Artificial Intelligence

Larry Holder
School of EECS
Washington State University
Overview

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Course Information

- Webpage: [www.eecs.wsu.edu/~holder/courses/AI](http://www.eecs.wsu.edu/~holder/courses/AI)
- Blackboard Learn ([learn.wsu.edu](http://learn.wsu.edu))
- Email ([holder@wsu.edu](mailto:holder@wsu.edu))
Introduction

Readings: R&N Chapter 1
What Is AI?

John McCarthy, Dartmouth (1956)
- “The science and engineering of making intelligent machines.”

Intelligent?

What makes humans intelligent?
Intelligence

- Ability to learn or understand or to deal with new or trying situations
- Ability to apply knowledge to manipulate one's environment
- Ability to think abstractly as measured by objective criteria (e.g., tests)
Four Approaches to AI

- Acting humanly
- Thinking humanly
- Thinking rationally
- Acting rationally
AI = Acting Humanly

- Turing Test
  - Can the machine convince a human that it is human via written English?
- Machine abilities?

- Loebner Prize
  - [wikipedia.org/wiki/Loebner_Prize](https://wikipedia.org/wiki/Loebner_Prize)
AI = Thinking Humanly

- Building machines that mimic human cognition
- “Cognitive Science”
- How to capture human thought?
AI = Thinking Rationally

- Laws of thought
- Logic
- Difficulties
  - Expressing knowledge as logical formulae
    - Define “chair”?
  - Logical reasoning is hard (NP–Hard)
    - If A is true, and A→B, then is B true?

Aristotle
384–322 BC
AI = Acting Rationally

- Rational agent
  - Acts to achieve the best outcome
  - Encompasses other approaches
- Focus of textbook ("a modern approach")
IBM’s Watson competes against humans in Jeopardy! Game (2011)

Is Watson
- Acting humanly?
- Thinking humanly?
- Thinking rationally?
- Acting rationally?
Computer Learns to Play Breakout

- Is DQN Breakout
  - Acting humanly?
  - Thinking humanly?
  - Thinking rationally?
  - Acting rationally?
Foundations of AI

- Philosophy
  - Logic, knowledge and rationality
- Mathematics
  - Algorithms, computability, probability
- Economics
  - Utility and decision theory, games
- Linguistics
- Neuroscience
  - Neuron, connectome
- Psychology
  - Human cognition
- Control Theory
- Computer Engineering
- Computer Science
History of AI

- Gestation of AI (1943–1955)
  - Turing’s “Computing Machinery and Intelligence”
  - Artificial neuron

- Birth of AI (1956)
  - John McCarthy
  - Dartmouth Summer Workshop
  - Newell and Simon’s “Logic Theorist”

- Early enthusiasm, great expectations (1952–1969)
  - Newell and Simon’s “General Problem Solver”
  - Symbolic programming languages (LISP)
  - Perceptron
“AI Winter” (1966–1973)
- Systems lacked commonsense knowledge, made simple mistakes
- Most AI problems found to be intractable

Knowledge–based systems (1969–1979)
- Knowledge and uncertainty representation
- Expert systems (Ed Feigenbaum)

AI industry (1980–present)

Return of neural networks (1986–present)
- Multi–layer perceptron, back–propagation
History of AI (cont.)

- AI adopts scientific method (1987–present)
  - Empirical validation and theory

- Emergence of intelligent agents (1995–present)
  - Human–level AI
  - Artificial general intelligence

- Availability of “big data” (2001–present)

- Deep learning (2010–present)
Achievements

- Game playing
- Robotics
- Planning and scheduling
- Language understanding
- Speech recognition
- Big data
- Deep learning
- Vision
Caution

- “AI is a fundamental risk to the existence of human civilisation.”
  - Elon Musk, July 2017

- “… whose culmination is a world relying on machines ungoverned by ethical or philosophical norms.”
  - Henry Kissinger, June 2018
Summary

- AI is the science and engineering of building intelligent machines
  - I.e., machines that act rationally
- Impressive achievements
- Promising, challenging future