George Mason University
College of Engineering, School of Computing, Department of Computer Science

CS 580 Introduction to Artificial Intelligence

Meeting times: Tuesday, Thursday 10:30 am – 11:45 am
Meeting location: Online on Blackboard

Instructor: Dr. Gheorghe Tecuci, Professor of Computer Science
Office hours: Online by appointment, for questions unrelated to the course. Course-related questions will be addressed during the course online meetings.
E-mail: tecuci at gmu dot edu

Graduate Teaching Assistant: Juan Huang
E-mail: jhuang21 at gmu dot edu
Office hours: Thursdays, 3-4 pm at ENGR 4456, 4-5 pm online (link).

Course Description
Artificial Intelligence is the Science and Engineering domain which is concerned with the theory and practice of developing systems that exhibit the characteristics we associate with intelligence in human behavior, such as reasoning, problem solving and planning, learning and adaptation, natural language processing, and perception. This course is a broad introduction to the basic principles and the major methods of Artificial Intelligence, preparing the students to build complex systems incorporating capabilities for intelligent processing of information. We will cover the main results from three waives in the evolution of AI: Handcrafted Knowledge (problem solving as search; constraint satisfaction problems; adversarial search; logic and production systems; resolution and prolog; ontologies and the semantic web), Statistical Learning (probabilistic reasoning basics; Bayesian networks inference and learning; machine learning basics; inductive learning of decision trees; very fast decision trees; neural networks and back propagation; deep learning; recurrent neural networks; convolutional neural networks, large language models), and Contextual Adaptation (evidence-based reasoning; instructable agents).
Students will have accounts on Blackboard and can download the lecture notes by going to courses.gmu.edu and logging in using their Mason ID and passwords. They should also be familiar with Zoom and Microsoft Teams.

Online Teaching and Class Attendance
This is a synchronous online class and your class attendance is required.
A few days before each class meeting the lecture (pdf and recording) will be posted on Blackboard.
Your assignment is to watch them before the meeting and to do the associated exercises.
During the class meetings I will answer questions about the posted lectures and discuss the exercises to improve your understanding of course material.

Course Topics & Schedule

Tuesday		Thursday
Week 1	**Jan 16** Artificial Intelligence and Intelligent Agents	**Jan 18** Problem-Solving as Search

Week 2	**Jan 23** Problem-Solving as Search	**Jan 25** Constraint Satisfaction Problems
Week 3	**Jan 30** Adversarial Search	**Feb 1** Logic and Production Systems
Week 4	**Feb 6** Resolution and Prolog	**Feb 8** Resolution and Prolog
Week 5	**Feb 13** Ontologies	**Feb 15** Semantic Web
Week 6	**Feb 20** **Midterm**	**Feb 22** Probabilistic Reasoning Basics
Week 7	**Feb 27** Bayesian Networks Inference and Learning	**Feb 29** Bayesian Networks Inference and Learning
Week 8	**Mar 5** Spring Recess (no class)	**Mar 7** Spring Recess (no class)
Week 9	**Mar 12** Bayesian Networks Inference and Learning	**Mar 14** Machine Learning Basics
Week 10	**Mar 19** Inductive Learning of Decision Trees	**Mar 21** Inductive Learning of Decision Trees
Week 11	**Mar 26** Inductive Learning of Decision Trees	**Mar 28** Very Fast Decision Trees
Week 12	**Apr 2** Neural Networks	**Apr 4** Neural Networks
Week 13	**Apr 9** Deep Learning	**Apr 11** ChatGPT
Week 14	**Apr 16** Evidence-based Reasoning	**Apr 18** Evidence-based Reasoning
Week 15	**Apr 23** Instructable Cognitive Agents	**Apr 25** Instructable Cognitive Agents
Week 16	**Apr 30** Reading Day (no class)	**May 2** **Final Exam**

Outcomes
- Knowledge of and ability to apply uninformed and heuristic search methods;
- Knowledge of and ability to apply knowledge representation and reasoning methods based on first-order logic;
- Knowledge of and ability to apply basic probabilistic reasoning methods;
- Knowledge of and ability to apply basic machine learning methods.

Grading Policy
- Mid-term exam: 40%
- Final exam: 60%

Exams

Part 1 closed-book exam with LockDown Browser
(https://web.respondus.com/he/lockdownbrowser/).
Part 2 open-book exam
Dates (mark your calendar)
- Mid-term exam: 02/20/2024
- Final exam: 05/02/2024

Honor Code Policy
Mason is an Honor Code university. You are expected to abide by the University's honor code (http://oai.gmu.edu/mason-honor-code/), as well as the CS department Honor Code (http://cs.gmu.edu/resources/honor-code/). Any collaboration between students on assignments or exams is unacceptable.

Required Reading
- Tecuci G., *Lecture Notes in Artificial Intelligence*, 2023 (available on Blackboard)

Recommended Reading
- Poole D.L. and Mackworth A.K., *Artificial Intelligence: Foundations of Computational Agents,* Cambridge University Press, Second edition 2017, Third edition, 2023.
- Russell S., and P. Norvig P., *Artificial Intelligence: A Modern Approach,* Prentice Hall
  Fourth edition (ISBN-13: 978-0134610993, ISBN-10: 0134610997, 2020) or
  Third edition (ISBN-13: 978-0-13-604259-4, 2010) or
  Second edition (ISBN: 0-13-790395-2, 2003).

Other Readings
- Tecuci, G., Marcu, D., Boicu, M., Schum, D.A., *Knowledge Engineering: Building Cognitive Assistants for Evidence-based Reasoning*, Cambridge University Press, 2016.
- Gathering Strength, Gathering Storms: One Hundred Year Study on Artificial Intelligence, The One Hundred Year Study on Artificial Intelligence (AI100) 2021 Study Panel Report.
- Witten, I., Frank E., Hall M., *Data Mining: Practical Machine Learning Tools and Techniques,* Morgan Kaufmann, 2011. Free access on-campus from http://proquest.safaribooksonline.com/book/-/9780123748560
- Mitchell, T.M., *Machine Learning*, New York: McGraw Hill, 1997.See also 2015-2016 chapters at http://www.cs.cmu.edu/~tom/NewChapters.html
- Nilsson J.N., *Artificial Intelligence: A New Synthesis,* Morgan Kaufmann, 1998.
- Luger G., *Artificial Intelligence: Structures and Strategies for Complex Problem Solving,* Addison Wesley, 2009.

Email Communication

- For all the issues related to the course, always email to <u>both</u> tecuci at gmu dot edu and jhuang21 at gmu dot edu.
- You are <u>required</u> to always use your <u>Mason email</u> and include <u>CS580</u> in the subject.
- <u>Do not sent us email through Blackboard</u>.

Mason Email Accounts
Students must activate their Mason email accounts to receive important University information, including messages related to this class.

Office of Disability Services
If you are a student with a disability and you need academic accommodations, please see Dr. Tecuci and contact the Office of Disability Services (ODS) at 993-2474. All academic accommodations must be arranged through the ODS (http://ds.gmu.edu/).

Other Useful Campus Resources
- Writing Center: A114 Robinson Hall; (703) 993-1200; http://writingcenter.gmu.edu
- University Libraries "Ask a Librarian" http://library.gmu.edu/ask
- Counseling and Psychological Services (CAPS): (703) 993-2380; https://caps.gmu.edu/

University Policies
The University Catalog, http://catalog.gmu.edu, is the central resource for university policies affecting student, faculty, and staff conduct in university affairs. You may also review the University Policy web site, http://universitypolicy.gmu.edu/