CS 4200: ARTIFICIAL INTELLIGENCE

Dr. Daisy Tang

Outline

- Course Overview
- What is Artificial Intelligence (AI)
- History of AI
- The State of the Art

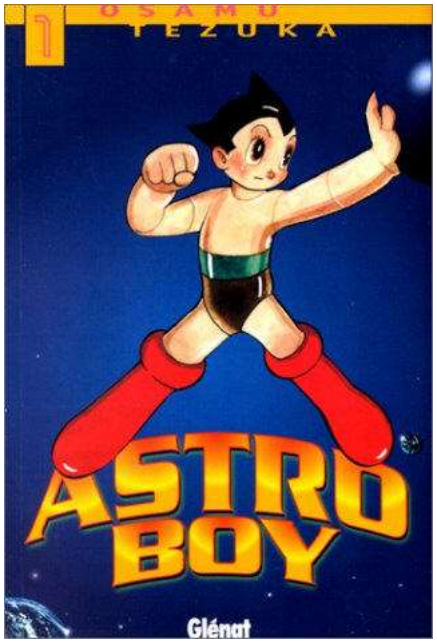
Course Overview

- See blackboard

Course Overview

- Week/Module 1:
  - Introduction; Intelligent agents
- Week/Module 2:
  - Uninformed Search; Informed Search
- Week/Module 3:
  - Local search; Constraint Satisfaction Problem
- Week/Module 4:
  - Adversarial Search; Logical Agent
- Week/Module 5:
  - First-Order Logic; Planning

What is AI?


OSAMU TEZUKA
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ASTRO BOY
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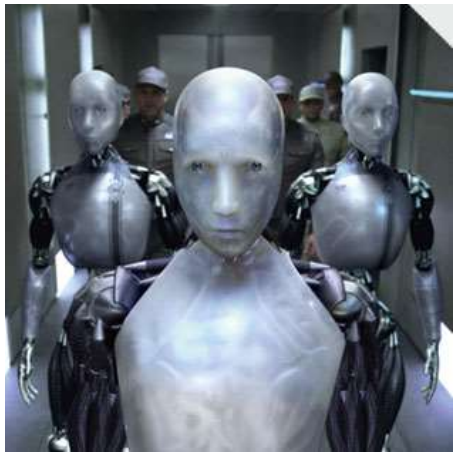



ALPHAGO
01:59:25
AlphaGo
Lee Sedol

Definition from John McCarthy

- It is the science and engineering of making intelligent machines, especially intelligent computer programs.

- What is intelligence then?
  - The computational part of the ability to achieve goals in the world. Varying kinds and degrees of intelligence occur in people, many animals and some machines.

John McCarthy's What is AI?

http://www-formal.stanford.edu/jmc/whatisai/whatisai.html

The Rise of AI

- Do you use AI in your daily life?

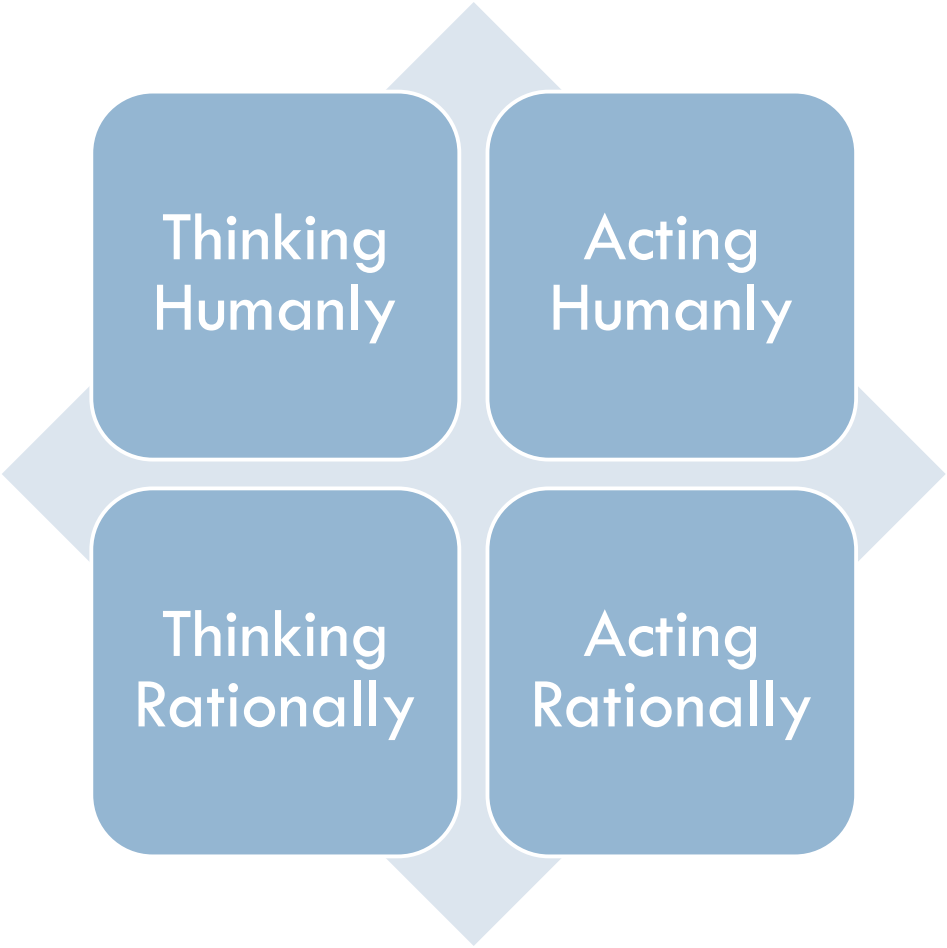
- Some examples:
  - Google Assistant can now make real phone calls for you:
    - https://www.youtube.com/watch?v=JvbHu_bVa_g
  - Covid-19 accurately diagnosed by AI model
    - https://www.genengnews.com/news/covid-19-accurately-diagnosed-by-ai-model/

In-Class Exercise #1.1

- **Requirements**:
  - Please write a 1-2 paragraphs of summary about your own definition of AI (in your own words) followed by the discussion of one recent event on how AI is being used in our daily life.
  - Please include a link to either a youtube video or an article that your reference.
  - Submission Deadline: 7/4/2020

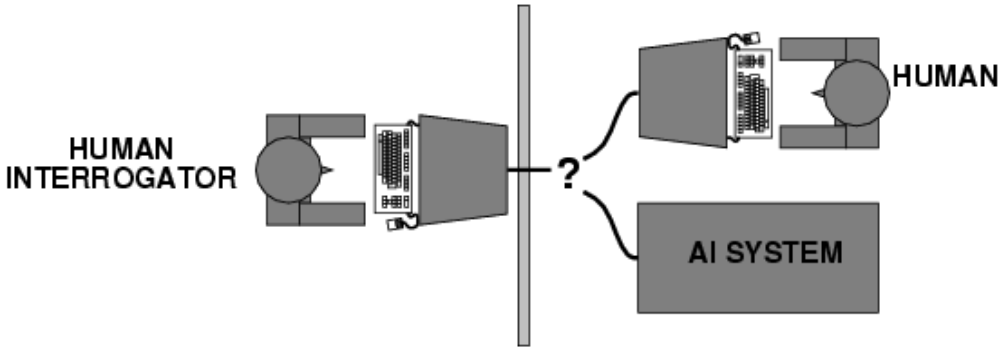
Four Categories Views of AI

- Please watch a short video about 4 views of AI



Acting Humanly: Turing Test

- Proposed by Alan Turing in 1950



- Suggested major components of AI?
- Loebner Prize (Mitsuku, 2016 winner)
- http://www.loebner.net/Prizef/loebner-prize.html

Thinking Humanly: Cognitive Modeling

- Requires scientific theories of internal activities of the brain
- How to validate? Requires
  - Predicting and testing behavior of human subjects
  - Direct identification from neurological data
- Both approaches (roughly, Cognitive Science and Cognitive Neuroscience) are now distinct from AI

Thinking Rationally: Laws of Thoughts

- Aristotle:
  - what are correct arguments/thought processes?
- Problems:
  - not easy to state informal knowledge in the formal terms required by logical notation
  - big difference between being able to solve a problem in principle and doing so in practice

Acting Rationally: Rational Agent

- Agent: something that acts
  - Agents are not merely "program"
- Rational: doing the right thing
  - It is expected to maximize goal achievement, given the available information
- Doesn't necessarily involve thinking – e.g., blinking reflex – but thinking should be in the service of rational action
- Two advantages: more general than "thinking rationally", better than human standards

Foundations of AI

Philosophy	Logic, methods of reasoning, mind as physical system foundations of learning, language, rationality
Mathematics	Formal representation and proof algorithms, computation, (un)decidability, (in)tractability, probability
Economics	utility, decision theory, game theory
Neuroscience	physical substrate for mental activity
Psychology	phenomena of perception and motor control, experimental techniques
Computer engineering	building fast computers
Control theory	design systems that maximize an objective function over time
Linguistics	knowledge representation, natural language

History of AI

1943	McCulloch & Pitts: Boolean circuit model of brain
1950	Turing's "Computing Machinery and Intelligence"
1956	Dartmouth meeting: "Artificial Intelligence" adopted
1952—69	Look, Ma, no hands!
1950s	Early AI programs, including Samuel's checkers program, Newell & Simon's Logic Theorist, Gelernter's Geometry Engine
1965	Robinson's complete algorithm for logical reasoning
1966—73	AI discovers computational complexity Neural network research almost disappears
1969—79	Early development of knowledge-based systems
1980--	AI becomes an industry
1986--	Neural networks return to popularity
1987--	AI becomes a science
1995--	The emergence of intelligent agents
2011--	Availability of very large data sets

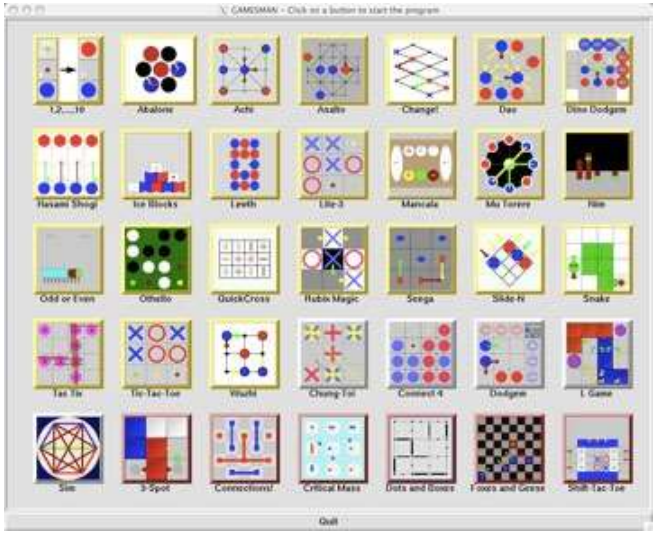
Branches of AI

- Logical AI
- Search
- Pattern recognition
- Representation
- Inference
- Common sense knowledge and reasoning
- Learning from experience
- Planning
- Heuristics
- Genetic programming
- Robotics
- And many others

State of the Art

- Machine learning
- Robotics: DARPA Grand/Urban Challenges
- Speech recognition: banking agent, travel agent
- Autonomous planning and scheduling: NASA's autonomous planning programs
- Game playing: IBM's Deep Blue, Google's AlphaGo
- Spam fighting
- Logistic planning: during the Persian Gulf crisis of 1991, U.S. forces deployed a tool to do automated logistics planning and scheduling for transportation, hours vs. weeks of efforts
- Robotics: Roomba that helps cleanning, PackBots that handle hazardous materials, clear explosives and identify location of snipers
- Machine translation
- …… many others

Examples



gamescrafter @ Berkeley

Packbot 510

Autonomous Vehicle

DARPA Urban Challenge
https://www.youtube.com/watch?v=cdgQpa1pUUE (Self Driving Car)
https://www.youtube.com/watch?v=vC66XFoN4DE (Alpha Go)

In-Class Exercise #1.2

- **Requirements:**
  - Given the most recent AI application (you can reuse the same application from the previous exercise or a brand new one), list the key areas of AI that you will need to explore to implement this application.
  - Submission Deadline: 7/11/2021

Next Subject …

- Intelligent agent