



CS 2510 OL / Introduction to Artificial Intelligence 2026 Summer

Compiled: 2026-05-12 11:47

T/W/Th 09:00–11:30 AM, via MS Teams

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Welcome to the course!

Overview and topics: This course will introduce you to the foundations of artificial intelligence: its history and selected methods. Topics include: logic- and rule-based approaches, knowledge representation, heuristic search, A*, IDA*, alpha/beta pruning, minimax, expectiminimax, Markov models and Markov decision models, decision tree, ensemble learning / random forest, the neural model and simple multi-layer perceptrons. Other topics, if any, TBD.

Prerequisites: CS2240 with grade of C- or better.

Learning objectives: Through selected readings, lecture, in-class active learning exercises, discussion, and homework, students will be able to:

- describe in general terms the history and development of the field of artificial intelligence;
- use Prolog to develop small scale knowledge-bases of facts and rules, and then use queries and helper functions to produce inferences / predictions (including application of recursive rules);
- construct and evaluate simple knowledge representations, and be able to identify how a knowledge representation determines what inferences are sanctioned;
- identify common biases in knowledge representations;
- understand how heuristic search can outperform naive search in many instances;

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- choose or design an appropriate heuristic for use with A* and IDA* algorithms (also ensuring the heuristics is admissible, and if possible, consistent);
 - apply α - β pruning to heuristic search, understand the benefits of doing so, and, given small problem instances, identify subtrees which can be pruned;
 - compute best moves / actions, using minimax or expectiminimax, given a game tree for evaluation;
 - implement at least one fully-observable, two-player, turn-taking, deterministic game using minimax;
 - compute a stochastic matrix (Markov model) from a set of observations and use the resulting model to make single- and multi-time step predictions;
 - understand the basics of Markov decision processes (MDPs), the Bellman equation, and how policies are devised to maximize long term rewards, given a particular environment with rewards and actions;
 - construct decision trees using ID3 and/or CART algorithms and produce classification predictions using such trees;
 - understand how entropy and information gain are used in constructing decision trees, and perform such computations by hand or in code;
 - implement random forest in code and compare results with individual decision trees;
 - understand and compute metrics commonly used to evaluate model performance (*e.g.*, precision, recall, accuracy, F-measure, *etc.*);
 - understand how simple neurons (units) aggregate inputs and produce output via various activation functions, and perform simple computations on small problem instances (for example, applying the perceptron learning rule);
 - perform experiments to test how hidden layers, non-linear activation functions, and learning rate affect model performance and training time; and
 - describe the concepts behind backpropagation without detailed or rigorous mathematical treatment.

Course materials: Materials including lecture notes will be circulated via Brightspace.

Software: You should have a working installation of Python (Python 3.10 or higher is recommended). We will use Scikit-Learn and Matplotlib. We may also use TensorFlow or PyTorch (TBD) All of these are pip-installable (instructions will be circulated via Brightspace). You may wish to use Anaconda, but I find this has an unnecessarily large footprint. With these installed, Numpy, Scipy, and many other packages will be installed as dependencies. I *strongly* recommend creating a new virtual environment for this course, to isolate requirements.

We will do some programming in Prolog. Installation will vary from machine to machine, from OS to OS, so I cannot provide a universal recipe. See SWI Prolog: <https://www.swi-prolog.org/>. Your best bet on systems with package managers (Linux, macOS) is to use the package manager (e.g., Apt, Aptitude, dpkg, Homebrew, MacPorts, etc.) If installation is problematic, you can run Prolog programs in the SWISH web interface at: <https://swish.swi-prolog.org/>.

Correspondence: Please use email for electronic correspondence (and not MS Teams). Please indicate the course in which you are enrolled in the subject line. Please use your UVM email for all correspondence.

Weekly schedule of topics
(tentative and subject to change):

Week	Topic
1	Brief history of AI; logic programming with Prolog
2	Heuristic search: A* and IDA*
3	Adversarial games: minimax, expectiminimax, α - β pruning
4	Markov models and Markov decision processes
5	Decision trees, ensemble learning, and random forest
6	Artificial neural networks

In addition to the above, we'll read a few papers and set aside some class time for (hopefully lively) discussion.

Grading:

Weight	Assessment
60%	in-class discussion and active learning
30%	homework and mini-projects
10%	quizzes and exam
100%	TOTAL

Grades will be assigned using a conventional scale.

$\geq 98^*$	A+	≥ 77	C+
≥ 93	A	≥ 73	C
≥ 90	A-	≥ 70	C-
≥ 87	B+	≥ 65	D
≥ 83	B	$< 65^{**}$	F
≥ 80	B-		

* To earn an A+ you must reach or exceed the indicated threshold excluding bonus points.

** To pass the course you must reach or exceed the indicated threshold excluding bonus points.

Scores will not be rounded up when assigning letter grades. Moreover, I reserve the right to reduce your final score by one full percentage point if you ask to have your score rounded up.

Any grade appeal (assignment, quiz, lab, exam, *etc.*) must be directed to the instructor within one week of the grade being posted. The secret word is “pomelo.” If grading is done on Gradescope, there’s a *regrade request* feature which should be used for grade appeals.

Academic integrity: The Department of Computer Science enforces UVM’s Code of Academic Integrity. Any suspected violation of this policy will be referred immediately to UVM’s Center for Student Conduct (<https://www.uvm.edu/sconduct>). Sanctions for a violation may include a grade of XF in the course. Additional violations can result in dismissal from the university. In a word: *Don’t*. All students should read and understand this policy. See: <https://go.uvm.edu/cai>.

Collaboration on quizzes and exams is strictly prohibited. Use of online services as a source of solutions is strictly prohibited. Using generative AI such as ChatGPT or Claude, or websites such as Chegg or Course Hero to complete coursework is a form of academic dishonesty. Work you submit for an individual grade must be your own. Any work not produced by you must be cited. For certain assignments, students may collaborate on homework (typically limited to teams of two). If you collaborate with another student on an assignment, be sure to indicate team members as specified. If you have any questions ask!

Any attempt to tamper with or defeat any autograder is a form of academic dishonesty. This applies wherever autograded are in use, for example on Brightspace or Gradescope.

All code submitted by students is subject to code similarity review.

Exams, quizzes, homework assignments, answer keys and solutions, presentations or lecture notes, specifications and rubrics are copyright protected works, unless clearly and explicitly indicated otherwise. Any unauthorized copying or distribution of protected works is a violation of federal law and may result in disciplinary action. This includes submission of protected works as prompts to generative AI. Sharing of course materials without the specific, express approval of the instructor may be a violation of the University’s Code of Academic Integrity and an act of academic dishonesty, which could result in disciplinary action. Violations will be handled under UVM’s Intellectual Property Policy and Code of Academic Integrity, as appropriate. See: <https://go.uvm.edu/ipp> and <https://go.uvm.edu/cai>.

Attendance: The UVM attendance policy is available at <https://go.uvm.edu/srr>. We hold class sessions for a reason and attendance is not optional. There will be no make-ups for in-class active learning exercises or assessments if you did not attend class without prior notification and approval.

Since our course is a mere six weeks, it’s difficult to get caught up if you miss even a single class meeting. To encourage regular attendance, there is a strict attendance policy.

You are allowed two unexcused absences. For each unexcused absence over this limits, your final grade will be reduced. If you have more than four unexcused absences this will result in an automatic F (failure).

If you are not able to attend a class session please notify me via email as soon as possible. Depending on the nature of your absence, it may be appropriate for you to contact UVM Student Health Services (<https://www.uvm.edu/health/SHS>), CEMS Student Services (<https://www.uvm.edu/cems/student-services>), or the Dean’s Office for your college. In many cases, these can provide an official

request for flexibility on your behalf. While reasonable accommodations will be granted in the event of documented illness or emergencies, you are responsible for making up any work you have missed.

Late policy / extensions: Each homework assignment has a specific due date / time. You may submit work up to 24 hours after the due date / time, however, late submissions will be penalized 20%. Submissions that are more than 24 hours late will not be accepted unless an extension has been granted. We will consider reasonable requests for extensions when extenuating circumstances arise. (It can't hurt to ask.) However, extensions will not be granted if the request for extension is made within 24 hours of the time an assignment is due, except in the most extraordinary circumstances. So if you wish to request an extension, *do so early!* If an extension is granted, you must submit your work by the agreed-upon extension date.

Student course evaluations: Students are warmly encouraged to complete an evaluation of the course at its conclusion. Evaluations are anonymous and confidential, and the information gained, including constructive criticisms, will be used to improve the course.

Accommodations: In keeping with UVM policy, if you have a documented disability and are interested in utilizing ADA accommodations, you should contact Student Accessibility Services (SAS), the office of Disability Services on campus for students. SAS works with students and faculty in an interactive process to explore reasonable and appropriate accommodations, which are communicated to faculty in an accommodation letter.

Contact SAS: A170 Living/Learning Center; +1 802 656 7753; access@uvm.edu; or visit <https://www.uvm.edu/access>.

If you are entitled to use the Exam Proctoring Center, please book reservations at least four days in advance.

Participation: Even though this is an online course, you are expected to be an active participant. The more engaged you are, the more you will learn—and the more fun you'll have. This includes reading assigned materials, watching instructional videos, and the like. Since we won't have regular face-to-face interactions in class, it's all the more important to ask questions—either in drop-in office hours or on an *ad hoc* basis. When it comes to asking questions, *please don't be shy!* There's no such thing as a “dumb” question (I earnestly believe this). If there's something you don't understand—*ask!* Asking questions helps you understand the material presented in the course. Also, when you ask a question you help me do a better job of explaining. If I explain something, and you still don't quite grasp it, chances are that I didn't do as good a job of explaining as I might have.

Diversity, equity, and inclusion: UVM is a place where you should be treated with respect and kindness. We welcome individuals of all ages, backgrounds, beliefs, interests, ethnicities, genders, gender identities, gender expressions, national origins, religious affiliations, sexual orientations, ability, and other visible and non-visible differences. All students are expected to contribute to a respectful, welcoming and inclusive environment for every other member of the community. If you ever feel that you have been unfairly treated or judged by an instructor, a mentor, another student, or another member of the community, please let someone know. Your instructors and advisors in the CEMS Office of Student Services are available to discuss any concerns, or you can report an incident of bias through the bias report program (<https://go.uvm.edu/brp>).

Conduct: Be kind to one another and to yourself. Be respectful of yourself, others, and the institution. Please arrive on time.

Promoting health and safety: If you are concerned about a UVM community member or are concerned about a specific event, we encourage you to contact the Dean of Students Office (+1 802 656 3380). If you would like to remain anonymous, you can report your concerns online by visiting the Dean of Students website at <https://www.uvm.edu/deanofstudents>.

Wellbeing resources:

- Center for Health and Wellbeing: <https://www.uvm.edu/health/services>
- Counseling and Psychiatry Services (CAPS): +1 802 656 3340
- Food Insecurity Assistance: <https://www.uvm.edu/health/food-insecurity-uvm>

Student advocacy: https://www.uvm.edu/deanofstudents/student_advocacy

Your identity at UVM: Students at UVM can specify the first name and pronoun they want used on campus. For information on how to update your preferred name and personal pronouns as well as keeping your legal name private, and UVM policy on lived name and pronouns, see: <https://go.uvm.edu/lnpr>.

Religious holidays: Students have the right to practice the religion of their choice. In order to receive extensions or excused absences, you should submit via email your documented religious holiday schedule for within the first week of the course. Reasonable extensions will be granted where assignment deadlines conflict with religious holidays.

Student athletes: In order to receive extensions or excused absences, you should submit via email appropriate documentation as soon as possible, preferably within the first week of the course. Reasonable extensions will be granted where assignment deadlines conflict with team events or team travel.

Statement on alcohol and other drugs: We want you to get the most you can out of this course. Therefore, you are expected to familiarize yourself and abide by the University's policies with regard to alcohol, cannabis, tobacco, and other drug use. See: <https://go.uvm.edu/actd>. Please do everything you can to optimize your learning and to participate fully in this course.

Class format changes: The University of Vermont reserves the right to make changes in the course offerings, mode of delivery, degree requirements, charges, regulations, and procedures contained herein as educational, financial, and health, safety, and welfare considerations require, or as necessary to be compliant with governmental, accreditation, or public health directives.

Changes to this document: This document is subject to change. Any such change will be communicated via an announcement on Brightspace. The latest version of the syllabus will always be available on Brightspace.