CZ3005: Artificial Intelligence

Introduction

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Research area: artificial intelligence, agent technology, modeling and engineering, games for education and for healthcare, software engineering and crowdsourcing, etc.

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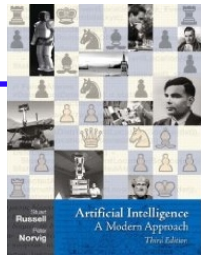
Course Matters



- Textbook: S. Russell and P. Norvig *Artificial Intelligence: A Modern Approach* Prentice Hall, 2010, Third Edition
- Grading:
  - Coursework (quiz/lab assignment) (40%)
  - Final exam (60%)
- During class: You may ask questions at any time
- After class: visit my office, schedule a meeting, email
- 2 Lab Sessions: Week 10/11; Week 12/13
  - TS5 is on week 9, 11 due to the public holiday on week 13

Schedule for the First Half

Week	Date	Lecture	Lecture Topic	Tutorial	Lab
1	January 9	1	Introduction		Starts from the week 10 in second half
	January 12	2	Intelligent Agents		
2	January 16	3	Intelligent Agents		
	January 19	4	Uninformed Search		
3	January 23	5	Uninformed Search	1	
	January 26	6	Informed Search		
4	January 30	Public Holiday - CNY		2	
	February 2	7	Informed Search		
5	February 6	8	Constraint Satisfaction	3	
	February 9	9	Constraint Satisfaction		
6	February 13	10	Game Playing	4	
	February 16	11	Game Playing		
7	February 20	E-learning			
	February 23	E-learning			
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Outline

- What is AI?
- A brief history
- The state of the art

CS and AI

- Computer science aims
  - to understand the physical and mathematical limits of computation
  - to improve the ways computers are applied
  - to develop programs for some tasks, e.g. "Hello World!“
- Artificial intelligence aims
  - to understand the mathematical and computational limits of intelligent behavior
  - to improve the ability of computers to behave intelligently
  - to develop programs that behave like a human, e.g. a program can write other programs

What is AI?

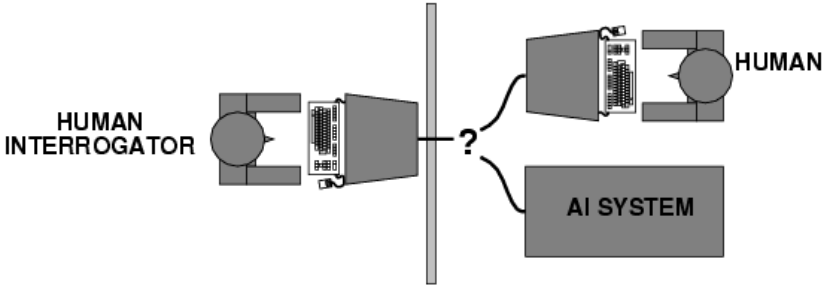
Views of AI fall into four categories:

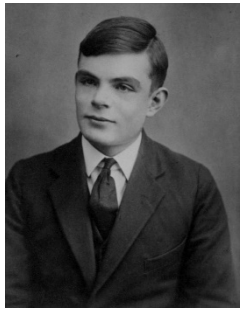
Thinking Humanly	Thinking Rationally
Acting Humanly	Acting Rationally

The textbook advocates "acting rationally"

Acting humanly: Turing Test

- Turing (1950) "Computing machinery and intelligence":
- Operational test for intelligent behavior: the Imitation Game





- Suggested major components of AI: knowledge, reasoning, language understanding, learning
- Can Siri Pass The Turing Test?
  - https://www.youtube.com/watch?v=0qcHhBSbyVw

Thinking humanly: cognitive modeling

- 1960s "cognitive revolution": information-processing psychology
- Requires scientific theories of internal activities of the brain
- Both approaches (Cognitive Science and Cognitive Neuroscience) are now distinct from AI

Thinking rationally: "laws of thought"

- Aristotle: what are correct arguments/thought processes?
  - Several Greek schools developed various forms of logic: notation and rules of derivation for thoughts; may or may not have proceeded to the idea of mechanization
- Direct line through mathematics and philosophy to modern AI
- Problems:
  - Not all intelligent behavior is mediated by logical deliberation
  - What is the purpose of thinking? What thoughts should I have?

Acting rationally: rational agents

- Rational behavior: doing the right thing
- The right thing: that which is expected to maximize goal achievement, given the available information
- This course is about designing rational agents
- For any given class of environments and tasks, we seek the agent(s) with the best performance

AI prehistory

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
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, grammar

Abridged history of AI

1943	McCulloch & Pitts: Boolean circuit model of brain
1950	Turing's "Computing Machinery and Intelligence“
1956	Dartmouth meeting: "Artificial Intelligence" adopted
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, multi-agent systems

Computer Chess

Deep Blue VS Garry Kasparov

ENIAC
1946

Deep Blue
1997

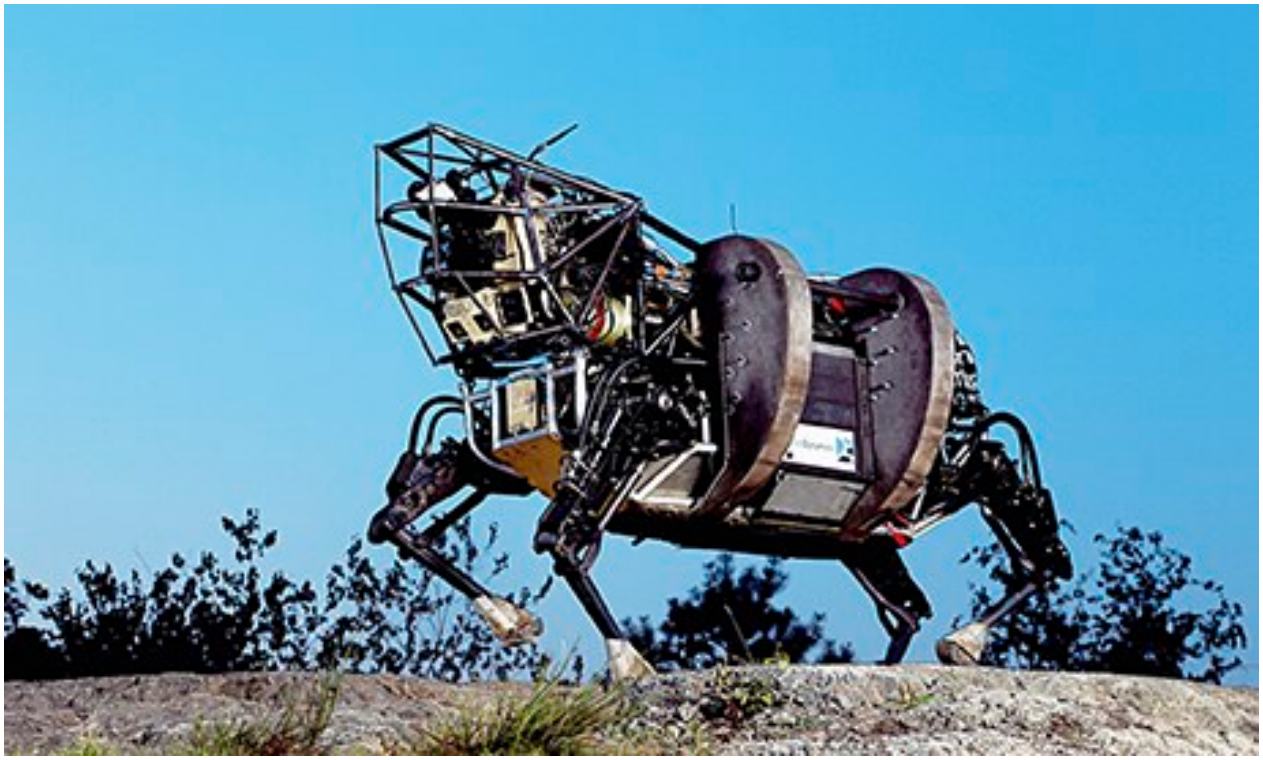
Google Driverless Car

TED talk by Sebastian Thrun from Stanford:
http://www.ted.com/talks/sebastian_thrun_google_s_driverless_car

IBM's Watson Destroys Humans in Jeopardy

https://www.youtube.com/watch?v=P18EdAKuC1U

Google's Robot Dog



https://www.youtube.com/watch?v=4NzcB6TMzjw

Robot Soccer

TED talk by Peter Stone from UT Austin:
http://www.youtube.com/watch?v=FXhw0_-iKwQ

AlphaGo vs World Champion (Lee Sedol 9-Dan)

March 9 – 15, 2016

- Time limit: 2 hours
- Venue: Seoul, Four Seasons Hotel

- AlphaGo Wins (4:1)