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

CS 480 Introduction to Artificial Intelligence

Meeting times: Tuesday, Thursday 10:30 am – 11:15 am
Meeting location: Online on Blackboard

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Instructor: <u>Dr. Gheorghe Tecuci</u>, 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, Ph.D. Student
E-mail: jhuang21 at gmu dot edu
Office hours: Online through Blackboard, Tuesday, Thursday 9:30 AM– 10:30 AM

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), 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 <u>synchronous</u> online class and your class attendance is <u>required</u>.
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
- Artificial Intelligence and Intelligent Agents   Week 1 (Tuesday)
- Problem Solving as Search   Week 1 (Thursday) and Week 2 (Tuesday)
- Constraint Satisfaction Problems   Week 2 (Thursday)
- Adversarial Search   Week 3 (Tuesday)

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- Logic and Production Systems   Week 3 (Thursday)
- Resolution and Prolog   Week 4
- Ontologies   Week 5 (Tuesday)
- Semantic Web   Week 5 (Thursday)
- Mid-Term Exam   Week 6 (Tuesday)
- Probabilistic Reasoning Basics   Week 6 (Thursday)
- Bayesian Networks Inference and Learning   Week 7 and Week 8 (Tuesday)
- Machine Learning Basics   Week 8 (Thursday)
- Inductive Learning of Decision Trees   Week 9 and Week 10 (Tuesday)
- Very Fast Decision Trees   Week 10 (Thursday)
- Neural Networks   Week 11
- Deep Learning   Week 12
- Evidence-based Reasoning   Week 13
- Instructable Cognitive Agents   Week 14
- Final Exam   Week 15

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: 20%
- Mid-term exam: 30%
- Final exam: 50%

Absence from 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.

Assignments Deadline Policy
Assignments are due before the beginning of the class.
No late assignments will be accepted because their solution and the grading policy will be discussed in class the day they are due. You should be able to assess your grade at that time.
You should not register for this course section if you cannot satisfy this requirement. No special accommodations can be provided.

Monitored Exams
We will employ the LockDown Browser (https://web.respondus.com/he/lockdownbrowser/), in order to replicate the conditions of a closed-books exam taken in class, where the students are monitored by the instructor.
You may work out the solution on paper and copy the result in Blackboard, but no calculators are allowed.

Each student must have two devices:
- A computer prepared for LockDown Browser, with microphone and video camera connected to the computer.
- A ZOOM connection (may be on a mobile device – phone, iPad or on another computer).

It is strongly recommended that the exams be taken in a quiet, isolated room. The ZOOM device must point from a short distance to the workplace showing the computer monitor, student body, and surroundings.

Exam Dates (mark your calendar)
- Mid-term exam: 02/28/2023
- Final exam: 05/16/2023

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 both 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>CS480</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/