

CS351 Introduction to Artificial Intelligence

T, Th 4:20 p.m. – 5:30 p.m. UT 104

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Course Description

This course will introduce the basic principles in artificial intelligence research. It will cover simple representation schemes, problem solving paradigms, constraint propagation, and search strategies. Areas of application such as knowledge representation, natural language processing, expert systems, vision and robotics will be explored. The LISP programming language will also be introduced.

Prerequisites

CS 220

Required Texts

1. [Artificial Intelligence: A Modern Approach](#), 2nd edition, by Russell and Norvig, Prentice Hall.
2. *LISPcraft* by Robert Wilensky, W.W. Norton.

Software

Allegro Common Lisp. A free version is at: <http://www.franz.com/downloads/>

Grading policy

Exams 1, 2	30%
Final Exam	15%
Assignments	15%
Project	30%
Presentation	10%

Course Objectives

- To have an appreciation for and understanding of both the achievements of AI and the theory underlying those achievements.
- To have an appreciation for the engineering issues underlying the design of AI systems.
- To have a basic proficiency in a traditional AI language including an ability to write simple to intermediate programs and an ability to understand code written in that language.
- To have an understanding of the basic issues of knowledge representation and blind and heuristic search, as well as an understanding of other topics such as minimax, resolution, etc. that play an important role in AI programs.

- To have a basic understanding of some of the more advanced topics of AI such as learning, natural language processing, agents and robotics, expert systems, and planning.

Introductory Readings

[What is AI?](#) (by John McCarthy)

[History and Promise of AI](#) (by David Waltz)

[The Human Intelligence Enterprise. Why I am Optimist](#) (by Patrick Winston)

Other Readings

[Machine Learning and Data Mining](#), by Tom Mitchell, Communications of the ACM

[Does Machine Learning Really Work?](#) By Tom Mitchell, AI Magazine

AI Resources

[AAAI AI resources](#)

[CMU AI Repository](#)

Guy Steele's [Common Lisp the Language, 2nd Edition](#)

[AI Programming Resources](#)

Readings from Wilensky

Introduction to Lisp Chapters 1-8 Getting Started, Symbolic Computation, Basic LISP primitives, Procedure Definition and Binding, Predicates/conditionals/Logical Operators, Recursion, Iteration, Procedure and Data Abstraction, Mapping.

Readings from Russell & Norvig

Introduction Chapter 1

What is AI, Foundations of AI, History of AI.

Intelligent Agents Chapter 2

Agents and Environments, Structure of Agents.

Problem Solving by Searching Chapter 3

Problem Solving Agents, Searching for Solutions, Uninformed Search Strategies: Breadth-First Search, Depth-First Search, Depth-limited Search, Iterative Deepening Depth-first Search, Comparison of Uninformed Search Strategies.

Informed Search and Exploration Chapter 4

Informed (Heuristic) Search Strategies: Greedy Best-first Search, A* Search, Heuristic Functions, Local Search Algorithms and Optimization Problems.

Constraint Satisfaction Problems Chapter 5

Backtracking Search for CSPs, Local Search for CSPs.

Adversarial Search Chapter 6

Games, Minimax Algorithm, Alpha-Beta Pruning

Reasoning and Knowledge Representation Chapter 10+Additional Notes

Introduction to Reasoning and Knowledge Representation, Propositional Logic, First-order Logic, Semantic Nets, Other Knowledge Representation Schemes.

Reasoning with Uncertainty & Probabilistic Reasoning 14.1+14.2 +Additional Notes

Acting Under Uncertainty, Bayes' Rule, Representing Knowledge in an Uncertain Domain, Bayesian Networks.

Learning Chapter 18+20.1+20.2+Additional Notes

Forms of Learning, Decision Trees and the ID3 Algorithm, Statistical Learning, Summary of other Approaches.