

# CISS450 Lecture 1: Introduction

Yihsiang Liow

August 24, 2024

# Table of contents I

- 1 History of AI?
- 2 What is AI?
- 3 Foundations of AI
- 4 Foundations of AI
- 5 CISS450

# History of AI I

- Readings: AIMA3 Chapter 1, AIMA4 Chapter 1.
- What is AI?  
What is CS, Math, Physics, etc. about? Solving problems.  
What is behind solving problems? Intelligence. Can the process of solving problems be mechanized? i.e., can a machine achieve the same process of solving problems as humans?

# History of AI II

- BC384-322. Aristotle. Beginning of logic.
- 1642. Pascal invented Pascaline calculator. Schickard failed about 20 years earlier.



## History of AI III

- 1600 (late) - Leibnitz' Dream. Every philosophical argument should be resolved by calculations like math.

“The only way to rectify our reasonings is to make them as tangible as those of the Mathematicians, so that we can find our error at a glance, and when there are disputes among persons, we can simply say: Let us calculate, without further ado, to see who is right.” – Leibnitz 1685
- 1847-1854. Boole. Symbolic logic - continues Aristotle's logic.
- 1900. Hilbert's Decision Problem: Is there an algorithm that accepts a logic problem and answer yes or no.
- 1935-6. Church-Turing thesis: Any computable function is computable by a Turing machine (an abstract definition of a computing machine)

## History of AI IV

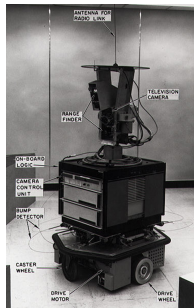
- 1943. McCulloch & Pitts: Boolean circuit model of brain
- 1940s. Creation of computers Heath Robinson, Z-3, ABC/ENIAC, etc. Computers become more powerful and approximates Turing machine.
- 1950. Turing test. Problem is not an algorithmic problem in the usual sense. The problem is to “behave like human being”.
- 1952. Samuel’s Checkers program learned weights and played at strong amateur level
- 1955. Newell & Simon’s Logic Theorist prove theorems in Principia Mathematica (Bertrand Russell) using search and heuristics. Improvement: 1959 – General Problem Solver (GPS).

# History of AI V

- 1956. Birth of AI at Dartmouth College. Beginning of Golden Age of AI (1956-1976) John McCarty, Marvin Minsky, etc. Promises too much.
  - “Machines will be capable, within twenty years, of doing any work a man can do.” – Herbert Simon
  - “Within 10 years the problems of artificial intelligence will be substantially solved.” – Marvin Minsky

# History of AI VI

- 1966-72. Shakey. Funded by DARPA. Language: LISP. Computer vision. NLP. Logic- and goal-based agent. Planning ability. A\* search. Hough algorithm for image processing.



<https://www.youtube.com/watch?v=7bsEN8mwUB8>



# History of AI VII

- 1969-79. Early development of knowledge-based systems
- 1980-88. Expert systems industry booms
- 1987-Present. Probabilistic reasoning and machine learning.
- 1988-93. Expert systems industry busts: "AI Winter"
- 1985-95. Neural networks return to popularity

# History of AI VIII

- 1997. Deep Blue (IBM) beats Gary Kasparov in chess



# History of AI IX

- 2005. DARPA Grand Challenge. Stanley drives 132 miles in desert.



[https://www.youtube.com/watch?v=vCRrXQRvC\\_I](https://www.youtube.com/watch?v=vCRrXQRvC_I)

# History of AI X

- 2011-Present. Big data, machine learning, artificial neural networks, deep learning.
- 2011. Watson (IBM) wins Jeopardy

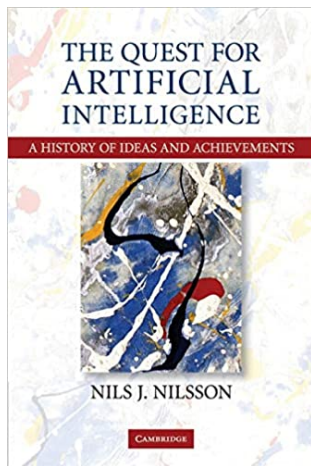


# History of AI XI

- 2016. AlphaGo beats Lee Sidol in Go.



# History of AI XII



## History of AI XIII

- Hyper-acceleration of AI related R&D in academic and industry since 2010.
- IEEE 2020 Top 12 Technology Trends. <https://www.prnewswire.com/news-releases/ieee-computer-societys-top-12-technology-trends-for-2020-300971863.html>  
AI dominates the list. Same thing for 2019, 2018 (google).
- Applications of AI:  
[https://en.wikipedia.org/wiki/Applications\\_of\\_artificial\\_intelligence](https://en.wikipedia.org/wiki/Applications_of_artificial_intelligence)
- Top AI companies <https://www.datamation.com/artificial-intelligence/top-artificial-intelligence-companies.html>
- Top Chess Engine Competition  
[https://en.wikipedia.org/wiki/Top\\_Chess\\_Engine\\_Championship](https://en.wikipedia.org/wiki/Top_Chess_Engine_Championship)

# Four directions/definitions I

- Four areas of AI (in 2 dimensions):

		Manner	
		humanly	rationally
Action	think	think humanly	think rationally
	act	act humanly	act rationally

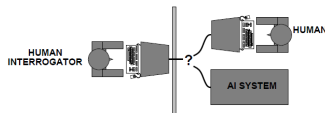


# Acting humanly I

- Alan Turing (1912 -1954)



- Turing Test (Alan Turing 1950).



# Acting humanly II

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

<https://drive.google.com/file/d/1dn6e-bJs7GXW9DSuyvEQvaF7jFb1vfS0/view?usp=sharing>

- Predicted that by 2000, a machine might have a 30% chance of fooling a lay person for 5 minutes
  - Anticipated all major arguments against AI in following 50 years
  - Suggested major components of AI: knowledge, reasoning, language understanding, learning
- Turing worked in the area of logic, automata theory, cryptography, etc.

# Acting humanly III

- To pass Turing test, subject must have the following capabilities:
  - natural language processing (NLP)
  - knowledge representation: represent knowledge as data
  - automated reasoning: use stored information to answer questions and draw new conclusions
  - machine learning: adapt to new circumstances
- In Turing test interrogator does not interact directly with subjects. There is no test of subject's physical simulation of a human and no test of subject's ability to process other forms of data (example: visual, audio).

# Acting humanly IV

- Eliza:

<http://psych.fullerton.edu/mbirnbaum/psych101/Eliza.htm>

# Acting humanly V

- **Total Turing test**: includes ability to process perceptual data and can pass objects to interrogator. To pass total Turing test, need
  - computer vision
  - robotics
- AIMA does not talk about what type of perceptual data. But can involve subjects visual ability to recognize/classify physical objects.
- Smell? Touch?
- No reason to stop at total Turing test ... the “extreme Turing test”: The test involves talking face to face with subject.

## Acting humanly VI

- Ex machina:  
<https://www.youtube.com/watch?v=XYGzRB4Pnq8&v1=en>
- Google I/O 2018 highlights: Android P, Google Lens and AI.  
<https://www.youtube.com/watch?v=rk3EVJ2IQzc>
- New Google AI Can Have Real Life Conversations With Strangers: (2018 I/O developer conference):  
<https://www.youtube.com/watch?v=1XUQ-DdSDoE>
- Most realistic robots 2018:  
<https://www.youtube.com/watch?v=sSOLAK33W04>
- Google I/O 2018 Keynote:  
<https://www.youtube.com/watch?v=ogfYd705cRs>

# Acting humanly I

- When solving a problem, want the steps to follow what most humans would take.

# Thinking rationally I

- The subject perceives the environment and and thinks logically in order to decide on an action that will achieve or optimize goal.



# Acting rationally I

- Act in a way that is rational and optimizes goal.
- The focus of this course: rationality. To think and act rationally.

# Foundations of AI I

- The following are areas that influence the development 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: formal theory of rational decisions
  - Neuroscience: plastic physical substrate for mental activity
  - Psychology: adaptation, phenomena of perception and motor control, experimental techniques (psychophysics, etc.)
  - Control theory and cybernetics: homeostatic systems, stability, simple optimal agent designs
  - Linguistics: knowledge representation, grammar

# Foundations of AI I

- The following are areas that influence the development 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: formal theory of rational decisions
  - Neuroscience: plastic physical substrate for mental activity
  - Psychology: adaptation, phenomena of perception and motor control, experimental techniques (psychophysics, etc.)
  - Control theory and cybernetics: homeostatic systems, stability, simple optimal agent designs
  - Linguistics: knowledge representation, grammar

# CISS450 I

- Class: CISS450 AI, Fall 2024
- Instructor: Dr. Yihsiang Liow
- Class website: <http://ciss450.pythonanywhere.com>
  - User: 8rene
  - Password: 3descartes

# CISS450 II

- Topics
  - Python
  - Agents
  - Brute force search
  - Heuristic search
  - Adversarial search
  - Local search
  - Constraint satisfaction search (CSP)
  - Logic agents
  - Genetic algorithms
  - Artificial neural networks

## CISS450 III

- Language: For Fall 2024 Python 3 (with Python 2 fall back ...) and possibly C++.
  - <http://greenteapress.com/thinkpython/html/index.html>
- Platform: Fedora 40 virtual machine. (F31 fall back ...) <http://yliow.github.io>
- Assignments, quizzes, midterm, final exam, project.