EECS 391: Introduction to AI

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Announcements

- Website and blackboard are available
- Please respond to Doodle poll
- Reading assignment: Chapter 3 of textbook

Today

- What is AI?
- Subfields of AI
- Applications of AI today
- AI in the near future
- General Architecture of Intelligent Agents

What is AI?

- What is “intelligence”?
  - A human-centric view: “Can machines think?”

A. M. Turing (1950) Computing Machinery and Intelligence. *Mind 49:* 433-460.

COMPUTING MACHINERY AND INTELLIGENCE

By A. M. Turing

1. The Imitation Game

I propose to consider the question, "Can machines think?" This should begin with definitions of the meaning of the terms "machine" and "think." The definitions might be framed so as to reflect so far as possible the normal use of the words, but this attitude is dangerous, If the meaning of the words "machine" and "think" are to be found by

Can machines think?

A journalist once asked Edsger Djikstra, “Prof. Djikstra, do you think machines will ever be able to think?”

Djikstra responded, “Young man, do you think submarines will ever be able to swim?”

What is AI?

- Intelligence is *not* some mystical special quality humans alone are endowed with
  - It is the result of a *computational process*
    - "Thinking," whatever

- Modern AI is about the *process* of intelligence, decoupled from the entity possessing it

~~What is intelligence?~~

- What does intelligence *allow you to do?*

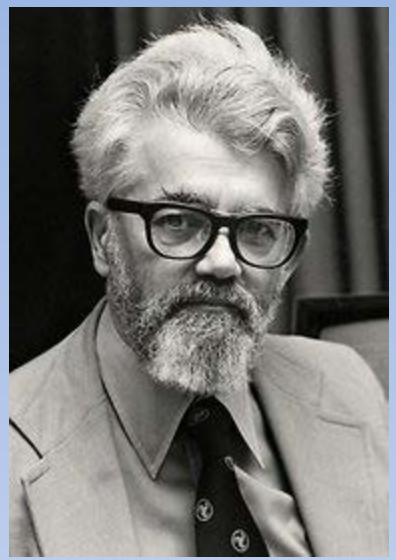
- Try to characterize intelligence "operationally"
  - I give you a sealed box and some rules for input/output. I claim, "This is an intelligent box."
  - How do you try to prove/disprove my claim?

What does intelligence do?

- Enables *Behavior*
  - That allows *flexible, rational problem solving*
  - That allows *learning*

Intelligence is a capability that enables flexible, adaptive, rational problem solving behavior.

What is AI?



- Intelligent behavior
- Embodied in an *artifact*
  - Something made by humans
  - Usually we take this to mean a digital computer

- Term “artificial intelligence” created by John McCarthy (1927-2011) in 1956

Human Intelligence and Modern AI

- Human intelligence can be used to identify a set of problems that could be a part of an intelligent system's repertoire of problems

- Several parts of AI are involved in solving problems that humans solve

A Closer Look

- Person A tells person B, “Please pick up the pencil on the desk.” Person B does this.
  - What just happened?

A Closer Look (2)

- Person B hears a sequence of sounds, which have to be converted to *words* (speech recognition)

- The *sentence structure* must be recovered in order to know what needs to be done to whom (natural language processing)

A Closer Look (3)

- Person B must then *look around to identify* (a) the current state of the environment (desk, etc) and (b) the correct "pencil" (computer vision and object recognition/classification)

- The facts about the pencil and its environment are *converted into a representation* that can be reasoned with (knowledge representation and reasoning)

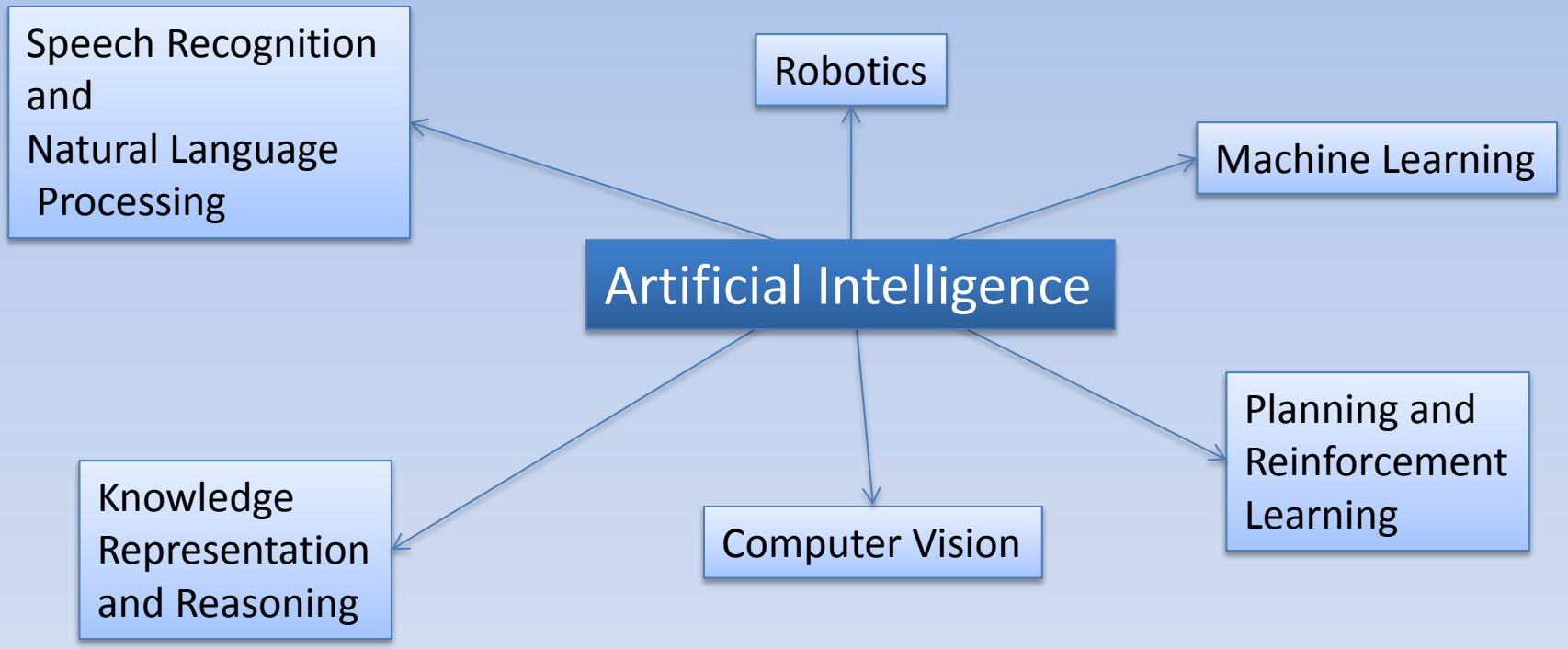
A Closer Look (4)

- Given the current state of the environment and the "goal" (i.e. the pencil should be picked up), person B then *moves their hand to achieve the goal* (planning and reinforcement learning)
- The next time such a request (or a similar one) is made, we may expect person B to respond more quickly, having *learned to do this task* (machine learning)

A Closer Look (5)

- Finally, if we want to *build a physical system* to emulate this behavior, we also need robotics

Modern AI subfields

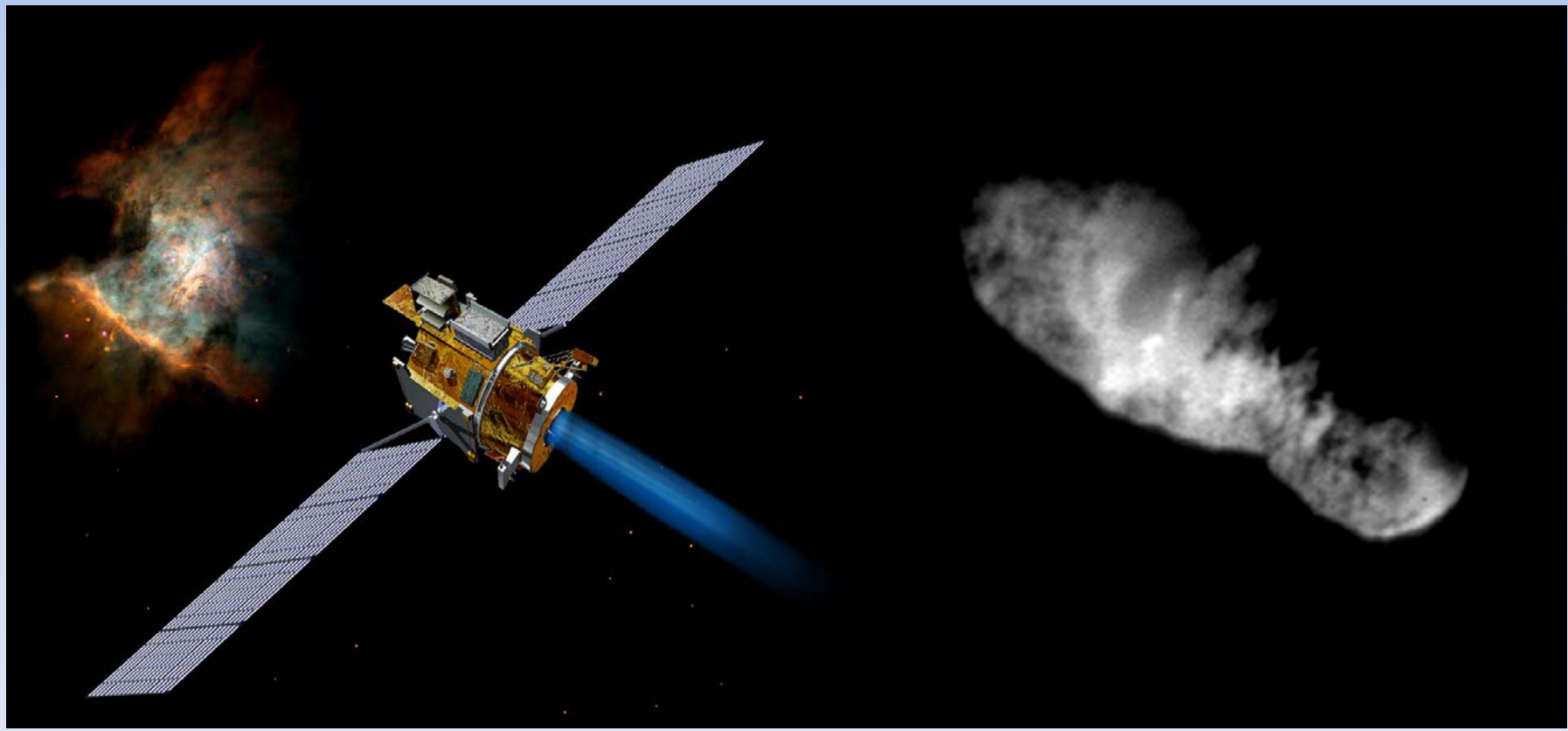


Recent AI Milestones (1997)

- One night in Bangkok…
  - Or, New York, May 11, 1997

Recent AI Milestones (1998)

- NASA's Deep Space One mission uses automated planning and smart navigation



Recent AI Milestones (2005, 2007)

- Stanford's automated vehicle, Stanley, completes DARPA grand challenge (2005)

- CMU's BOSS completes DARPA urban challenge (2007)

Recent AI Milestones (2011)

- IBM's Watson system defeats Ken Jennings and Brad Rutter at Jeopardy!

Recent AI Milestones (2011)

- Apple releases Siri, a personal voice assistant (voice recognition and question answering)

Recent AI Milestones

- Handwriting recognition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Intelligent Tutoring
Ubiquitous Computing
Social Computing
Autonomous Space Exploration
AI and Preferences, Media & Entertainment
Home Robotics
Gesture Recognition
Multimodal Interfaces
Mixed-Initiative Collaboration
Robots For Education
Robotic Surgery
Diagnosis
Drug Design
Scientific Discovery
Assistive Technology
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Descartes
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Leibniz
Whitehead
Lovelace
Russell
Turing
AI HISTORY TOUR
See the AI timeline and more at
www.aaai.org/AILandscape
The AI Landscape
David Leake, Indiana University, Poster Development Committee Chair
Poster Design: Giacomo Marchesi, www.GiacomoMarchesi.com

"If you invent a breakthrough in artificial intelligence, so machines can learn, that is worth ten Microsofts."

----Bill Gates, at a speech in MIT in 2004

Great! I only have 9.99999999999999 Microsofts left to go…

In the near future…

- Computer processing power is growing rapidly

- In a decade or two, we will have computers that are roughly hardware equivalent to the human brain

In the near future…

- Autonomous vehicles
- Artificial characters in video games/ online worlds

- But still some time away from a flexible, integrated intelligent system

Ethical Issues

Summary

- We learned about:
  - What AI is about and its subfields
  - Some current applications of AI
  - AI in the near future