Introduction to CAP 4630/5605 - Introduction to Artificial Intelligence

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Overview

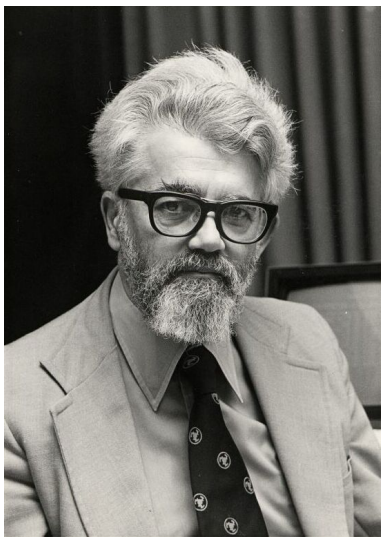
1. Syllabus
2. AI and its foundations
3. State of Art
4. AI Ethics and Concerns

Our Course

Course Dates	1/8/18 - 4/27/18
Class Times	TR 6pm-7:15pm
Class Location	Building 15, Room 1205
Class Website	This class uses Canvas (`http://www.unf.edu/canvas/`)
Textbook	Russell and Norvig, *Artificial Intelligence: A Modern Approach*, Third edition

What is AI?

No clear consensus on the definition of AI.



John McCarthy
1956 coined it[1]
1927 - 2011

- Q. What is artificial intelligence?
- A. It is the **science and engineering of making intelligent machines**, especially intelligent computer programs. It is related to the similar task of using computers to understand human intelligence, but AI does not have to confine itself to methods that are biologically observable.
- Q. Yes, but what is intelligence?
- A. Intelligence is 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.

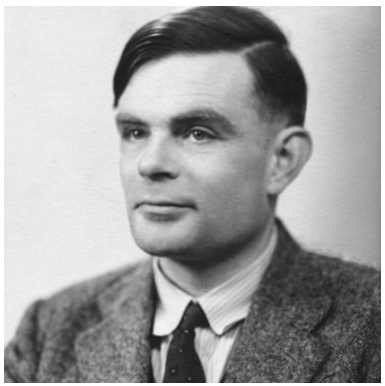
[1] `http://www-formal.stanford.edu/jmc/whatisai/node1.html`

What is AI?

Thinking Humanly	**Thinking Rationally**
"The exciting new effort to make computers think . . . *machines with minds*, in the full and literal sense." (Haugeland, 1985) "[The automation of] activities that we associate with human thinking, activities such as decision-making, problem solving, learning . . ." (Bellman, 1978)	"The study of mental faculties through the use of computational models." (Charniak and McDermott, 1985) "The study of the computations that make it possible to perceive, reason, and act." (Winston, 1992)
Acting Humanly	**Acting Rationally**
"The art of creating machines that perform functions that require intelligence when performed by people." (Kurzweil, 1990) "The study of how to make computers do things at which, at the moment, people are better." (Rich and Knight, 1991)	"Computational Intelligence is the study of the design of intelligent agents." (Poole *et al.*, 1998) "AI . . . is concerned with intelligent behavior in artifacts." (Nilsson, 1998)

Figure: Some definitions, organized into four categories

Acting Humanly



Alan Turing
1912 - 1954

1. Turing test: A computer passes the test if a human interrogator, after posing some written questions, cannot tell whether the written responses come from a person or from a computer. Total Turing test: it includes a video signal to test perceptual and physical abilities of the subject.
2. With total Turing test, researchers generated six disciplines within AI:
   - natural language processing, knowledge representation,
   - automated reasoning, machine learning,
   - computer vision, and robotics.

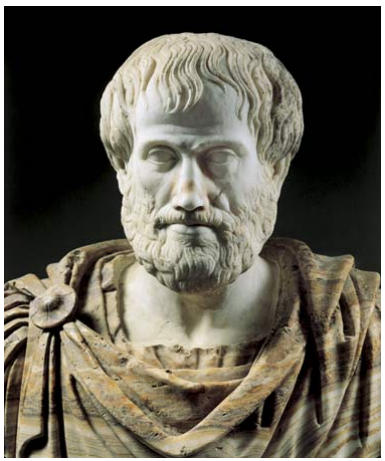
Thinking Humanly

1. First is first, how humans think? (Studied in cognitive science)
2. Then, how computers think? (Arguably told by the logic flows)
3. Finally, check if the two match.
4. E.g., GPS (NOT Global Positional System!) by Newell and Simon in 1961.

Figure: Allen Newell (L) and Herbert Simon

- This category is not served in this course.

Thinking Rationally



Aristotle
384 - 322 BC

1. Aristotle was one of the first to attempt "laws of thinking."
   - Syllogism: "All men are mortal. Socrates is a man. Therefore Socrates is mortal."
2. Logicians in 19th century developed different logics that can in principle solve any problem described in logical notations.

- Hard to model informal knowledge, e.g., probability, into standard logics.
- Solve a problem in principle vs. in practice.

Acting Rationally

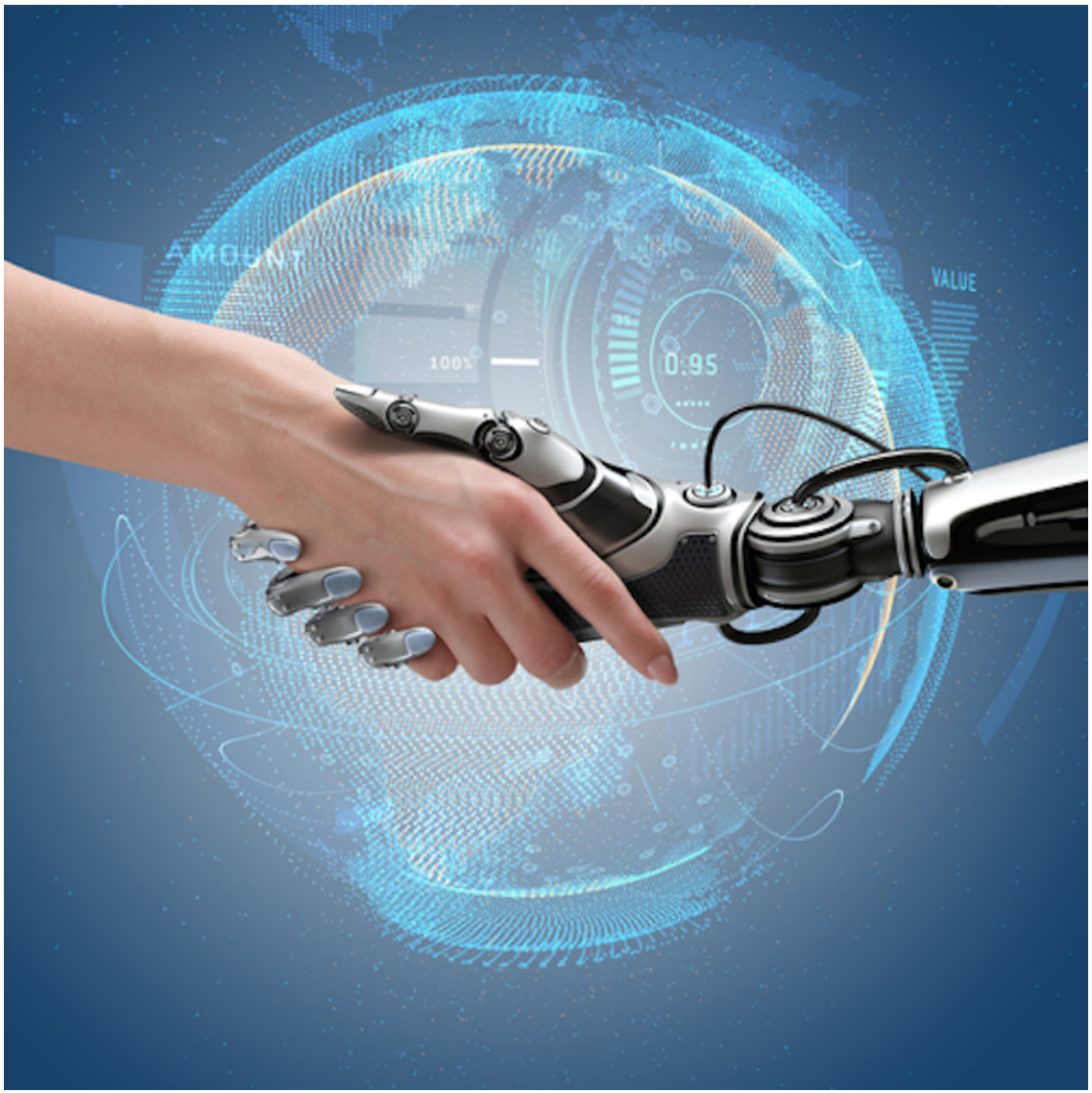
1. An **agent** (from Latin word *agere*, to do) is something (e.g., program, robot and even human) that acts.
2. A **rational agent** is one that acts to **achieve the best outcome**.
3. Our course concentrate on this category of AI, including studying **general principles of rational agents** and **components for constrcting them**.

+ It builds on mathematical rationality, not human thinking or acting.
+ It extends the "laws of thinking" because reasoning logically is part of being a rational agent.
  - E.g., retreating from hot stove is a quick reflex action.

Foundations of AI

1. Philosophy: how does the mind work? (rationalism, dualism, materialism,. . .)
2. Mathematics: logics, computability, and probability
3. Economics: decision theory, preferences, social computing
4. Neuroscience: neurons, artificial neural networks
5. Psychology: cognitive psychology
6. Computer engineering
7. Control theory and cybernetics: robotics
8. Linguistics: knowledge representation, natural language processing

AI in Everyday Life?



AI in Everyday Life

1. iRobot Roomba autonomous vacuum cleaner
2. Virtual assistants: Siri, Cortana, Google Now, etc
3. Spam filters using machine learning
4. Recommendation systems: Amazon, Netflix
5. Natural language translation using machine learning: Facebook

Beat Humans in Chess

Figure: IBM Deep Blue beat chess world champion Garry Kasparov in 1997

Beat Humans in Go

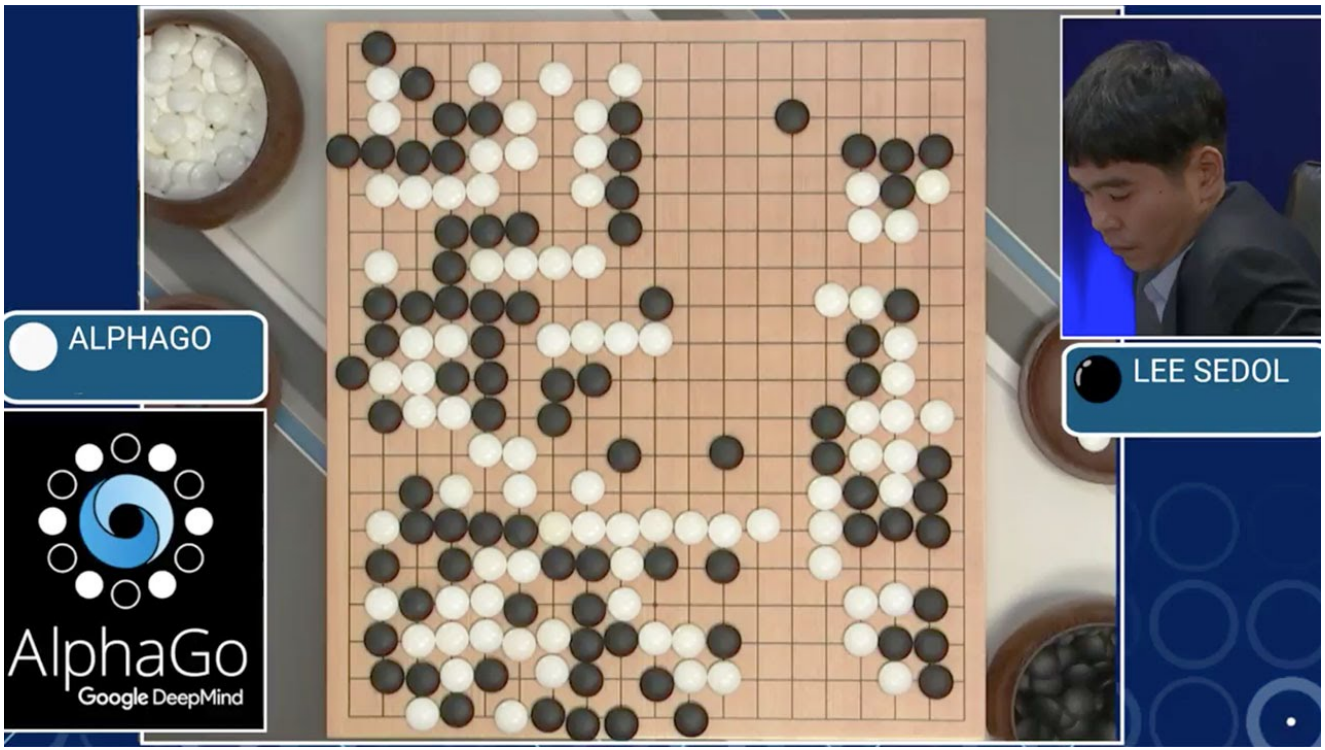


Figure: Google AlphaGo beat Go master Lee Sedol in 2016

Beat Humans in Go

Figure: Google AlphaGo beat Go world champion Ke Jie in 2017

Robotic Butlers

Figure: Savioke's robotic bulter in a hotel lobby

Autonomous Cars

Figure: Uber self-driving chauffeur

Fully Automated Agents!

Rosie in the Jetsons?

Terminator?

Autonomous Weapons

Figure: A petition started in 2015 to ban fully autonomous weapons[2]

[2] `https://futureoflife.org/open-letter-autonomous-weapons/`

Automated Manufacturing

Figure: Tesla's manless manufacturing plant

Economic vs. Employment

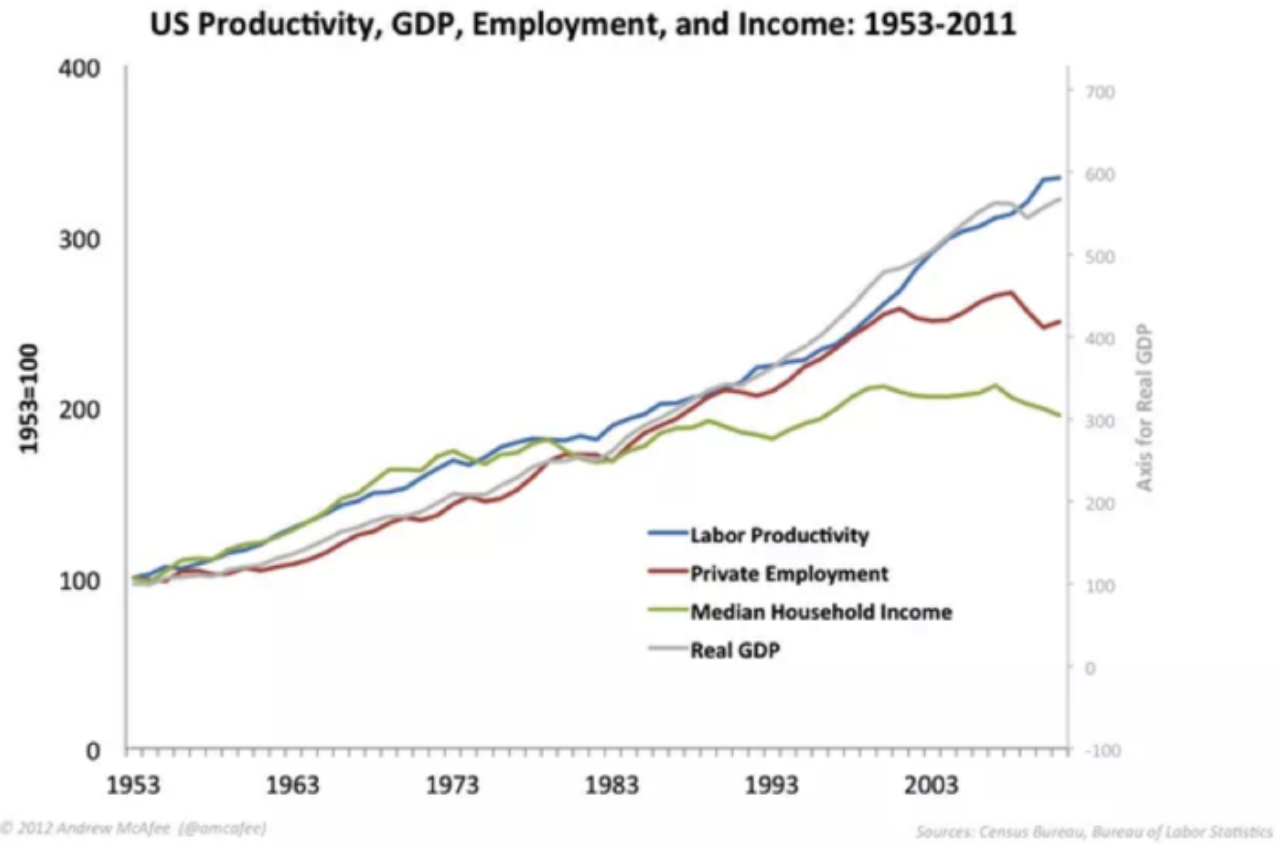


Figure: Automation has decoupled job creation from economic growth[3]

[3] Moshe Vardi, *Humans, Machines, and Work: The Future is Now*, `https://www.youtube.com/watch?v=5ThiClGEBes`