CS 730/730W/830: Intro AI

What is AI?
This class
Agents

Prof. Wheeler Ruml, Kingsbury W233 (esp ?)

Matt Hatem, Kingsbury W236 (esp Fri 2–4pm)

"Thinking inside the box."

4 handouts: course info, schedule, slides, asst 1

What is AI?
- My Definition
- Intelligence
- The Goal
- AI Today

This class

Agents

What is AI?

My Definition of AI

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What is Intelligence?

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What behaviors require intelligence?
What makes an agent intelligent?

Different Goals in AI

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Cognitive modeling: behaves like a human
Engineering: achieve human performance
Rational: behaves perfectly, normative
Bounded-rational: behaves as well as possible

Subfields: knowledge representation and reasoning, computer problem-solving, planning, machine learning, natural language processing, (autonomous) robotics, intelligent agents, multi-agent systems, distributed AI, intelligent user interfaces, machine vision
Other terms: computational intelligence
Related: adaptive behavior, complex adaptive systems, artificial life, cognitive modeling

AI Today

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- Game playing: chess, checkers, backgammon, othello, crosswords
- Design: VLSI, jet engines
- Diagnosis: POS, NASD, loans, customer service, Windows, medical testing and classification, DS1
- Planning: airports, flight routes, Dell, DART, Orbitz
- Learning: Amazon, Netflix, Walmart
- Robotics: somersaults, ping-pong, devil sticks, cleaning
- Language: voice recognition, translation (Iraq, doctors)

AI Today

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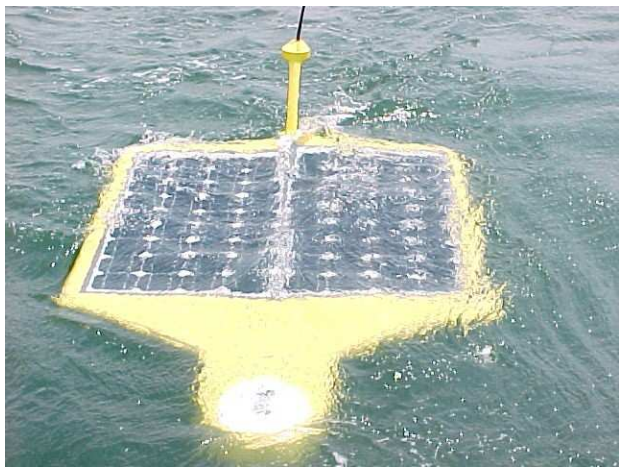

Cf. logistics (DARPA, Ascent),
autonomic computing (IBM, HP, Sun)

What is AI?
This class
- Relations
- Contents
- Schedule
- Course Mechanics

Agents

This class

Relations

What is AI?
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- CS: algorithms
- Engineering: applications
- Cognitive psychology: modeling
- Philosophy: mind, rationality
- Math: logic
- Linguistics: language processing
- Operations research: optimization
- Economics: agents

Contents

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This particular pattern of molecules known as a 'human being' has evolved an amazing depth of consciousness: an ability to internally model the reality beyond the senses, to imagine futures that have never happened, to use language, to use rationality to build and test theories about our universe, to become self-aware.
—Jeff Lieberman (artist, roboticist)

Schedule

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1. problem-solving (3 weeks): vacuum robot planner
2. logic (3 weeks): theorem prover
3. planning (3 weeks): planner
4. learning (3 weeks): reinforcement learning agent, handwriting recognizer
5. probabilistic reasoning (2 weeks)

Formalisms:

1. combinatorial search
2. propositional logic
3. first-order logic
4. Markov decision processes
5. hidden Markov models
6. Bayesian networks (graphical models)

Not: NLP, vision, robotics, cognitive modeling, philosophy

Course Mechanics

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Agents

- General information
- Schedule
- Asst 1

What is AI?
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- Agent Designs
- Examples
- Environments
- Cognitive Science
- AI in 1 line
- A Search Space
- EOLQs

Agents and Environments

Agent Designs

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Reflex: sensors $\rightarrow$ effectors

Reflex with state: sensors + state $\rightarrow$ effectors + new state

Goal-based: reason from goals to means

Utility-based: use quantitative measure of happiness

What kind of agent?

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1. Thermostat
2. DART military logistics planner
3. Mail delivery robot
4. Medical diagnosis system
5. Eliza

Environments

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Observability: complete, partial, hidden
Predictability: deterministic, strategic, stochastic
Interaction: episodic, sequential
Time: static, dynamic
State: discrete, continuous (also time, percepts, and actions)
Agents: single, multiagent (competitive, cooperative)

Cognitive Science

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The ability to think is perhaps the most distinctive of human capacities. Typically, thinking involves mentally representing some aspects of the world (including aspects of ourselves) and manipulating these representations or beliefs so as to yield new beliefs, where the latter may aid in accomplishing a goal.
—Edward E. Smith (Psychology, U Michigan)

The ability to solve problems is one of the most important manifestations of human thinking. ... We might therefore suspect that problem solving depends on general cognitive abilities that can potentially be applied to an essentially unlimited range of domains.
—Keith Holyoak (Psychology, UCLA)

The Core Symbiosis

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- Management of possibilities
  - order of search, evaluation
- Representation of knowledge
  - facts, situations, dependencies, consequences

A Search Space

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EOLQs

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Please write down the most pressing question you have about the course material covered so far and hand it to a member of the teaching staff on your way out.

Thanks!