COMP SCI 540 section 001 Syllabus

Introduction to Artificial Intelligence

COURSE INFORMATION

Introduction to Artificial Intelligence
COMP SCI 540 001 (3 Credits)
2020 Fall (1212) [1212]

Description
Principles of knowledge-based search techniques, automatic deduction, knowledge representation using predicate logic, machine learning, probabilistic reasoning. Applications in tasks such as problem solving, data mining, game playing, natural language understanding, computer vision, speech recognition, and robotics.

Prerequisite(s)
(COMP SCI 300 or 320 or 367) and (MATH 211, 217, 221, or 275) or graduate/professional standing or declared in the Capstone Certificate in Computer Sciences for Professionals

Course Designations
Breadth - Natural Science
Level: Advanced
LAS Credit

Instruction Mode
Face to Face

Section Level Com B
False

Department: Computer Sciences
College: Letters and Science

Canvas Course URL

https://canvas.wisc.edu/

2020 Fall (1212) [1212]
Term Start Date: Wednesday, 2-Sep-2020 **Term End Date:** Monday, 1-Feb-2021

Location and Schedule: ONLINE TR 11:00 AM-12:15 PM
CRN: 266004280

How the Credit Hours are Met

This class meets for two 75-minute class periods each week over the semester and carries the expectation that students will work on course learning activities (reading, writing, problem sets, studying, etc.) for about 3 hours out of classroom for every class period.

Course format: We plan to post pre-recorded lecture video segments on Canvas. In the regular lecture time (Tuesday/Thursday 11:00-12:15 CT), we will have synchronous classes in BlackBoard on Canvas, during which we will watch the lecture segments, do Q&A, quizzes, and discussions. We will also use Piazza for asynchronous discussions. During lecture hours: Each lecture will be a series of short pre-recorded videos posted to Canvas before class. The lecture will be divided into three blocks. In each block, the instructor will broadcast a short video using BBCollaborate Ultra, pause for interactive Q&A, and deliver short quiz questions to clear up any confusion before proceeding to the next block. All video content will also be available to watch asynchronously outside of the lecture time. We suggest watching the content during class time, posting questions on Piazza during the lecture, and participating in the quiz. However, we acknowledge that your time constraints may not allow synchronous participation.

We will use Piazza for real-time Q&A during lectures. Please follow these rules:

- Please check if someone has posted the same / similar question before you; it's much easier if we build on the thread.
- Use an informative "Summary" line to help others.

To summarize: In class you watch videos with the instructor, ask / discuss questions on Piazza, and take short quizzes as poll.

INSTRUCTORS AND TEACHING ASSISTANTS

<u>Instructors</u>

Yingyu Liang

LIANG24@WISC.EDU

Instructor Availability

Tuesday 16:00 – 17:00 CT, Thursday 8:00 – 9:00 CT

Anthony Gitter

gitter@biostat.wisc.edu

Instructor Availability

Tuesday 14:30 – 15:30 CT

Yin Li

yin.li@wisc.edu

Instructor Availability

Monday 16:00 – 17:00 CT

Daifeng Wang

daifeng.wang@wisc.edu

Instructor Availability

Wednesday 9:00 – 10:00 CT

Instructors/TAs/peer mentors will hold office hours in BBCollaborate Ultra.

TA Office Hours

Instructors/TAs/peer mentors will hold office hours in BBCollaborate Ultra. Students should attend the office hours for the section in which they originally enrolled.

The detailed office hours are available on the course website: https://happyharrycn.github.io/CS540-Fall20/

GRADING AND COURSE MATERIALS

Course Website, Learning Management System and Instructional Tools

The course website
   https://happyharrycn.github.io/CS540-Fall20/
provides public materials such as slides, schedule, and policies.

Canvas is used to provide private materials that should not be shared, such as videos, assignments, and grades. BBCollaborate Ultra is used to host synchronous classes. Piazza is used for discussion, questions, and announcements. It is also used for the live Q&A sessions in the synchronous classes.

Learning Outcomes

1. (Uninformed Search Methods) Identify the formulation of search for problem solving tasks. Understand important concepts in uninformed search. Apply the search methods on the formulated search problem.
2. (Informed Search Methods) Understand important concepts in informed search. Differentiate from uninformed search. Solve the formulated search problem with the informed search methods.
3. (Local Search Methods) Identify the formulation of search for problem solving tasks. Apply the hill climbing method for local search problems. Identify and summarize the important features of the simulated annealing and genetic algorithms.
4. (Probability and NLP) Understand basic concepts in probability and apply them in solving given probability problems. Understand basic notions in natural language process, and apply bag-of-words, tf-idf, n-gram models, and smoothing.
5. (Naïve Bayes) Understand MLE and MAP. Understand the Naïve Bayes method and apply it in solving given problems.
6. (Linear Algebra and PCA) Understand basic notions of linear algebra. Identify and summarize the important features of PCA.
7. (Game Playing) Recall the concept of games. Perform the minimax game playing method on formulated game tasks. Apply alpha-beta pruning to speed up the minimax method.
8. (Unsupervised and Supervised Learning) Identify and summarize important features about supervised learning and unsupervised learning. Differentiate between the two types of tasks.

9. (Classic Learning Methods) Apply linear regression, hierarchical agglomerative clustering algorithm, k-means clustering, or K nearest neighbor algorithm on given problem instances. Judge if the method is appropriate for a given task.
10. (Neural Networks and Deep Learning) Apply Perceptron learning rule on given problem instances. Implement neural networks using given software packages.
11. (Reinforcement Learning) Understand the concepts of reinforcement learning. Identify and summarize its important features. Compute value function and Q function. Apply value iteration and Q learning on given problems.

Grading

- Midterm Exam: 15%
- Final Exam: 15%
- Homework Assignments: 70%

- A: 87% and above
- AB: 81%-86.9%
- B: 77%-80.9%
- BC: 71%-76.9%
- C: 65%-70.9%
- D: 60%-64.9%
- F: 59.9% and below

Points are given to individual exams and homework assignments.

At the end of the semester, the final letter grades are given based on a curve. The points are averaged with the weights given above. These weights placed on the assignments will be strictly enforced. Then the final letter grade will be assigned based on the percentile of the averaged points in the class:

- A: Top 15-25% of course grades
- AB: next 15-25%
- B: next 0-20%
- BC: next 0-20%
- C: next 0-20%
- D/F: 0-5%

Since the students' performances may vary from semester to semester, the instructors reserve the rights in adjusting this final grade distribution within the specified ranges above. McBurney Center students should contact the instructors to specify any special requests for the exams or homework assignments together with the supporting documentation provided by the McBurney Center. We will do our best to accommodate the requests.

Discussion Sessions

We will use Piazza for real-time Q&A during lectures. Please follow these rules:

- Please check if someone has posted the same / similar question before you; it's much easier if we build on the thread.
- Use an informative "Summary" line to help others.

Piazza is also used for asynchronous discussions.

Required Textbook, Software, & Other Course Materials

The textbook is optional: Artificial Intelligence: A Modern Approach (4th edition). Stuart Russell and Peter Norvig. Pearson, 2020. ISBN 978-0134610993.

Representative list of readings

The lectures will be self-contained. The slides will be available on the course website.
Homework assignments may involve some reading, for example, homework 0 will require reading the report Stanford One Hundred Year Study on Artificial Intelligence 2016 Report.

EXAMS, QUIZZES, PAPERS & OTHER MAJOR GRADED WORK

Homework & Other Assignments

Homework assignments will include written problems and sometimes programming in Python. Frequently-asked questions (FAQs) on homework assignments will be posted on Piazza. Homework is always due the minute before class starts on the due date. Late submissions will not be accepted. Assignment grading questions must be raised with the TAs within 72 hours after it is returned. Regrading request for a part of a homework question may trigger the grader to regrade the entire homework and could potentially take points off. Regrading will be done on the original submitted work, no changes allowed.

We will drop **TWO** lowest homework score from your final homework average calculation. This drop is meant for emergency. We do not provide additional drops, late days, or homework extensions.

We encourage you to use a study group for doing your homework. Students are expected to help each other out, and if desired, form ad-hoc homework groups.

Potential updates on the policy will be posted on the course website.

Exams, Quizzes, Papers & Other Major Graded Work

There will be a midterm exam and a final exam. All exams will be conducted online through Canvas. Students are allowed to choose their own exam schedule within a window of 24 hours. Makeup exams will not be scheduled. Please plan for exams at these times and let us know about any exam conflicts during the first two weeks of the semester. If an emergency arises that conflicts with the exam times, email us as soon as possible. Emergency exam conflicts will be handled on a case-by-case basis. Exam grading questions must be raised with the instructor within 72 hours after it is returned. If a regrade request is submitted for a part of a question on the exam, the grader reserves the right to regrade the entire exam and could potentially take points off.

Potential updates on the policy will be posted on the course website.

Digital Exam Proctoring

No

Honorlock

Honorlock is the campus-supported proctoring tool. For FAQ's about Honorlock

Additional resources about Honorlock include:

- *See suggested syllabus language for use of Honorlock*
- *For Instructors: Honorlock Quick Guide and UW-Madison's Knowledge Base documentation*
- *For Students: Getting Started for Students*

Privacy of Student Information and Digital Proctoring Statement

The privacy and security of faculty, staff and students' personal information is a top priority for UW-Madison. The university carefully reviews and vets all campus-supported teaching and learning tools, including proctoring tools and takes necessary steps to ensure that tool providers prioritize proper handling of sensitive data in alignment with FERPA, industry standards and best practices.

Under the Family Educational Rights and Privacy Act (FERPA – which protects the privacy of student education records), student consent is not required for the university to share with Honorlock those student education records necessary for carrying out the proctoring service. 34 CFR 99.31(a)(1)(i)(B). FERPA specifically allows universities to treat vendors as school officials and to share student education records with them where they perform services for the university and are subject to FERPA requirements governing the use and redisclosure of personally identifiable information from education records. Honorlock is FERPA compliant and is bound by the terms of its agreement with the university to comply with FERPA's restrictions on the use of student education records.

Privacy of Student Records and the Usage of Audio Recorded Lectures

See information about privacy of student records and the usage of audio-recorded lectures.

Usage of Audio Recorded Lectures Statement

Lecture materials and recordings are protected intellectual property at UW- Madison. Students in this course may use the materials and recordings for their personal use related to participation in this class. Students may also take notes solely for their personal use. If a lecture is not already recorded, you are not authorized to record my lectures without my permission unless you are considered by the university to be a qualified student with a disability requiring accommodation. [Regent Policy Document 4-1] Students may not copy or have lecture materials and recordings outside of class, including posting on internet sites or selling to commercial entities. Students are also prohibited from providing or selling their personal notes to anyone else or being paid for taking notes by any person or commercial firm without the instructor's express written permission. Unauthorized use of these copyrighted lecture materials and recordings constitutes copyright infringement and may be addressed under the university's policies, UWS Chapters 14 and 17, governing student academic and non-academic misconduct

OTHER INSTRUCTIONAL REQUIREMENTS

Practice physical distancing (staying at least six feet apart from others), in both indoor and outdoor spaces, including when entering and exiting building and instructional spaces.

- Monitor symptoms using the COVID-19 Symptom Tracker daily and, if symptoms exist, stay home and immediately get tested. Free testing is available to the entire campus community including students. Find more information on testing including on-campus testing locations, getting test results and what to do if you test positive for COVID-19.
- Follow specific guidance on classroom seating and furniture use. "Sit Here Signs" will be placed in classrooms to indicate where students should sit, as well as floor decals to indicate where furniture should be placed and remain.
- Limit the sharing of materials (papers, books, writing utensils, calculators, etc.) with others in class. Any materials brought to class must be taken with you when leaving the classroom.
- Food and beverages are not allowed in instructional spaces. For students who may need access to food or beverages during class (e.g., medical condition, other accommodation or circumstance) may do so while wearing face coverings. If this will be a reoccurring situation, students should discuss their on-going need with their instructor.
- Carefully observe and follow health and safety signs posted inside and outside the classroom.
- Course start and stop times are not staggered. At their discretion, instructors may start or end class a few minutes off schedule to avoid congestion in the halls.

Additionally, students should:

- Clean desks and seats before and after class with the provided classroom supplies and wipe off hands with disinfectant wipes. The provided cleaning supplies will be safe for skin contact; gloves are not needed. See guidance for cleaning classrooms.
- Exit the classroom as quickly as possible to allow the next section to transition in safely
- Be aware of and sensitive to others around you, particularly those who may be struggling or having diKculties.

HOW TO SUCCEED IN THIS COURSE

Resource links to other campus services:

- University Health Services
- Undergraduate Academic Advising and Career Services
- Office of the Registrar
- Office of Student Financial Aid
- Dean of Students OXce

STUDENTS' RULES, RIGHTS & RESPONSIBILITIES

During the global COVID-10 pandemic, we must prioritize our collective health and safety to keep ourselves, our campus, and our community safe. As a university community, we must work together to prevent the spread of the virus and to promote the collective health and welfare of our campus and surrounding community. Rights & Responsibilities

UW-MADISON BADGER PLEDGE

Badger Pledge

UW-MADISON FACE COVERING GUIDELINES

UW-Madison face covering guidelines. While on campus all employees and students are required to wear appropriate and properly fitting face coverings while present in any campus building unless working alone in a laboratory or office space.

Face Coverings During In-person Instruction Statement (COVID-19)

Individuals are expected to wear a face covering while inside any university building. Face coverings must be worn correctly (i.e., covering both your mouth and nose) in the building if you are attending class in person. If any student is unable to wear a face-covering, an accommodation may be provided due to disability, medical condition, or other legitimate reason.

Students with disabilities or medical conditions who are unable to wear a face covering should contact the McBurney Disability Resource Center or their Access Consultant if they are already affliated. Students requesting an accommodation unrelated to disability or medical condition, should contact the Dean of Students Office.

Students who choose not to wear a face covering may not attend in-person classes, unless they are approved for an accommodation or exemption. All other students not wearing a face covering will be asked to put one on or leave the classroom. Students who refuse to wear face coverings appropriately or adhere to other stated requirements will be reported to the Office of Student Conduct and Community Standards and will not be allowed to return to the classroom until they agree to comply with the face covering policy. An instructor may cancel or suspend a course in-person meeting if a person is in the classroom without an approved face covering in position over their nose and mouth and refuses to immediately comply.

QUARANTINE OR ISOLATION DUE TO COVID-19

Students should continually monitor themselves for COVID-19 symptoms and get tested for the virus if they have symptoms or have been in close contact with someone with COVID-19. Students should reach out to instructors as soon as possible if they become ill or need to isolate or quarantine, in order to make alternate plans for how to proceed with the course. Students are strongly encouraged to communicate with their instructor concerning their illness and the anticipated extent of their absence from the course (either in-person or remote). The instructor will work with the student to provide alternative ways to complete the course work.

COURSE EVALUATIONS

Students will be provided with an opportunity to evaluate this course and your learning experience. Student participation is an integral component of this course, and your feedback is important to me. I strongly encourage you to participate in the course evaluation.

Digital Course Evaluation (AEFIS)

UW-Madison uses an online course evaluation survey tool, AEFIS. In most instances, you will receive an official email two weeks prior to the end of the semester when your course evaluation is available. You will receive a link to log into the course evaluation with your NetID where you can complete the evaluation and submit it, anonymously. Your participation is an integral component of this course, and your feedback is important to me. I strongly encourage you to participate in the course evaluation.

ACADEMIC CALENDAR & RELIGIOUS OBSERVANCES

• See: https://secfac.wisc.edu/academic-calendar/#religious-observances

Weekly Course Topics

Week	Course Topics
Sept 2	Introduction to AI, introduction to Python
Sept 7	Uninformed search, informed search
Sept 14	A* algorithm for informed Search, hill climbing, simulated annealing, genetic algorithm
Sept 21	Review the search part, introduction to probability
Sept 28	Introduction to statistics and decision theory, natural language processing, Naïve Bayes classifier)
Oct 5	Introduction to linear algebra and PCA
Oct 12	Introduction to logic
Oct 19	Introduction to game theory, introduction to machine learning
Oct 26	Introduction to unsupervised and supervised learning, k-means clustering, linear regression
Nov 2	K-NN classifier, Perceptron
Nov 9	Introduction to neural networks
Nov 16	Introduction to deep learning
Nov 23	Convolutional deep learning
Nov 30	Introduction to reinforcement learning
Dec 7	Applications and Ethics of Artificial Intelligence

ACADEMIC INTEGRITY STATEMENT

By virtue of enrollment, each student agrees to uphold the high academic standards of the University of Wisconsin-Madison; academic misconduct is behavior that negatively impacts the integrity of the institution. Cheating, fabrication, plagiarism, unauthorized collaboration, and helping others commit these previously listed acts are examples of misconduct which may result in disciplinary action. Examples of disciplinary action include, but is not limited to, failure on the assignment/course, written reprimand, disciplinary probation, suspension, or expulsion.

ACCOMMODATIONS FOR STUDENTS WITH DISABILITIES STATEMENT

The University of Wisconsin-Madison supports the right of all enrolled students to a full and equal educational opportunity. The Americans with Disabilities Act (ADA), Wisconsin State Statute (36.12), and UW-Madison policy (Faculty Document 1071) require that students with disabilities be reasonably accommodated in instruction and campus life. Reasonable accommodations for students with disabilities is a shared faculty and student responsibility. Students are expected to inform faculty [me] of their need for instructional accommodations by the end of the third week of the semester, or as soon as possible after a disability has been incurred or recognized. Faculty [I], will work either directly with the student [you] or in coordination with the McBurney Center to identify and provide reasonable instructional accommodations. Disability information, including instructional accommodations as part of a student's educational record, is confidential and protected under FERPA. (See: McBurney Disability Resource Center)

DIVERSITY & INCLUSION STATEMENT

Diversity is a source of strength, creativity, and innovation for UW-Madison. We value the contributions of each person and respect the profound ways their identity, culture, background, experience, status, abilities,

and opinion enrich the university community. We commit ourselves to the pursuit of excellence in teaching, research, outreach, and diversity as inextricably linked goals.

The University of Wisconsin-Madison fulfills its public mission by creating a welcoming and inclusive community for people from every background – people who as students, faculty, and staff serve Wisconsin and the world.