South Dakota School of Mines & Technology

Advanced Topics in Artificial Intelligence, Fall, 2022

CSC 449/549
3 Credits

Instructor Information

Instructor's Name

Dr. Larry Pyeatt

Instructor's Contact Information

Phone: 355-3451
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Office: McLaury 103F
Office hours are posted beside my office door.

Course Information

Course Meeting Times and Location

Meeting time and location: 1:00-1:50, MWF, EEP 251A

Course Delivery Method

Standard lecture format. Homework and labs will be turned in using D2L dropbox.

Course Description

This course will cover advanced topics in artificial intelligence, such as: pattern recognition, neural networks, computational neuroscience, evolutionary computing, immunocomputing, swarm intelligence, machine learning, Markov decision processes, reinforcement learning, probabilistic reasoning, fuzzy logic, expert systems, and intelligent agents.

The topic for this semester is Deep Reinforcement Learning.

Course Prerequisites

Prerequisite: CSC 300 with a grade of "C" or better and MATH 225.
Note: Students enrolled in CSC 549 will be held to a higher standard than those enrolled in CSC 449.

Student Learning Outcomes

A student who successfully completes this course should, at a minimum, be able to:

1. explain temporal difference learning and the Bellman equation,
2. implement tabular RL methods for a simple control task,
3. apply deep RL methods to complex control tasks.

Course Goals

The primary objective of this course is to educate students on the basics of deep reinforcement learning.

Tentative Topics

1. Introduction and definition of Reinforcement Learning
2. Markov Decision Process
3. Temporal Differencing and the Bellman equation
4. Tabular RL methods
5. Approximate RL methods
6. Deep Q-Networks
7. Advantage Actor-Critic
8. Proximal Policy Optiization
9. Environment Design

Course Materials

Required Textbook(s) and Materials

Title: Reinforcement Learning: An Introduction, Sutton & Barto 2018
Location: http://incompleteideas.net/book/the-book-2nd.html

Title: Foundations of Deep Reinforcement Learning: Theory and Practice in Python
Publisher : Addison-Wesley Professional; 1st edition (December 5, 2019)
Language : English
Paperback : 416 pages
ISBN-10 : 0135172381
ISBN-13 : 978-0135172384

Optional Textbook(s) and Materials

Title: Deep Reinforcement Learning 1st ed. 2022 Edition
Publisher : Springer; 1st ed. 2022 edition (June 12, 2022)
Language : English
Paperback : 421 pages
ISBN-10 : 9811906378
ISBN-13 : 978-9811906374

Technology Equipment Needed for the Course

All technology and equipment will be provided in the department CENG lab (McLaury 105).

Technology Skills Needed for the Course

Students will need a strong background in programming. Most of the programming in this course will be done in Python. If you are unfamiliar with Python, there are many on-line tutorials and books to get you started.

Course Grading

Coursework

Coursework will include lab assignments, homework, three major programming assignments, and exams.

Attendance Policy

Attendance at lecture and labs is mandatory. Students must have no more than two unexcused absences in order to receive at least a D in this course. This supersedes the grading scale. Attendance may be verified through in-class quizzes, collected homework, or any other method chosen by the instructor. Attendance may not be verified for every class meeting, but may be verified randomly at the discretion of the instructor. A random sample of students may be checked for attendance during any given class period.

Late/Make-up Assignment Policy

No work will be accepted after the due date. If you must miss a test for a legitimate reason, you may take a make-up exam according to department policy. If you miss an exam without a legitimate reason, you will receive a zero for the exam. In order for a reason to be considered legitimate you must a) contact the instructor before the exam, and b) provide suitable documentation. Do not expect to make up for missing assignments by doing extra work at the end of the semester.

Academic Integrity

South Dakota Mines is committed to academic honesty and scholarly integrity. The South Dakota Board of Regents Policy 2:33 provides a comprehensive definition of "Academic Dishonesty", which include cheating and plagiarism. All Instructors at South Dakota Mines are required to report allegations of academic misconduct to the Student Conduct Officer. The South Dakota Board of Regents Policy 3:4 provides detailed information regarding key definitions, policy information, prohibited conduct, and the Student Conduct process adhered to at South Dakota Mines. Any student suspected of violating academic integrity standards will be reported in accordance with the process outlined on the South Dakota Mines website.

Grading and Assessment

Grades for this course will be based on total points earned for graded items.

Explain how students will be assessed and receive feedback. The table below is an example; adapt the table below to fit the needs of your course. The formatting structure of the table is already set and is accessible.]

Assignment Name/Description	**Each**	**Total**
Homework	5%	10%
Programming Assignments	15%	45%
Mid-term Exams	15%	30%
Final Exam	15%	15%
TOTAL		**100%**

Additionally, students must obtain an average of 60% over the exam scores in order to receive at least a D in this course. This supersedes the grading scale.

Grading Scale

Course grade will be assigned according to the following table:

Letter Grade	Percent
A	>= 90%
B	>= 80%
C	>= 70%
D	>= 60%
F	< 60%

ADA Statement

South Dakota Mines strives to ensure that physical resources, as well as information and communication technologies, are reasonably accessible to users in order to provide equal access to all. If you encounter any accessibility issues, you are encouraged to immediately contact the instructor of the course and the Title IX and Disability Coordinator, Ms. Amanda Lopez at disabilityservices@sdsmt.edu or 605.394.2533, who will work to resolve the issue as quickly as possible.

COVID-19

In Fall, 2021 courses scheduled to meet face-to-face will be held in person and at normal capacities. If you contract COVID-19 and must isolate, you are asked to reach out to your instructor and the Dean of Students Office (deanofstudents@sdsmt.edu or 605.394.2416) to develop a plan for staying on track with your courses. Class lectures will not be recorded.

Freedom in Learning Statement

Under Board of Regents and University policy, student academic performance may be evaluated solely on an academic basis, not on opinions or conduct in matters unrelated to academic standards. Students should be free to take reasoned exception to the data or views offered in any course of study and to reserve judgement about matters of opinion, but they are responsible for learning the content of any course of study for which they are enrolled. Students who believe that an academic evaluation reflects prejudiced or capricious consideration of student opinions or conduct unrelated to academic standards should contact the Provost and Vice President for Academic Affairs at provost@sdsmt.edu to initiate a review of the evaluation.