CS 360: Advanced Artificial Intelligence

Fall 2008

Instructor: Gautam Biswas
Time: Tu-Thurs. 1:10-2:25 pm
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Course Objectives: Artificial Intelligence (AI) is viewed in different ways which makes it hard to define. However, a majority of computer scientists, engineers, and cognitive psychologists view AI as a discipline that enumerates and explores tasks that are hard to solve (sometimes impossible) using conventional algorithms. In other words, AI deals with complex problems (e.g., playing chess, planning trips, and natural language understanding) that cannot be solved without using forms of computational or human intelligence.

We will adopt this viewpoint in this course and study AI both from the ***computational*** (how can we design effective and efficient algorithms to solve problems that typically have exponential complexity) and ***cognitive*** (how do humans solve complex problems effectively and efficiently) viewpoints. The course will cover fundamental concepts, ideas, techniques, and applications and provide practical experience by implementing intelligent reasoning techniques.

Text: *Artificial Intelligence A Modern Approach,* by Stuart Russell and Peter Norvig, second edition, Prentice Hall, NJ, 2003.

Pre-requisites: CS 260 (Introduction to AI), or equivalent, or permission of instructor.

Syllabus:

No	Topic Name	Russell & Norvig Chapter
1	**Introduction to AI**	1
2	**Intelligent Agents (self-study)**	2
3	**Introduction to Lisp (self-study, optional)** (*Note: Choice of language for Programming assignments: Lisp, Java, or C++*)	Handouts
4	**Search and Problem Solving** Introduction (Uninformed Search) Informed (Heuristic Search) Constraint Satisfaction Problems (CSP) Adversarial Search (Two person games) Additional Papers: 1. R.E. Korf, "Depth-First Iterative Deepening: An Optimal Admissible Tree Search," *Artificial Intelligence*, vol. 27, pp. 97-109, 1985. 2. E.A. Hansen and R. Zhou, "Anytime Heuristic Search," *Journal of Artificial Intelligence Research*, vol. 28, pp. 267-297, 2007. 3. R. Bartak, "Constraint Propagation and Backtracking Search," Lec-	3 4 5 6

	ture Notes, 2005. 4. Lawler and Wood, "Branch and Bound Methods: A Survey," Operations Research, 14(4): 699-719, 1966.	
5	**Knowledge Representation and Reasoning (Logical Representations)** Propositional Logic First Order Logic and Inference Knowledge Representation & Ontologies	 7.1-7.6 8.1-8.4, 9 10.1-10.6
6	**Planning** Planning & Partial Order Planning Introduction to Planning and Scheduling with Resource Constraints	 11.1-11.4 12.1-12.2, notes
7	**Reasoning under Uncertainty** Bayes Rule and Bayes Nets Hidden Markov Models, Dynamic Bayes Nets	 14.1-14.5 15.1, 15.3, 15.5
8	**Learning from Observations** Inductive Learning and Decision Trees Statistical Learning Methods	 18.1-18.3 20.1-20.3

Additional papers on topics 5 (semantic web) and 6 (scheduling with resource constraints) will be made available before they are covered in class.

Grading Scheme: The grades for the class will be based on homework assignments (4), programming assignments (2), exams (2), and a paper report (on a topic of the student's choice).