CS 482/682
INTRODUCTION TO ARTIFICIAL INTELLIGENCE
FALL 2013

Class Description and Information

Problem solving, search, and game trees. Knowledge representation, inference, and rule-based systems. Semantic networks, frames, and planning. Introduction to machine learning, neural-nets, and genetic algorithms. (Formerly CS 476/676; implemented Spring 2005.)

Prerequisite(s): CS 365; CS 302.

- Semester: Fall 2013
- Meeting Time: MW 1:00 - 2:15 pm
- Classroom: SEM 201, MS 227
- Credits: 3
- Type: Elective
- Webpage: http://www.cse.unr.edu/∼sushil/class/ai/

Textbook

"Artificial Intelligence: A Modern Approach"
by Stuart Russell and Peter Norvig (Third Edition)
Prentice Hall Series in Artificial Intelligence

Instructor

Sushil Louis
Office: SEM 233
Hours: T 10:00 - 1:00 pm (or email to set up a different time)
Email: sushil at cse.unr.edu
Webpage: http://www.cse.unr.edu/∼sushil/

Description

The class will introduce fundamental ideas that have emerged over the past fifty years of AI research. It will also provide a useful toolbox of AI algorithms.

The main unifying theme is the idea of an intelligent agent: autonomous computational systems that receive percepts from the environment and perform actions or take decisions. The objective of the class is to teach students how to identify the appropriate technique for designing such intelligent agents for different types of problems.

Preliminary Content

1. Introduction
   (a) What can a computer do and what can't it do?
   (b) What is AI?
   (c) Foundations, history, State of the Art
2. Agent based approach
   (a) Formulation
   (b) Rational Agents
   (c) Environments
3. Solving Problems by Searching
   (a) Formulation
   (b) Uninformed Search Strategies
   (c) Heuristic Search
   (d) Seach and Optimization
   (e) Nondeterministic actions
   (f) Searching with Partial Observations
4. Adversarial Search
   (a) Formulation
   (b) Adversarial Search and Games
   (c) Minimax, Alpha-beta pruning
   (d) Static Evaluators or Imperfect Real-Time Decisions
   (e) Stochastic games
   (f) Partially observable games
   (g) State of the art
5. Constraint Satisfaction Problems (CSPs)
   (a) Formulation
   (b) Inference in CSPs
   (c) Backtracking Search
   (d) Local and Heuristic Search
6. Logic and Resolution Proof
   (a) Formulation
   (b) Propositional and First order logic
   (c) Unification and resolution proofs
7. Classical Planning
   (a) Formulation
   (b) Planning as State-Space Search

(c) Other approaches
(d) Scheduling

8. Knowledge Representation
   (a) Formulation
   (b) Categories, objects, events
   (c) Reasoning and default information
9. Uncertain Knowledge and Reasoning
   (a) Formulation
   (b) Probability
   (c) Bayes' Rule and its use
   (d) State of the art
10. Learning
   (a) Formulation
   (b) Supervised learning
   (c) Decision Trees
   (d) Theory of Learning
   (e) Linear Regression and Classification
   (f) Neural networks
   (g) SVMs
   (h) Classifier systems, Genetic Programmin
   (i) Reinforcement Learning
11. The Future

Slides presented during the lectures will be available on the website. Nevertheless, they will not cover all the material discussed in the classroom, especially mathematical notions presented on the whiteboard. The students are encouraged to take notes.

Assignments and Grading (preliminary)

There will be a number of programming assignments. No late assignments will be accepted. Use whatever programming language you like. Assignments will be posted on the class web page. Each assignment and the project will have a special section for graduate students. Undergrad students may do the graduate student portion for extra credit. Typically, each homework and assignment will have extra credit assigned to it. Assignments will ask you to implement AI algorithms and test their efficiency. Typically you will be asked to submit an electronic version of your code, test runs and a typeset report. Written assignments will need to be typeset.

There will be two exams and a final project. Check the tentative schedule on the class webpage. Both exams will be in-class on a date arranged and announced ahead of time. Tentatively, your final grade grade will be based on

Exams	40%
Assignments	40%
Project	20%

Note: Assignments can be done by student pairs. I encourage you to switch partners for every assignment. Both members of the pair will get the same grade. No additional credit will be given for students that complete an assignment alone

Students will be assigned letter grades. Your grade will be one of A, B, C, D, or F. We will use the +/- grading system.

Gradaute student component

Graduate students are required to complete the graduate student portion indicated on every assignment and exam. These portions will typically require extra independent reading and research beyond that provided in our textbook.

Academic Standards

Cheating, plagiarism or otherwise obtaining grades under false pretenses" constitute academic dishonesty according to the code of this university. Academic dishonesty will not be tolerated and penalties can include canceling a student's enrollment without a grade, giving an F for the course or for the assignment. For more details, see the University of Nevada, Reno General Catalog.

Exams are to be treated as individual efforts. Assignments are not to be treated as collective efforts beyond the participation of the two members of the team. No assignment team is allowed to show its code or view the code of another team. Discussions are allowed for the class material but not on how to solve specific questions in homeworks and assignments.

A severe penalty will be given to any assignment which indicates collusion or cheating. The usual penalty for cheating on an assignment or an exam is failure in the course. Stealing another person's listing or having another person "ghost write" an assignment will be considered cheating.

You should carefully read the section on Academic Dishonesty found in the UNR Student Handbook. Your continued enrollment in this course implies that you have read it, and that you subscribe to the principles stated therein.

Accommodation for Disability

If you have a disability for which you will need to request accommodations, please contact the instructor or someone at the Disability Resource Center (Thompson Student Services - 101), as soon as possible.

Video/Audio recording

Surreptitious or covert video-taping of class or unauthorized audio recording of class is prohibited by law and by Board of Regents policy. This class maybe videotaped or audio recorded only with the written permission of the instructor. In order to accommodate students with disabilities, some students may have been given permission to record class lectures and discussions. Therefore, students should understand that their comments during class may berecorded.

Student Success Services

Your student fees cover usage of the Math Center (784-443 or www.unr.edu/mathcenter/), Tutoring Center (784-6801 or www.unr.edu/tutoring-center), and University Writing Center (784-6030 or http://www.unr.edu/writing-center). These centers support your classroom learning; it is your responsibility to take advantage of their services. Keep in mind that seeking help outside of class is the sign of a responsible and successful student."

Communications

If I need to communicate with the class as a whole I will post a message on the class web page. You are required to check the class web page and your email every day.

Course Outcomes

Program objectives and outcomes of the Bachelor of Science in Computer Science:
`http://www.cse.unr.edu/academics/accreditation/assessment-bscs.html`
Program objectives and outcomes of the Bachelor of Science in Computer and Info. Engineering:
`http://www.cse.unr.edu/academics/accreditation/assessment-bscie.html`

In relation to the above objectives and outcomes:

- Students should be able to apply logic, probabilities, statistics, learning and search tools in the design of intelligent agents.
  . *Assessment method:* Exams will test the ability of students in effectively applying these tools to the design of intelligent agents.
  . Contributes to Departmental Outcome 1
  . Contributes to CSE Objective 2

- Students should be able to compare the properties of intelligent agents through extensive experimentation and analysis of data.
  . *Assessment method:* Assignments will require students to run multiple experiments and evaluate the effectiveness of techniques given the collected data.
  . Contributes to Departmental Outcome 2
  . Contributes to CSE Objective 3

- Students should be able to theoretically analyze the properties of algorithms for the design of intelligent agents and their appropriateness under computational constraints such as time and memory limitations.
  . *Assessment method:* Assignments will often require students to solve a problem given computational constraints.
  . Contributes to Departmental Outcome 3
  . Contributes to CSE Objective 3

- Students should be able to evaluate the computational requirements necessary to solve a problem given a specific algorithmic approach.
  . *Assessment method:* Assignments will require students to analyze problems and formulate the appropriate solution.
  . Contributes to Departmental Outcome 5
  . Contributes to CSE Objective 3

- Students should be aware which techniques in the field of artificial intelligence are widely considered as state-of-the-art solutions.
  . *Assessment method:* Eams will require students to propose the widely considered best AI approach for different problem formulations.
  . Contributes to Departmental Outcome 11
  . Contributes to CSE Objective 2

- Students should be able to propose an approach for solving an AI problem by combining results of theoretical analysis and experimentation.
  . *Assessment method:* Programming assignments will specify certain requirements for the required intelligent agents and the students will have to apply and combine the appropriate tools from computer science and engineering to come up with complete solution.
  . Contributes to Departmental Outcome 12
  . Contributes to CSE Objective 3