COMP SCI 540 section 001 Syllabus

Introduction to Artificial Intelligence

COURSE INFORMATION

Introduction to Artificial Intelligence

COMP SCI 540 001(3.0 Credits)
2018-2019 Spring [1194]

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. Enroll Info: None

Prerequisite(s)

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

Breadths

N - Natural Science

Instruction Mode

Classroom Instruction

Department: COMPUTER SCIENCES
College: Letters and Science

Canvas Course URL

https://canvas.wisc.edu/

2018-2019 Spring [1194]
Term Start Date: Tuesday, 22-Jan-2019 **Term End Date:** Wednesday, 22-May-2019

Location and Schedule: Van Vleck Hall B130 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. The syllabus includes more information about meeting times and expectations for student work.

INSTRUCTORS AND TEACHING ASSISTANTS

Instructor

YINGYU LIANG
LIANG24@WISC.EDU

Instructor Availability

Wednesday 3:00-5:00pm

TA Office Hours

TAs:

Rohit Kumar Sharma <rsharma54@wisc.edu>, hours TBA
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Peer Mentors:
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ZE YU <zyu229@wisc.edu>, hours TBA
TANMAY BAGARIA <tbagaria@wisc.edu>, hours TBA

GRADING AND COURSE MATERIALS

Course Learning Outcomes (CLOs)

1. Uninformed Search Methods – Be able to formulate problem solving tasks as searching, goal test, operators, statespace graph search formulation, closed world assumption, expanding a node, frontier list, partial solution path, solution path, search tree, different search methods, completeness, optimality, admissibility, complexity, detecting repeated states, explored list.
   [S8346]

2. Informed Search Methods – Understand heuristic functions, evaluation functions, bestfirst search, greedy bestfirst search, beam search, algorithm A, algorithm A*, admissible heuristic, consistent heuristic, better informed heuristic, devising heuristics.
   [S8347]

3. Local Search Methods – Local search problem formulation, operators, neighborhood, move set, hillclimbing algorithm, local optima problem, hillclimbing with random restarts, stochastic hillclimbing (simulated annealing), escaping local optima, Boltzman's equation, cooling schedule, genetic algorithms, crossover, mutation, fitness function, proportional fitness selection, population, crowding.
   [S8348]

4. Game Playing – Zerosum games, perfect information games, deterministic vs. stochastic, playing as search, branching, minimax principle and algorithm, static evaluation, alpha-beta pruning, cutoff, best case and worst case of alpha-beta vs. minimax, iterative-deepening, horizon effect, quiescence search, representing nondeterministic games, chance nodes, expectimax value.
   [S8349]

5. Unsupervised Learning – Inductive learning, unsupervised learning, feature space, feature, attribute, examples, labels, classes, training set, testing set, classification problems, inductive bias, preference bias, hierarchical agglomerative clustering algorithm, single linkage, complete linkage, average linkage, dendrogram, k-means clustering algorithm, cluster center, distortion cluster quality.
   [S8350]

6. Knearest Neighbors – Knearest neighbor algorithm, training set, testing set, tuning set, setting parameters, k-fold cross validation, leave-one-out cross validation.
   [S8351]

7. Neural Networks – Perceptron,LTU, activation functions, bias input, input units, output units, Perceptron learning rule, Perceptron learning algorithm, epoch, weight space, input space, linearly separable, credit assignment problem, multi-layer feed-forward networks, hidden units, sigmoid, ReLU, back-propagation, gradient descent, deep learning, convolutional neural networks, pooling.
   [S8352]

8. reinforcement learning: interactive learning, environment, agent, feedback, state, rewards, Markov Decision Process, policy, optimal policy, value function, value iteration, Q function, Q learning.
   [S8353]

Grading

The grading for the course will be be based on:

- Midterm Exam: 15%
- Final Exam: 30%
- Homework Assignments: 55%

Note: The distribution of CS540 final grades has been as follows. This is an approximation, and changes from semester to semester. The median student's course grade is usually a low B or high BC. The percentiles refer to ranking based on the final weighted score.

- A top ~20% of class
- AB next ~20%
- B next ~20%
- BC next ~20%
- C next ~15%
- D next ~3%
- F next ~2%

Required Textbook, Software, & Other Course Materials

S. Russell and P. Norvig, Artificial Intelligence: A Modern Approach, 3rd ed., Prentice Hall, 2010. Other readings will be made available electronically on the course web page.

EXAMS, QUIZZES, PAPERS & OTHER MAJOR GRADED WORK

Exams, Quizzes, Papers & Other Major Graded Work

The midterm exam will cover material in the first half of the course. It will be taken during a 1 hour
block in an evening. Students may bring one 8.5” x 11” sheet of notes on both
sides, but otherwise the exam is closed-book. A calculator may also be used. Make-up exams must be approved at least one week before the regular exam.

The final exam will cover material in the whole course. It will be taken during a 2 hour
block as assigned by the university. Students may bring one 8.5” x 11” sheet of notes on both
sides, but otherwise the exam is closed-book. A calculator may also be used. No make-up final exam is possible except as allowed by university policy.

midterm
Time/Room TBA

final
May 7, 10:05AM - 12:05PM, room TBA

Homework & Other Assignments

Homework assignments will consist of written problems and programming problems. Programming problems will require writing code in the Java programming language. All
homework is to be completed individually. Students may do their programming assignments using either their own computer or else one of the computers in the Computer Sciences
Department’s instructional labs. Answers to written problems and Java code that is written by the student will be handed in electronically using the UWMadison’s
Canvas system.

Assignment grading questions must be raised with the instructor within one week after it is returned.

Late assignment policy will be posted on the course website.

ACADEMIC POLICIES

ACADEMIC INTEGRITY

By enrolling in this course, each student assumes the responsibilities of an active participant in UW-Madison's community of scholars in which everyone's academic work and behavior are held to the highest academic integrity standards. Academic misconduct compromises the integrity of the university. Cheating, fabrication, plagiarism, unauthorized collaboration, and helping others commit these acts are examples of academic misconduct, which can result in disciplinary action. This includes but is not limited to failure on the assignment/course, disciplinary probation, or suspension. Substantial or repeated cases of misconduct will be forwarded to the Office of Student Conduct & Community Standards for additional review. For more information, refer to https://conduct.students.wisc.edu/academic-integrity/

ACCOMMODATIONS FOR STUDENTS WITH DISABILITIES

McBurney Disability Resource Center syllabus 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."
http://mcburney.wisc.edu/facstaffother/faculty/syllabus.php

DIVERSITY & INCLUSION

Institutional statement on diversity: "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." https://diversity.wisc.edu/