

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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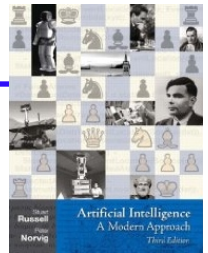
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Course Matters

- ❑ 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?

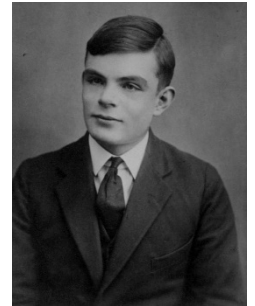
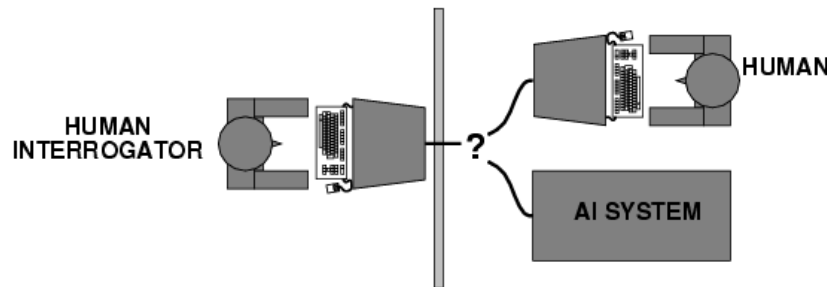
Views of AI fall into four categories:

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

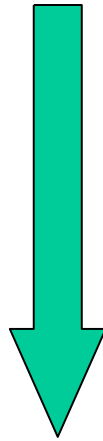
- ❑ 1943 McCulloch & Pitts: Boolean circuit model of brain
- ❑ 1950 Turing's "Computing Machinery and Intelligence"
- ❑ 1956 Dartmouth meeting: "Artificial Intelligence" adopted
- ❑ 1950s Early AI programs, including Samuel's checkers program, Newell & Simon's Logic Theorist, Gelernter's Geometry Engine
- ❑ 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



Deep Blue

This 1.4 ton
8-year-old sure
plays a mean
game of chess

Google Driverless Car



TED talk by Sebastian Thrun from Stanford:

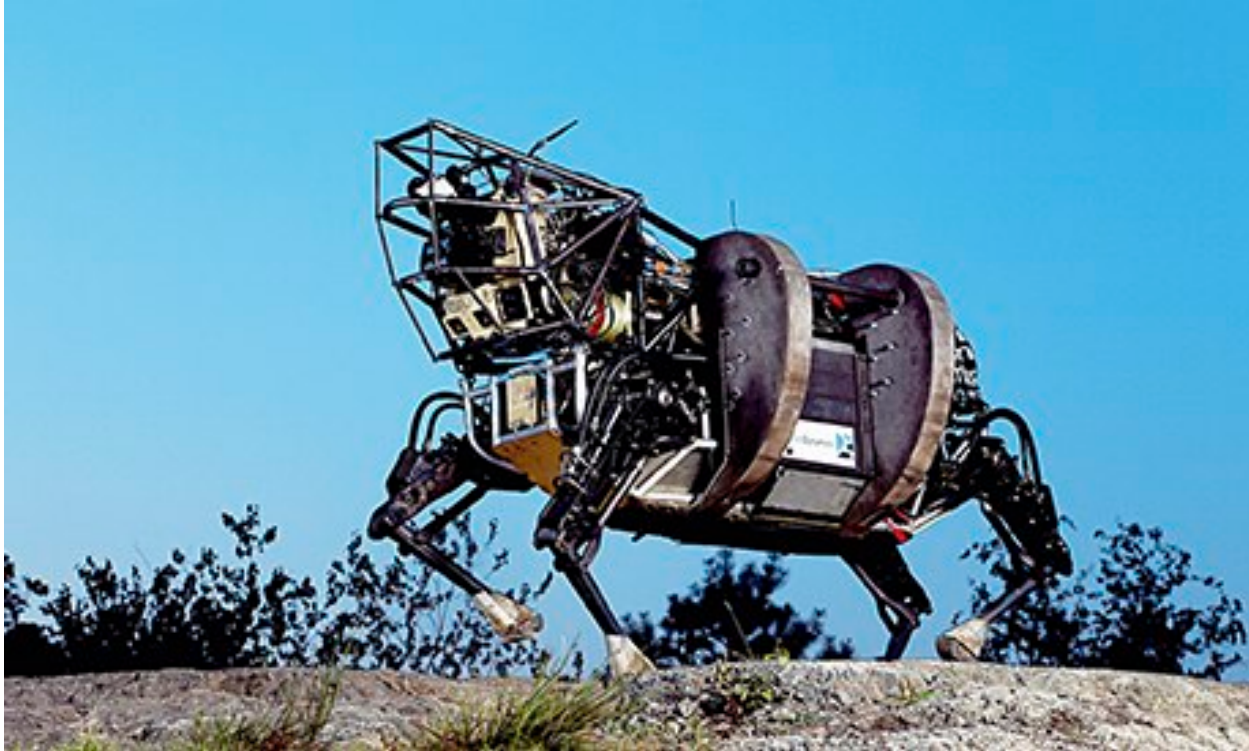
http://www.ted.com/talks/sebastian_thrun_google_s_driverless_car

IBM's Watson Destroys Humans in Jeopardy!



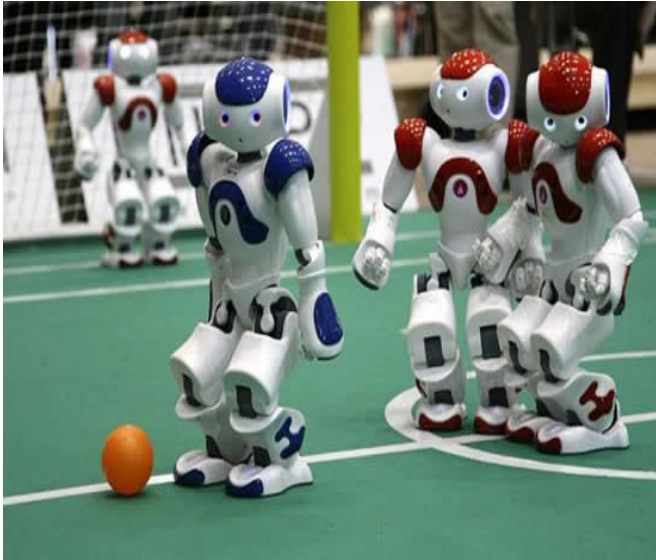
<https://www.youtube.com/watch?v=P18EdAKuC1U>

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)

