 - Wrap up Q-learning (Approximation function) Introduction to Machine Learning, linear regression and Logistic regression	Ch 26 and Ch 21		
	Th 3/23	Midterm exam II (optional)			
11	Tu 3/28	17- Machine learning Neural Networks, Convolutional Neural Network	Ch 21	HW6 (Machine learning, CNN and computer vision) due Monday 4/10	Project 3 due (3/28)
	Th 3/30	18- Computer Vision and CNN - Object Detection	Ch 25		Project 4 out (machine learning and computer vision) - due Sat 4/8

Tentative course schedule (subject to change)

Week	Date	Lecture	Readings	Homework	Project
12	Tu 4/4	19- Probability, Bayesian Inference, Conditional probability, Bayes' rule, Conditionally Independence	Ch 12		
	Th 4/6	20- Probability, Bayesian rule, Intro to Bayes' Net,	Ch 12 , 13		
13	Tu 4/11	21- Bayesian Networks: Inference	Ch 14		
	Th 4/13	22- Independence, Sampling Bayesian Inference	Ch 14	HW7 out (due - 4/20)	
14	Tu 4/18	23- Hidden Markov Models	Ch 19	HW 8 out (HMM and VPI), due 4/30	Final project (for CS5013 only) - presentation May 3 and 4 and 5

Tentative course schedule (subject to change)

Week	Date	Lecture	Readings	Homework	Project
	Th 4/20	24- Particle filtering and its application in robotics	Ch		Project 5 (HMM and Particle Filtering) - due 4/28
15	Tu 4/25	25- Decision Network and VPI	Ch 21		
	Th 4/27	26- AI and Trustworthiness - AI and Ethics - Future of AI		HW 8 due - 4/30	
16	Tu 5/2	CS 5013 final presentation			Final project presentation
	Th 5/4	27- Course Review			