Introduction to Artificial Intelligence

CSE 473

Autumn 2009

Administrative Details

- Instructor: Linda Shapiro, 634 CSE, shapiro@cs.washington.edu
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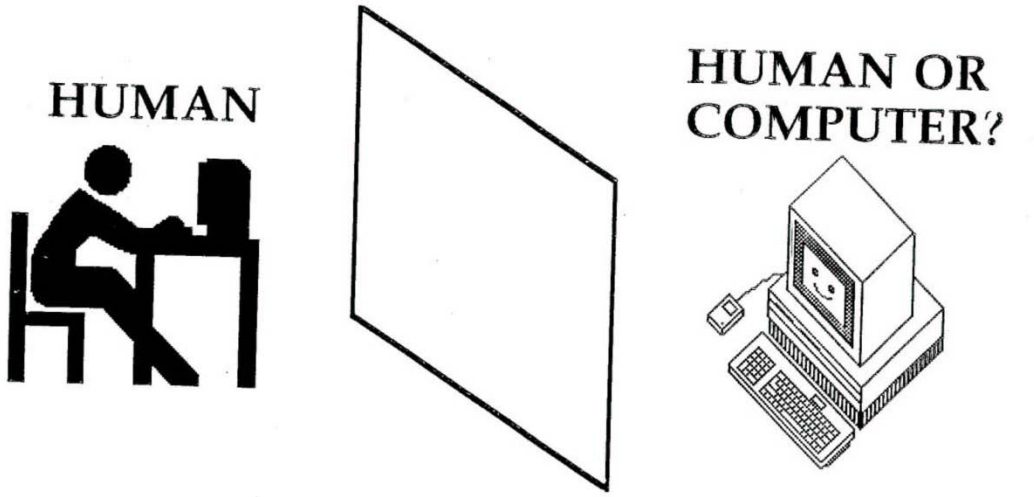
- Course Home Page: www.cs.washington.edu/473
- Text: Artificial Intelligence: A Modern Approach (2nd edition*), Russell and Norvig
- Final Exam: Tuesday, Dec 15, 2:30-4:20pm

What is intelligence?

- What capabilities should a machine have for us to call it intelligent?

Turing's Test

- If the human cannot tell whether the responses from the other side of a wall are coming from a human or computer, then the computer is intelligent.



Performance vs. Humanlike

- What is more important: how the program performs or how well it mimics a human?
- Can you get a computer to do something that you don’t know how to do? Like what?
- What about creativity?

Mundane Tasks

- Perception
  - Vision
  - Speech
- Natural Language
  - Understanding
  - Generation
  - Translation
- Reasoning
- Robot Control

Formal Tasks

- Games
  - Chess
  - Checkers
  - Kalah, Othello
- Mathematics
  - Logic
  - Geometry
  - Calculus
  - Proving properties of programs

Expert Tasks

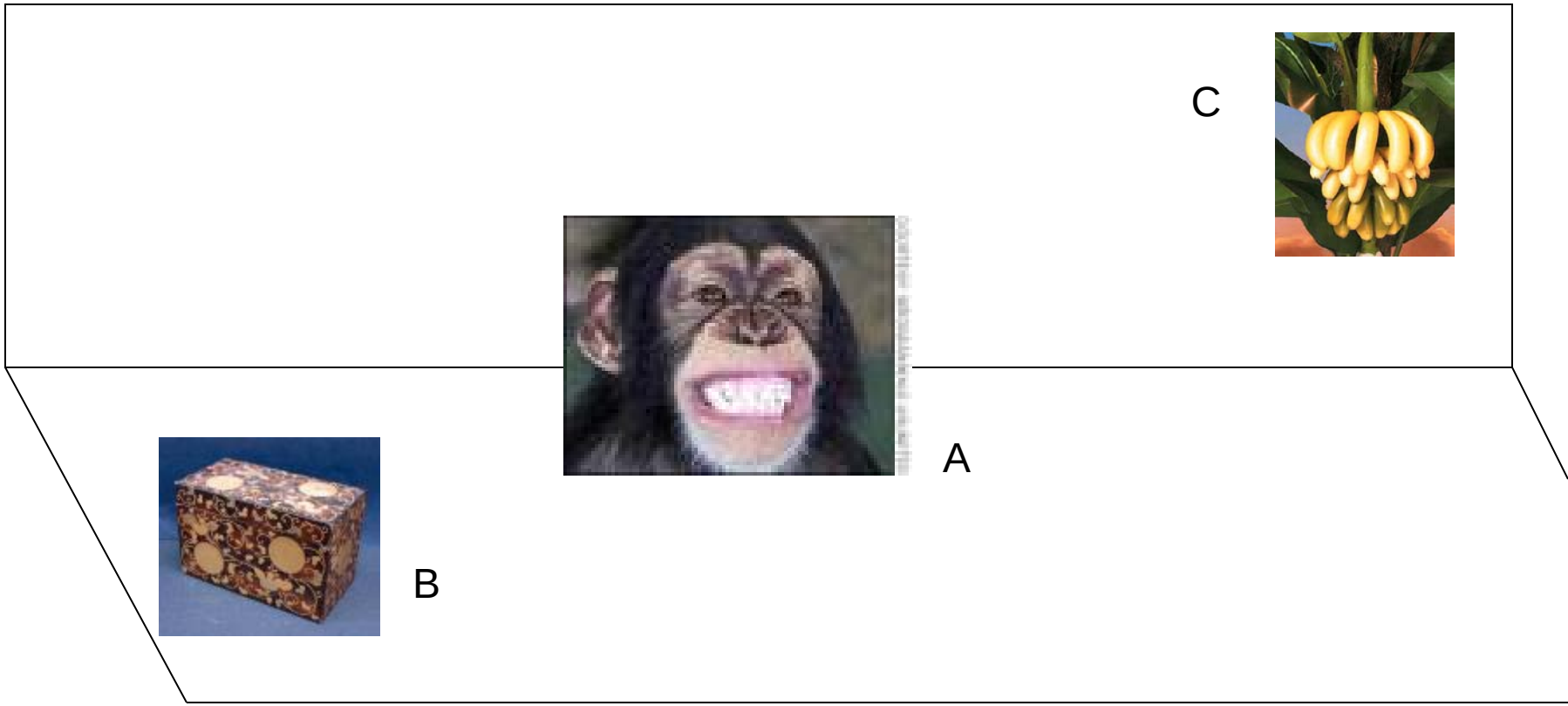
- Engineering
  - Design
  - Fault Finding
  - Manufacturing planning
- Medical
  - Diagnosis
  - Medical Image Analysis
- Financial
  - Stock market predictions

What is an intelligent agent?

- What is an agent?
- What does rational mean?
- Are humans always rational?
- Can a computer always do the right thing?
- What can we substitute for the right thing?

- What kinds of agents already exist today?

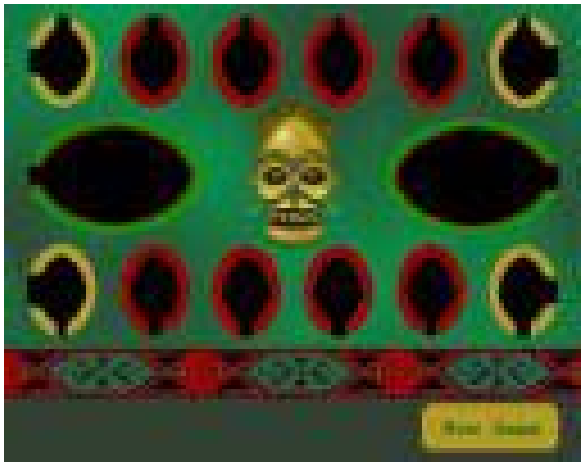
Problem Solving



Find a sequence of operations to produce the desired situation from the initial situation.

Game Playing

- Given:
  - An initial position in the game
  - The rules of the game
  - The criteria for winning the game
- WIN!

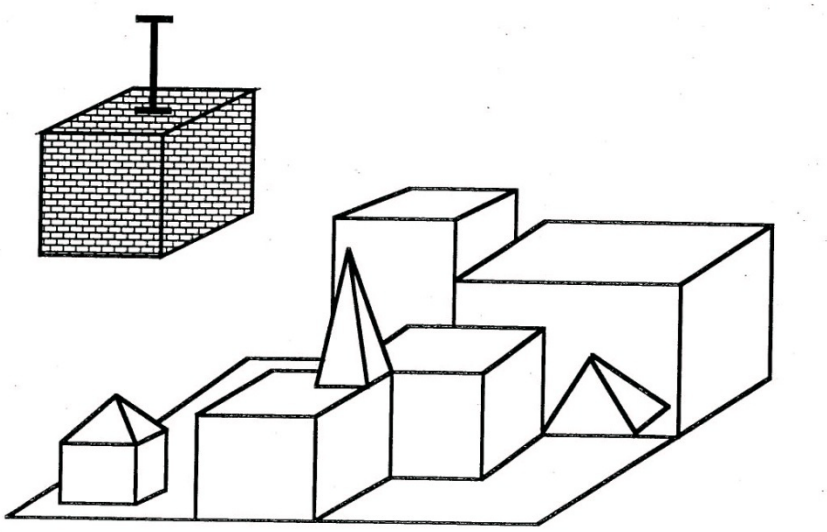


Theorem Proving

- Given:
  - ∀x (human(x) -> animal(x))
  - ∀x (animal(x) -> (eats(x) & drinks(x)))
- Prove:
  - ∀x (human(x) -> eats(x))

Natural Language Understanding

- Pick up a big red block.
- OK.



Expert Systems

"I'd like to buy a DEC VAX computer with 8MG of main memory, two 300MB disks, and a 1600 BPI tape drive."

Today's Response: "You gotta be kidding."

XCON: "1 XVW756 CPU, 2 XVM128A memory boards, 1 XDQ780C disk controller, 1 XDT780V disk drive, 1 XTQ780T tape controller, 1 XTT981Q tape drive, 1 XBT560M mass bus"

Computer Vision with Machine Learning

Given: Some images and their corresponding descriptions

{trees, grass, cherry trees}

{cheetah, trunk}

{mountains, sky}

{beach, sky, trees, water}

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To solve: What object classes are present in new images

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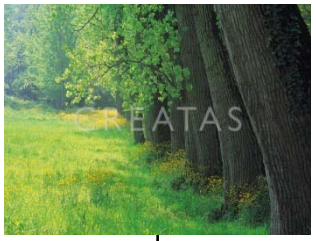

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Stuart Russell's "Potted History of AI"

- 1943 McCulloch & Pitts: neural nets model of the brain
- 1950 Turing's "Computing Machinery and Intelligence"
- 1952-69 Look Ma, no hands
- 1950s Early AI Programs: Logic Theorist, Checker Player, Geom
- 1956 Term "Artificial Intelligence" adopted
- 1965 Robinson's complete algorithm for logical reasoning
- 1966-74 AI discovers computational complexity; neural nets go
- 1969-79 Early development of knowledge-based "expert systems"
- 1980-88 Expert systems boom
- 1988-93 Expert systems bust: "AI Winter"
- 1985-95 Neural networks return
- 1988- AI and Statistics together
- 1995- Agents, agents everywhere
- NOW- PROBABILITY EVERYWHERE!
- NOW^{lgs}- Learning, Learning, Learning