[Artificial Intelligence & CS541]

[Department of Computer Science/Schaefer School of Engineering and Science]

[Spring 2023]

Instructor: Jonggi Hong

Canvas Course Address: https://sit.instructure.com/courses/64281

Course Schedule: January 2023 - May 2023

Contact Info: jhong8@stevens.edu

Virtual Office Hours: You can join through Zoom with an appointment during regular office hours. Set up an appointment through email.

Virtual session URL: https://stevens.zoom.us/j/2568698330 Links to an external site.

Prerequisite(s): MA 222 - Probability & Statistics, MA 232 - Linear Algebra

COURSE DESCRIPTION

This class covers the core concepts of artificial intelligence.

STUDENT LEARNING OUTCOMES

Outcomes of instruction:

1. **Search Idealization** - Find appropriate idealizations for converting real-world problems into AI search problems formulated using the appropriate search algorithm.
2. **Search Formalization** - Given a search problem, be able to analyze and formalize the problem (as a state space, graph, etc.) and select the appropriate search method and write the algorithm for it.
3. **Search Concepts** - Explain important search concepts, such as the difference between informed and uninformed search, the definitions of admissible and

consistent heuristics and completeness and optimality. Give the time and space complexities for standard search algorithms.

4. **Search Implementation** - Implement A* and iterative deepening search. Derive heuristic functions for A* search that are appropriate for a given problem.
5. **Constraint Satisfaction** - For constraint satisfaction problems, implement a backtracking search with conflict-directed backjumping, arc consistency, and the Minimum Remaining Values and Least Constraining Value heuristics. Implement local search with the min- conflicts heuristic.
6. **Alpha-beta** - Implement and execute by hand alpha-beta search. Design good evaluation functions and strategies for game playing.
7. **First-order logic semantics** - Translate English into first-order logic and vice versa. Represent and debug knowledge in an appropriate first-order logic representation.
8. **Logical proof** - Carry out proofs in first-order and propositional logic using techniques such as resolution, unification, and backward and forward chaining.
9. **Situation Calculus** - Proofs and planning using the situation calculus for reasoning about actions and their effects over time.
10. **Planning** - Explain the difference between plan space and state space. Describe and implement several major approaches to classical planning, including planning graphs, POP, planning graphs, and propositionalization.
11. **Bayes nets** - Design appropriate Bayes Nets corresponding to the causal relationships and conditional independence of a real-world situation. Derive the conditional independence of variables given a Bayes Net.
12. **Learning** - Given a real-world supervised learning problem, choose and implement appropriate learning algorithms such as decision trees, support vector machines, and boosting.

COURSE FORMAT AND STRUCTURE

This course is on-campus. Please contact the instructor if you should attend the class remotely. To access the course, please visit stevens.edu/canvas Links to an external site.. For more information about course access or support, contact the Technology Resource and Assistance Center (TRAC) by calling 201-380-6599.

COURSE MATERIALS

Textbook(s): Artificial Intelligence: A Modern Approach (3rd Edition), Stuart Russell and Peter Norvig

LEARNING ACCOMMODATIONS

Stevens Institute of Technology is dedicated to providing appropriate accommodations to students with documented disabilities. The Office of Disability Services (ODS) works with undergraduate and graduate students with learning disabilities, attention deficit-hyperactivity disorders, physical disabilities, sensory impairments, psychiatric disorders, and other such disabilities in order to help students achieve their academic and personal potential. They facilitate equal access to the educational programs and opportunities offered at Stevens and coordinate reasonable accommodations for eligible students. These services are designed to encourage independence and self-advocacy with support from the ODS staff. The ODS staff will facilitate the provision of accommodations on a case-by-case basis.

For more information about Disability Services and the process to receive accommodations, visit https://www.stevens.edu/student-diversity-and-inclusion/disability-services Links to an external site.. If you have any questions please contact: Phillip Gehman, the Director of Disability Services Coordinator at Stevens Institute of Technology at pgehman@stevens.edu or by phone 201-216-3748.

Disability Services Confidentiality Policy

Student Disability Files are kept separate from academic files and are stored in a secure location within the Office of Disability Services. The Family Educational Rights Privacy Act (FERPA, 20 U.S.C. 1232g; 34CFR, Part 99) regulates disclosure of disability documentation and records maintained by Stevens Disability Services. According to this act, prior written consent by the student is required before our Disability Services office may release disability documentation or records to anyone. An exception is made in unusual circumstances, such as the case of health and safety emergencies.

INCLUSIVITY

Name and Pronoun Usage

As this course includes group work and class discussion, it is vitally important for us to create an educational environment of inclusion and mutual respect. This includes the ability for all students to have their chosen gender pronoun(s) and chosen name affirmed. If the class roster does not align with your name and/or pronouns, please inform the instructor of the necessary changes.

Inclusion Statement

Stevens Institute of Technology believes that diversity and inclusiveness are essential to excellence in academic discourse and innovation. In this class, the perspective of people of all races, ethnicities, gender expressions and gender identities, religions, sexual orientations, disabilities, socioeconomic backgrounds, and nationalities will be respected and viewed as a resource and benefit throughout the semester. Suggestions to further diversify class materials and assignments are encouraged. If any course meetings conflict with your religious events, please do not hesitate to reach out to your instructor to make alternative arrangements.

You are expected to treat your instructor and all other participants in the course with courtesy and respect. Disrespectful conduct and harassing statements will not be tolerated and may result in disciplinary actions.

MENTAL HEALTH RESOURCES

Part of being successful in the classroom involves a focus on your whole self, including your mental health. While you are at Stevens, there are many resources to promote and support mental health. The Office of Counseling and Psychological Services (CAPS) offers free and confidential services to all enrolled students who are struggling to cope with personal issues (e.g., difficulty adjusting to college or trouble managing stress) or psychological difficulties (e.g., anxiety and depression). Appointments are can be made by phone (201-216-5177).

EMERGENCY INFORMATION

In the event of an urgent or emergent concern about the safety of yourself or someone else in the Stevens community, please immediately call the Stevens Campus Police at 201-216-5105 or on their emergency line at 201-216-3911. These phone lines are staffed 24/7, year round. For students who do not reside near the campus and require emergency support, please contact your local emergency response providers at 911 or via your local police precinct. Other 24/7 national resources for students dealing with mental health crises include the National Suicide Prevention Lifeline (1-800-273-8255) and the Crisis Text Line (text “Home” to 741-741). If you are concerned about the wellbeing of another Stevens student, and the matter is *not* urgent or time sensitive, please email the CARE Team at care@stevens.edu. A member of the CARE Team will respond to your concern as soon as possible.