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

CS 580 Introduction to Artificial Intelligence

Meeting time: Thursday 4:30 pm – 7:10 pm
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: Sivani Tadepalli, Ph.D. Student
E-mail: stadepal at gmu dot edu
Office hours: Online, by appointment

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 presents the basic principles and the major methods of Artificial Intelligence, preparing the students to build complex systems incorporating capabilities for intelligent processing of information. Covered topics include: heuristic search, constraint satisfaction, adversarial search, knowledge representation, logic and probabilistic reasoning, statistical learning, knowledge engineering and cognitive assistants. The students will also learn about the Disciple agent development environment created in the Learning Agents Center of George Mason University, as well as other artificial intelligence tools, such as the Weka machine learning workbench. 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.

Online Teaching and Class Attendance

This is a synchronous online class and your class attendance is required.

Classes may contain graded quizzes that can only be taken during the online class session. If, for any reason, you anticipate not being able to attend any of the class sessions you should not register for this course.

A few days before each class meeting the recorded lectures will be posted on Blackboard. Your assignment is to watch them before the meeting.

The classes will generally start with short graded quizzes testing that you have watched the recordings.

There will be other graded quizzes testing the understanding of previously discussed topics.

During the class meetings I will only answer questions about the posted lectures and solve problems to improve your understanding of course material.

Course Topics
- Overview of Artificial Intelligence and Intelligent Agents
- Problem Solving as Search
- Constraint Satisfaction Problems
- Adversarial Search
- Logic and Production Systems
- Resolution and Prolog
- Ontologies
- Semantic Web
- Probabilistic Reasoning Basics
- Bayesian Networks Inference and Learning
- Machine Learning Basics
- Inductive Learning of Decision Trees
- Very Fast Decision Trees
- Instance-based Learning
- Clustering
- Neural Networks
- Deep Learning
- Evidence-based Reasoning
- Instructable Cognitive Agents

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
- Assignments and Quizzes: 20%
- Mid-term exam: 40%
- Final exam: 40%

In the case of <u>quizzes and exams</u>, there will be partial credit for a partially correct answer, but also negative credit for any incorrect answer. You should always solve the problems to find their answers. Guessing is a wrong strategy that will result in a negative score.

Absence from the quizzes, the midterm exam, and the final exams will not be excused except for doctor-certified sickness on the day of the exam or quiz that prevented you from attending. If absence from a quiz or exam is unexcused, the grade will be entered as 0.

In the case of <u>assignments</u>, there will be partial credit for a partially correct solution, and <u>no</u> negative credit for mistakes.

Assignments Deadline Policy

Assignments are due before the beginning of the class.
No late assignments will be accepted because their solution will be discussed in class the day they are due.

Monitored Quizzes and Exams

We will employ the LockDown Browser (https://web.respondus.com/he/lockdownbrowser/) and the Respondus Monitor (https://web.respondus.com/he/monitor/).

Each student must have two devices:

- A computer prepared for Blackboard Respondus (with microphone and video camera connected to the computer).

- A ZOOM connection (may be on a mobile device – phone, iPad or on another computer).

The quizzes and the exams must be taken in a quiet, isolated room, looking at the screen. If the student looks in a different direction and/or speaks during the quiz or exam, the exam/quiz will be disregarded and 0 points will be awarded.

The ZOOM device must point from a short distance to the workplace showing the computer monitor, student hands and surroundings.

We may structure the exams in two parts:

- One following strictly the above rules.

- One that allows working out the solution on paper and copying the result in Blackboard.

Exam Dates (mark your calendar)
- Mid-term exam: 10/14/2021
- Final exam: 12/9/2021

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*, 2021 (available on Blackboard)

Recommended Reading
- 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
- Poole D.L. and Mackworth A.K., *Artificial Intelligence: Foundations of Computational Agents,* Cambridge University Press, Second edition 2017.
- Artificial Intelligence and Life in 2030: One Hundred Year Study on Artificial Intelligence, Report of the 2015 Study Panel, September 2016, https://ai100.stanford.edu/2016-report
- Tecuci, G., Marcu, D., Boicu, M., Schum, D.A., *Knowledge Engineering: Building Cognitive Assistants for Evidence-based Reasoning*, Cambridge University Press, 2016.
- 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.
- Tecuci G., *Building Intelligent Agents: An Apprenticeship Multistrategy Learning Theory, Methodology, Tool and Case Studies,* Academic Press, 1998.
- Jones T.M., *Artificial Intelligence: A Systems Approach,* Jones and Bartlett Publishers, 2009.

Email Communication
- For all the issues related to the course, always email to <u>both</u> tecuci at gmu dot edu and stadepal 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/