CMSC 471: Introduction to Artificial Intelligence
Spring 2025

Logistics

- Instructor: Dr. KMA Solaiman
- Email: ksolaima@umbc.edu
- Teaching assistant: TBD
- Grader: TBD
- Lecture time: **MW 1:00-2:15pm** *(01)*, **MW 4:00-5:15pm** *(02)*
- Location: ITE 229 (01) & ITE 227 (02)
- Credit Hours: 3.00
- Office hours
    - **MT 11:00 - 12:00 PM**, or by appointment, ITE 201-C, KMA Solaiman
- TA Office hour: ITE 344
- Q&A, Course discussion and Announcements: Blackboard
- For any other sensitive issue, please email me (ksolaima@umbc.edu), with a subject preceded by *CMSC471-concern*

Course Description

This course offers a comprehensive introduction to the field of Artificial Intelligence (AI). It covers fundamental concepts, techniques, and applications of AI, including search, knowledge representation, reasoning, machine learning, and natural language understanding. The course also explores contemporary topics such as fairness, ethics, and societal implications of AI, with a focus on responsible AI development. Students will gain hands-on experience through programming assignments and projects, applying AI algorithms and techniques to real-world problems.

The course will utilize the textbook "Artificial Intelligence: A Modern Approach (4th edition)" by Stuart Russell and Peter Norvig, along with supplementary materials and resources. Students will develop a solid understanding of core AI concepts and their practical applications, preparing them for careers in this rapidly evolving field.

Upon successful completion of this course, students will be able to:

- Understand the core problems, solutions, and history of Artificial Intelligence (AI).
- Apply various problem-solving approaches, including search algorithms, knowledge representation, and reasoning techniques.
- Comprehend the principles of machine learning, including supervised, unsupervised, and reinforcement learning.

- Analyze the ethical and societal implications of AI, and apply responsible AI development practices.
- Design and implement AI systems using Python, addressing real-world problems.
- Evaluate AI systems, considering factors such as performance, fairness, and bias.
- Communicate effectively about AI concepts and their applications.

CMI Text Book

This course is part of UMBC's Course Materials Initiative (CMI), so an electronic copy of the text Artificial Intelligence: A Modern Approach (4th edition) can be downloaded to your own computer, tablet, or phone or read through Blackboard.
The electronic copy can be read on Blackboard if you are registered for the class. In Blackboard, go to Course Materials ➔ My Textbooks & Course Resources.

Prerequisites

This is an upper-level undergraduate level Computer Science course and we will assume that you will have a good grounding in algorithms, statistics, and adequate programming skills (CMSC 341). Many of the homework assignments will involve programming and you will be expected to do them in Python. Having said that, we will try our best to provide materials or backgrounds for the programming assignments.

Course Schedule

This syllabus and schedule is preliminary and subject to change. We will adapt this as we go along and announcements will be made for assignment release and due dates. This is published to help in your planning. It is recommended you go through the readings before the class to have a better understanding of the material. Abbreviations refer to the following:

- RN: Russel/Norvig
- PM: David L. Poole & Alan K. Macworth, ARTIFICIAL INTELLIGENCE 3E, FOUNDATIONS OF COMPUTATIONAL AGENTS
- RLSB: Reinforcement Learning, Richard S. Sutton and Andrew G. Barto
- BB: Blackboard

Date	Topics	Notes	Readings
Week 1			
(1) Mon Jan 27	Course Overview: Administrivia and What is AI? Agents and Environments	History of AI	RN1 RN2
(2) Wed Jan 29	Agent Architectures Problem solving with 'search'	HW1 released (Alt: Class quiz on Feb 5)	RN 3.1-3.3
Week 2			
(2) Mon Feb 3	Uninformed search		RN 3.4
(3) Wed Feb 5	Informed search: Heuristic Search	HW1 due	RN 3.5

Week 3			
(4) Mon Feb 10	Informed search: A* Search Discuss Code Skeleton for PA1	PA1 released	RN 3.5, PM 3.7
(5) Wed Feb 12	Local and Online Search		RN 4.1
Week 4			
(6) Mon Feb 17	Constraint Satisfaction Problem CSP Demos	PA1 due, HW2 released	RN 6.1
(7) Wed Feb 19	Constraint Propagation, Backtracking search for CSPs Discuss Code Skeleton for PA2	PA2 released	RN 6.2-6.3.2
Week 5			
(8) Mon Feb 24	Local search and Structure Improvement for CSPs	HW2 due	RN 6.4-6.5.2
(9) Wed Feb 26	Adversarial Search (Games), MiniMax	PA2 due, HW3 released	RN 5.1-5.3
Week 6			
(10) Mon Mar 3	Stochastic Minimax, Mutli-agent games Monte Carlo Tree Search A comprehensive guide to MCTS algorithm with working example	PA3 released (!)	RN 5.4,5.5,5.7
(11) Wed Mar 5	Planning (w/o uncertainty) (!)	HW3 due	RN 11.1, 11.2-11.2.1, 11.3
Week 7			
(12) Mon Mar 10	**Midterm Review**	PA3 due (!)	
(13) Wed Mar 12	**Midterm Exam**		
Week 8			
(14) Mon Mar 17	Spring Break		
(15) Wed Mar 19	Spring Break		
Week 9			
(16) Mon Mar 24	Propositional Logic	HW4 released	RN 7.1-7.7
(17) Wed Mar 26	Reasoning with First order logic		RN 8.1-8.3, 9.1
Week 10			
(18) Mon Mar 31	Reasoning under uncertainty: Intro to Probability & Bayes Rule	HW4 due	RN 12
(19) Wed Apr 2	Reasoning with BBNs, Naïve Bayes	HW5 released	RN 13.1, 13.2
Week 11			
(20) Mon Apr 7	BBN Reasoning: Variable Elimination Maximum Likelihood Estimation	PM Example 9.27	PM 9.5, 10.2
(21) Wed Apr 9	Machine Learning: Supervised Learning Regression, Logistic Regression, SVM	HW5 due	RN 19
Week 12			

(22) Mon Apr 14	ML Tools, Evaluation Cross-Validation, Multiclass P/R/F	Practice Colab Notebooks	RN 19
(23) Wed Apr 16	Unsupervised Learning: K-means	PA4 released	RN 19.3 / Tom-Mitchell Chap 3
Week 13			
(24) Mon Apr 21	Neural Networks		RN 21
(25) Wed Apr 23	CNN / RNN / Pre-trained models Fine-tuning	PA4 due	Colab Notebooks CNN Blog
Week 14			
(26) Mon Apr 28	Generative AI Foundations GPT, Transformer architectures Large Language Models (LLMs) overview *GANs, diffusion models!*	Class Quiz: LLM architecture comparison report (!)	
(27) Wed Apr 30	Ethical AI and Responsible Development • AI fairness frameworks • Bias detection in AI systems	Societal implications of AI: COMPAS case study analysis	
Week 15			
(28) Mon May 5	Prompt engineering and Responsible Use of LLMs, Explainable AI (XAI)	HW/ Class Quiz: Prompt Design Workshop	
(29) Wed May 7	**Planning** with uncertainty Markov Decision Process/ Reinforcement Learning		RN 11.1, 11.2-11.2.1, 11.3
Week 16			
(30) Mon May 12	**Final Exam Review**		
(31) Wed May 14	**Study Day** No Classes		
Week 17			
TBD	**Final Exam**	TBD	

Midterm and Final Exams

The material covered by the exams will be drawn from assigned readings in the text, from lectures, from quizzes, and from the homework. Material from the readings that is not covered in class is fair game, so you are advised to keep up with the readings.
An exam guide will be posted before the exams.

Course Evaluation

Grades will be based on your performance in assignments (quizzes/homework/programming assignments), a mid-term examination and a final examination. The overall evaluation is as follows:

Component	%
Assignments	55%

Midterm	20%
Final	20%
Course Engagement	5%

"Course engagement" consists of, e.g., asking/answering questions and participating in discussion (in class, or online), responding to surveys or checkpointing questions, participating in in-class quizzes and discussions, etc. **If you do not have doubts, then helping others in class or in online discussion also counts as participation.**

Grading Scale:

The following grading scale is used on the normalized final, rounded percentages:

If you get at least a/an...	you are guaranteed a/an... or higher
90	A
80	B
70	C
60	D
0	F

As per University policy, incomplete will be granted only under extraordinary circumstances; students who are enrolled after the last day to drop a class should be prepared to receive a grade of A-F.

Policies

If you have extenuating circumstances that result in an assignment being late, please talk to me as soon as possible.

Due Dates

Due dates will be announced on the course website. Unless stated otherwise, items are due by **11:59 PM (UMBC time) of the specified day**. Submission instructions will be provided with each assigned item.

Extensions and Late Policy

Personal or one-off extensions will not be granted. Each student in this course has **ten (10) late days** available, with a maximum of **3 late days per assignment**. You can use these late days for personal reasons or emergencies, but please don't rely on them to procrastinate.

- **Late days are counted in 24-hour blocks**. If you submit an assignment 1 minute or 23 hrs 59 minutes late, it will count as using one full late day.
- Late days only apply to assignments submitted after the deadline. If you submit on time, your late days remain unaffected.
- Once you've used up your late days, any further late submissions will be recorded as a 0. However, you should still submit them, as they may help in borderline cases.

Please note, late days **cannot be used beyond the final exam period**. I reserve the right to issue class-wide extensions.

Academic Honesty

Do not cheat, deceive, plagiarize, improperly share, access or use code, or otherwise engage in academically dishonest behaviors. Doing so may result in lost credit, course failure, suspension, or dismissal from UMBC. Instances of suspected dishonesty will be handled through the proper administrative procedures.

We will follow a policy described in this statement adopted by UMBC's Undergraduate Council and Provost's Office.

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By enrolling in this course, each student assumes the responsibilities of an
active participant in UMBC's scholarly community, in which everyone's
academic work and behavior are held to the highest standards of honesty.
Cheating, fabrication, plagiarism, and helping others to commit these acts
are all forms of academic dishonesty, and they are wrong. Academic misconduct
could result in disciplinary action that may include, but is not limited to,
suspension or dismissal.
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Especially for computer science classes, there are generally questions about what is and is not allowed. You are encouraged to discuss the subject matter and assignments with others. The Campuswire discussion board provides a great forum for this. However, you may not write or complete assignments for another student; allow another student to write or complete your assignments; pair program; copy someone else's work; or allow your work to be copied. **(This list is not inclusive.)**

As part of discussing the assignments, you may plan with other students; be careful when dealing with pseudocode. A good general rule is that if anything is written down when discussing the assignments with others, you **must** actually implement it separately and you **must not** look at your discussion notes.

You are free to use online references like Stack Overflow for questions that are not the primary aspect of the course. If, for example, you're having an issue with unicode in Python, or are getting a weird compilation error, then sites like Stack Overflow are a great resource. Don't get stuck fighting your tools.

You may generally use external libraries (and even parts of standard libraries), provided what you use does not actually implement what you are directed to implement.

Generative AI: For this class, if you use ChatGPT (or similar chatbots or AI-based generation tools), you must describe exactly how you used it, **including providing the foundation model/ API, the model, the prompt, original generated result, and your edits.** This applies to prose, code, or any form of content creation. Not disclosing is an academic integrity violation. If you do disclose, your answer may receive anywhere from 0 to full credit, depending on the extent of substantive edits, achievement of learning outcomes, and overall circumvention of those outcomes.

Use of AI/automatic tools for grammatical assistance (such as spell-checkers or Grammarly) or small-scale predictive text (e.g., next word prediction, tab completion) is okay. Provided the use of these

tools does not change the substance of your work, use of these tools may be, but is not required to be, disclosed.
Be sure to properly acknowledge whatever external help—be it from students, third party libraries, or other readings—you receive in the beginning of each assignment. Please review this overview of how to correctly cite a source and these guidelines on acceptable paraphrasing or here.

Accommodations

Students with Accommodation Needs

The Office of Student Disability Services (SDS, https://sds.umbc.edu) works to ensure that students can access and take advantage of UMBC's educational environment, regardless of disability. From the SDS,
Accommodations for students with disabilities are provided for all students with a qualified disability under the Americans with Disabilities Act (ADA & ADAAA) and Section 504 of the Rehabilitation Act who request and are eligible for accommodations. The Office of Student Disability Services (SDS) is the UMBC department designated to coordinate accommodations that creates equal access for students when barriers to participation exist in University courses, programs, or activities.
If you have a documented disability and need to request academic accommodations in your courses, please refer to the SDS website at sds.umbc.edu for registration information and office procedures.
SDS email: disAbility@umbc.edu
SDS phone: 410-455-2459
If you require the use of SDS-approved accommodations in this class, please make an appointment with me to discuss the implementation of the accommodations.
Religious Observances & Accommodations UMBC Policy provides that students should not be penalized because of observances of their religious beliefs, and that students shall be given an opportunity, whenever feasible, to make up within a reasonable time any academic assignment that is missed due to individual participation in religious observances. It is the responsibility of the student to inform me of any intended absences or requested modifications for religious observances in advance, and as early as possible.

Sexual Assault, Sexual Harassment, and Gender-based Violence and Discrimination

UMBC Policy in addition to federal and state law (to include Title IX) prohibits discrimination and harassment on the basis of sex, sexual orientation, and gender identity in University programs and activities. Any student who is impacted by **sexual harassment, sexual assault, domestic violence, dating violence, stalking, sexual exploitation, gender discrimination, pregnancy discrimination, gender-based harassment, or related retaliation** should contact the University's Title IX Coordinator to make a report and/or access support and resources. The Title IX Coordinator can be reached at titleixcoordinator@umbc.edu or 410-455-1717.
You can access support and resources even if you do not want to take any further action. You will not be forced to file a formal complaint or police report. Please be aware that the University may take action on its own if essential to protect the safety of the community.
If you are interested in making a report, please use the Online Reporting/Referral Form. Please note that, if you report anonymously, the University's ability to respond will be limited.

Faculty Reporting Obligations

All faculty members and teaching assistants are considered Responsible Employees, per UMBC's Policy on Sexual Misconduct, Sexual Harassment, and Gender Discrimination. So please note that as instructors, I, other faculty members, and the teaching assistants are required to report all known information regarding alleged conduct that may be a violation of the Policy to the University's Title IX Coordinator, even if a student discloses an experience that occurred before attending UMBC and/or an incident that only involves people not affiliated with UMBC. Reports are required regardless of the amount of detail provided and even in instances where support has already been offered or received.

While faculty members want to encourage you to share information related to your life experiences through discussion and written work, students should understand that faculty are required to report past and present sexual harassment, sexual assault, domestic and dating violence, stalking, and gender discrimination that is shared with them to the Title IX Coordinator so that the University can inform students of their rights, resources, and support. While you are encouraged to do so, you are not obligated to respond to outreach conducted as a result of a report to the Title IX Coordinator.

If you need to speak with someone **in confidence**, who does not have an obligation to report to the Title IX Coordinator, UMBC has a number of Confidential Resources available to support you:

- Retriever Integrated Health (Main Campus): 410-455-2472; Monday – Friday 8:30 a.m. – 5 p.m.; **For After-Hours Support, Call 988.**
- Pastoral Counseling via The Gathering Space for Spiritual Well-Being: 410-455-6795; i3b@umbc.edu; Monday – Friday 8:00 a.m. – 10:00 p.m.
- For after-hours emergency consultation, call the police at 410-455-5555

Other Resources:

- Women's Center (open to students of all genders): 410-455-2714; womenscenter@umbc.edu;
- Monday – Thursday 9:30 a.m. – 5:00 p.m. and Friday 10:00 a.m. – 4 p.m.
- Maryland Resources, National Resources

Child Abuse and Neglect

Please note that Maryland law and UMBC policy require that I report all disclosures or suspicions of child abuse or neglect to the Department of Social Services and/or the police even if the person who experienced the abuse or neglect is now over 18.

Hate, Bias, Discrimination, and Harassment

UMBC values safety, cultural and ethnic diversity, social responsibility, lifelong learning, equity, and civic engagement.

Consistent with these principles, UMBC Policy prohibits discrimination and harassment in its educational programs and activities or with respect to employment terms and conditions based on race, creed, color, religion, sex, gender, pregnancy, ancestry, age, gender identity or expression, national origin, veterans status, marital status, sexual orientation, physical or mental disability, or genetic information.

Students (and faculty and staff) who experience discrimination, harassment, hate, or bias based upon a protected status or who have such matters reported to them should use the online reporting/referral form to report discrimination, hate, or bias incidents. You may report incidents that happen to you anonymously. Please note that, if you report anonymously, the University's ability to respond may be limited.

Acknowledgements

This class borrows inspirations from several incredible sources. The lecture slides' material is partially adapted from my colleagues, Tim Finin, Cynthia, and Frank Ferraro's class at UMBC, and CS188 from UC Berkeley.