

CS440 - Introduction to Artificial Intelligence

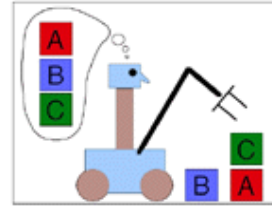
TURING TEST EXTRA CREDIT:
CONVINCE THE EXAMINER
THAT HE'S A COMPUTER.

YOU KNOW, YOU MAKE
SOME REALLY GOOD POINTS.

I'M ... NOT EVEN SURE
WHO I AM ANYMORE.

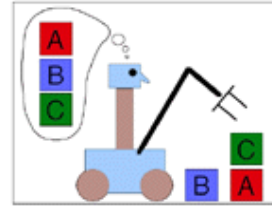


Course staff



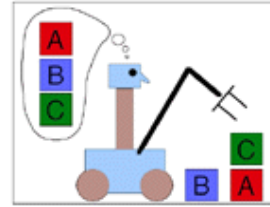
- Instructor: Hamidreza Chitsaz
 - Office: 342
 - Office Hours: Tue/Thu 11:00-noon
 - Email: chitsaz@colostate.edu
- Teaching Assistant:
 - Mohamed Chaabane

Course website



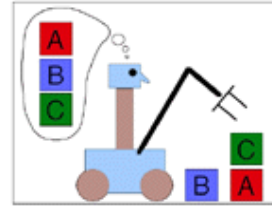
- Web Site: www.cs.colostate.edu/~cs440
- What you can find there:
 - All slides (hopefully before class so you can print and take notes on them)
 - All homework assignments
- Canvas

Workload



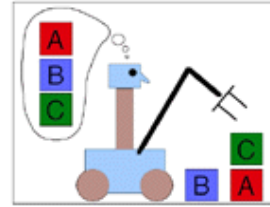
- Programming/written assignments (~6)
Language of your choice: Java/C++/Python
- Project
- Exams (midterm/final): take home exams

Grading



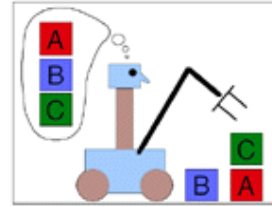
- Assignments: 40%
- Project: 25%
- Exams: midterm: 15%
final: 20%

Course Outline



- ❑ Search: How to explore the space of potential solutions to a problem.
- ❑ Logic: How to make inferences from stored/learned knowledge.
- ❑ Learning: How can a computer learn from data.
- ❑ + brief discussion of other topics

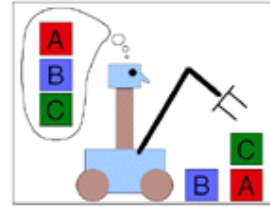
CSU AI Faculty



- Darrell Whitley
Genetic algorithms, search problems
- Ross Beveridge
Computer vision (face recognition)
- Bruce Draper
Computer vision (biologically inspired vision, action recognition, face recognition)
- Charles Anderson
Machine learning /
computational neuroscience
- Asa Ben-Hur
Machine learning in bioinformatics
- Hamidreza Chitsaz
Bioinformatics and robotics

What is Artificial Intelligence?


Press View



InfoWorld Home / Slideshows / 12 crackpot tech ideas that just might work

12 crackpot tech ideas that just might work

Artificial intelligence



©RYAN ETTER/JOHN ANANE-SEFAH

Artificial intelligence
Few terms carry as much baggage as artificial intelligence. And while sci-fi authors probe AI's metaphysical boundaries, researchers are producing worthwhile results. That said, AI itself remains elusive, and the measure of AI's position on the enterprise crackpot scale depends wholly on where you set the goals. With that in mind, expect the enterprise to benefit from similar AI-inspired advances in the very near future.

Related Links:
[Crackpot Tech blog post on artificial intelligence](#)

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February 19, 2007

THE MANY FACES OF GOOGLE | BusinessWeek

http://images.businessweek.com/ss/07/03/0329_google/source/9.htm

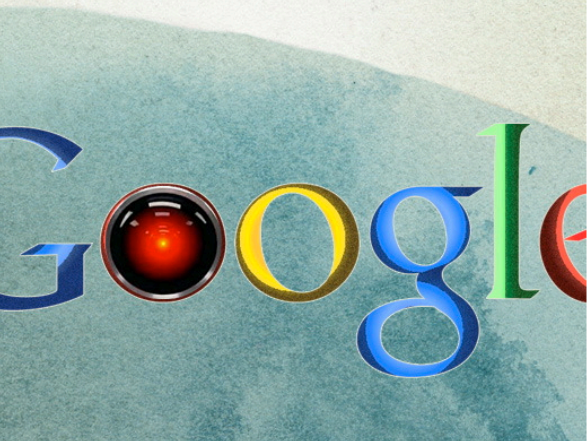
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INTERNET

Artificial Intelligence

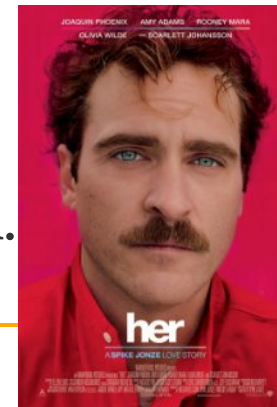
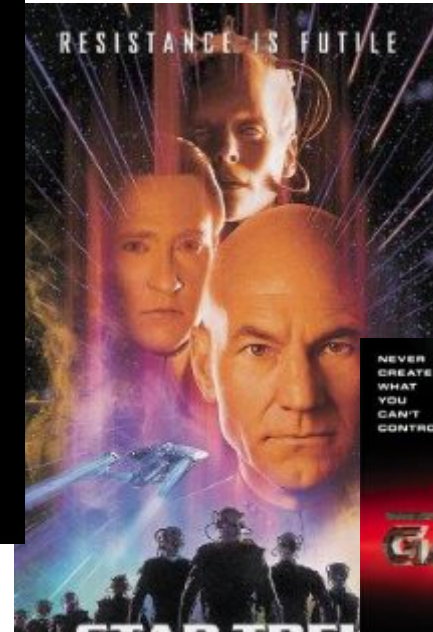
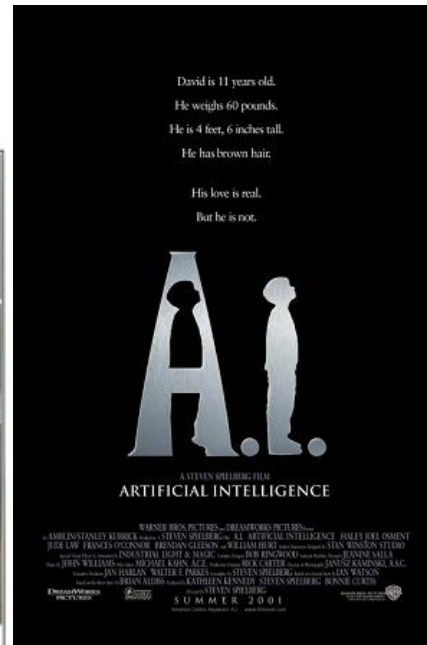
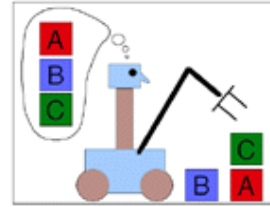
The Google Guys, co-founders Sergey Brin and Larry Page, have long said they envision Google's search engine ultimately becoming a real artificial intelligence, a thinking machine that could answer any question. To some people, this borders on creepy, evoking visions of the murderous computer HAL 9000 in the movie *2001: A Space Odyssey* or the Skynet AI in *The Terminator* that learned so much it decided that humans were a threat to its existence and had to be wiped out. More likely, Google will offer increasingly powerful AI techniques, already in primitive use when you misspell a query and Google asks, "Did you mean: query?"

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[Reader comments](#)
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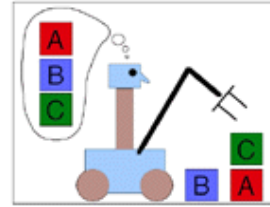
What is Artificial Intelligence?

Movie View



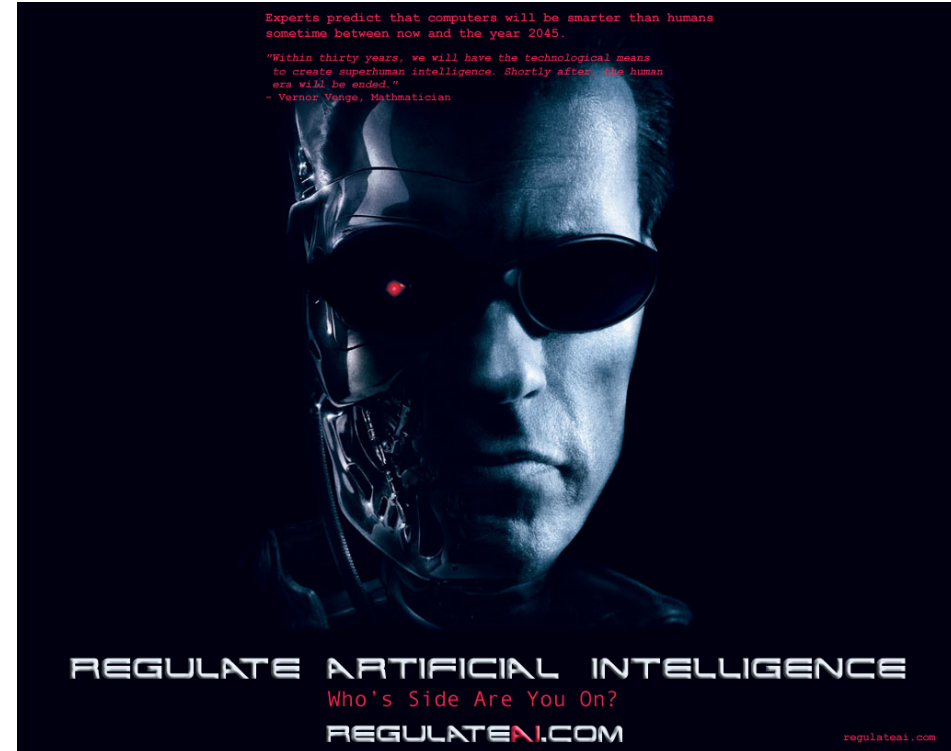
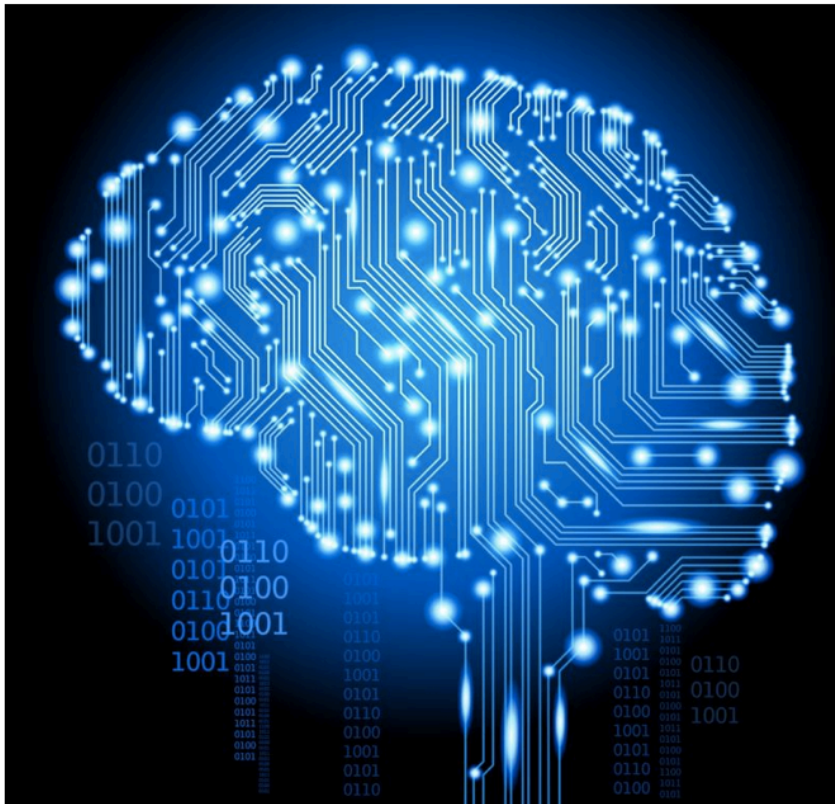
All images are movie posters taken from imdb.com.

What is Artificial Intelligence?



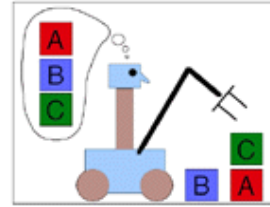
October 08, 2013

"Our Final Invention" --Will Artificial Intelligence End the Human Epoch?



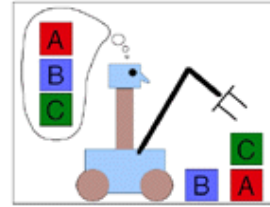
Within thirty years, we will have the technological means to create superhuman intelligence. Shortly after, the human era will be ended —"The Coming Technological Singularity" by Vernor Vinge, 1993

What is AI?

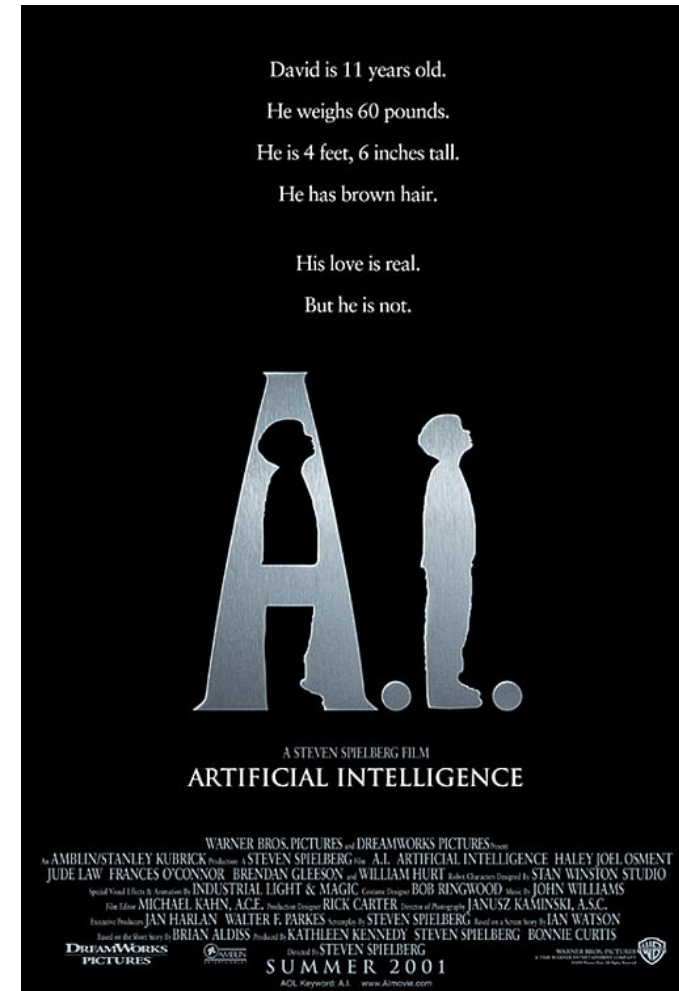


Let's explore some possible definitions.

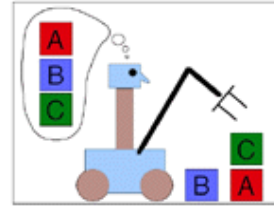
AI: Think Like Humans



- “The exciting new effort to make computers think ... machines with minds, in the full and literal sense”
Haugeland, 1985

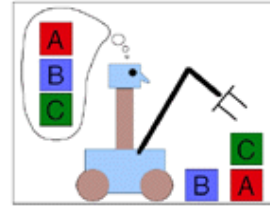


AI: Think Like Humans



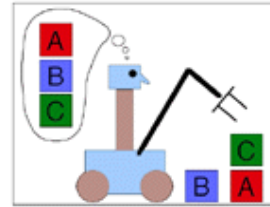
- How do humans think?
 - Requires understanding of brain activity (cognitive model).
- The available theories do not explain anything resembling human intelligence!

AI: Act Like Humans



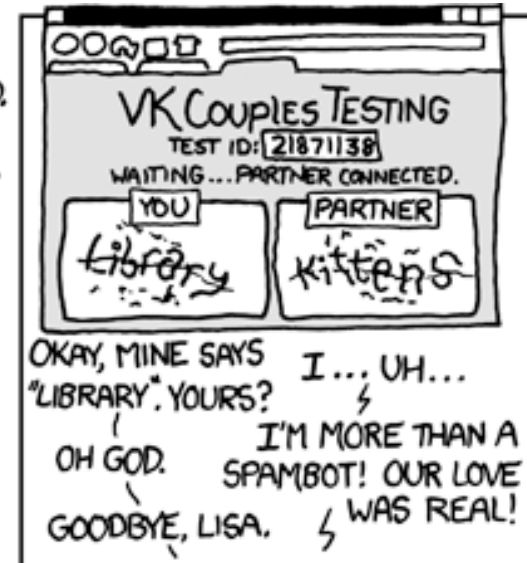
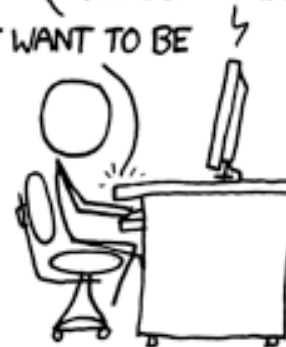
- “The art of creating machines that perform functions that require intelligence when performed by people” Kurzweil, 1990

The Turing Test

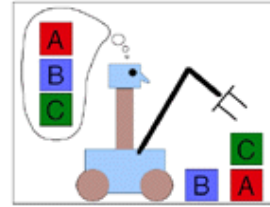


BEFORE THIS GOES ANY FURTHER, I THINK WE SHOULD GO GET TESTED. YOU KNOW, TOGETHER.

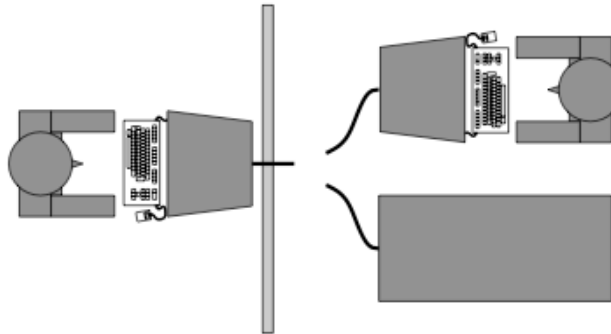
YOU DON'T TRUST ME?
I JUST WANT TO BE SURE.



The Turing Test

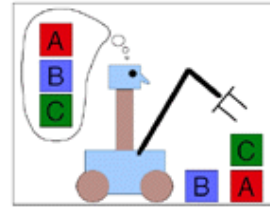


- When does a system behave intelligently?
 - Turing (1950) *Computing Machinery and Intelligence*
 - Operational test of intelligence.

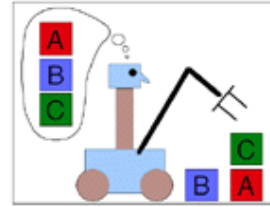


- Requires the successful application of major fields of AI: knowledge representation, reasoning, natural language processing, machine learning

IBM's Watson

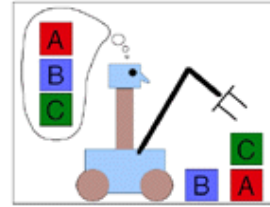


AI: Think Rationally



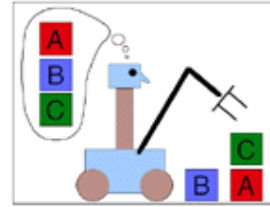
- “The study of the computations that make it possible to perceive, reason, and act.”
Winston 1992

Thinking rationally



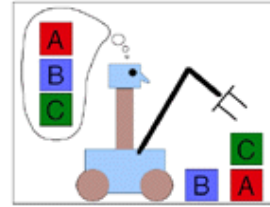
- Rationality as captured by logic.
- Problems:
 - Not all intelligent behavior is mediated by logical deliberation
 - What is the purpose of thinking? What thoughts should I (bother to) have?

AI: Acting Rationally



- “A field of study that seeks to explain and emulate intelligent behavior in terms of computation processes” Schalkoff, 1990
- “The branch of computer science that is concerned with the automation of intelligent behavior” Luger and Stubblefield
- Rational behavior: *doing the right thing*
 - The “right thing” is that which is expected to maximize goal given the available information.
- Our focus: rational agents, and how to construct them.

What is AI?

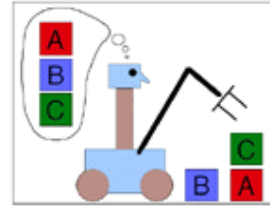


Definitions of artificial intelligence:

Systems that think like humans	Systems that think rationally
Systems that act like humans	Systems that act rationally

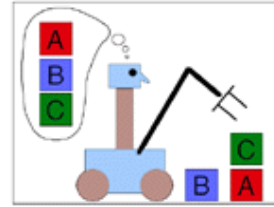
- The definitions vary by:
 - Thought processes vs. action
 - Judged according to human standards vs. success according to an ideal concept of intelligence.

Tools



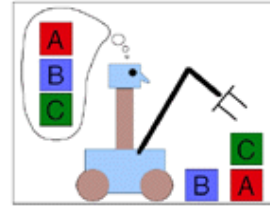
- Lisp
 - The traditional AI language
- Python
 - More common in AI research these days
- Prolog
 - Logic programming: fundamentally different!

Application areas



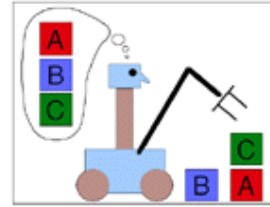
- Planning: What to do when.
- Computer vision: Seeing is knowing.
- Speech recognition: What words are spoken.
- Natural language processing (NLP): What do the words mean.

AI is pervasive in our everyday lives

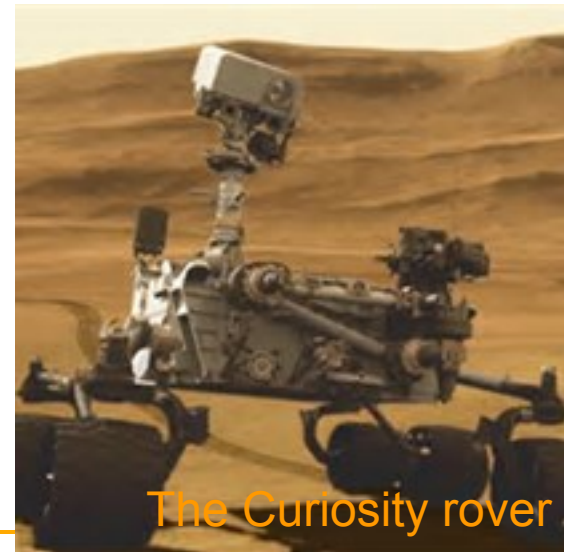


1. Check email [*spam filter, security agent*]
2. Read news [*personalized information agent*]
3. Drive to work [*traffic light control, collision avoidance, route planning*]
4. Teach [*search engine*]
5. Work on research projects [*search engine*]
6. Go grocery shopping [*market basket analysis, fraud detection*]
7. Talk with customer service [*voice recognition*]
8. Have dinner [*search engine*]
9. Watch video [*collaborative filtering*]

AI Systems: Some Milestones



- Deep Space 1: AI planner controls space probe - NASA 1999.
- Deep Blue: Defeats Kasparov, Chess Grand Master - IBM 1997
- DARPA grand challenge 2005: 130 mile race of driverless cars in the desert.
- Curiosity Mars rover 2012



The google driverless car

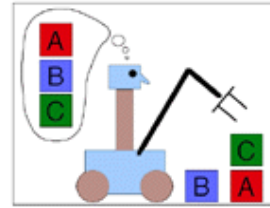
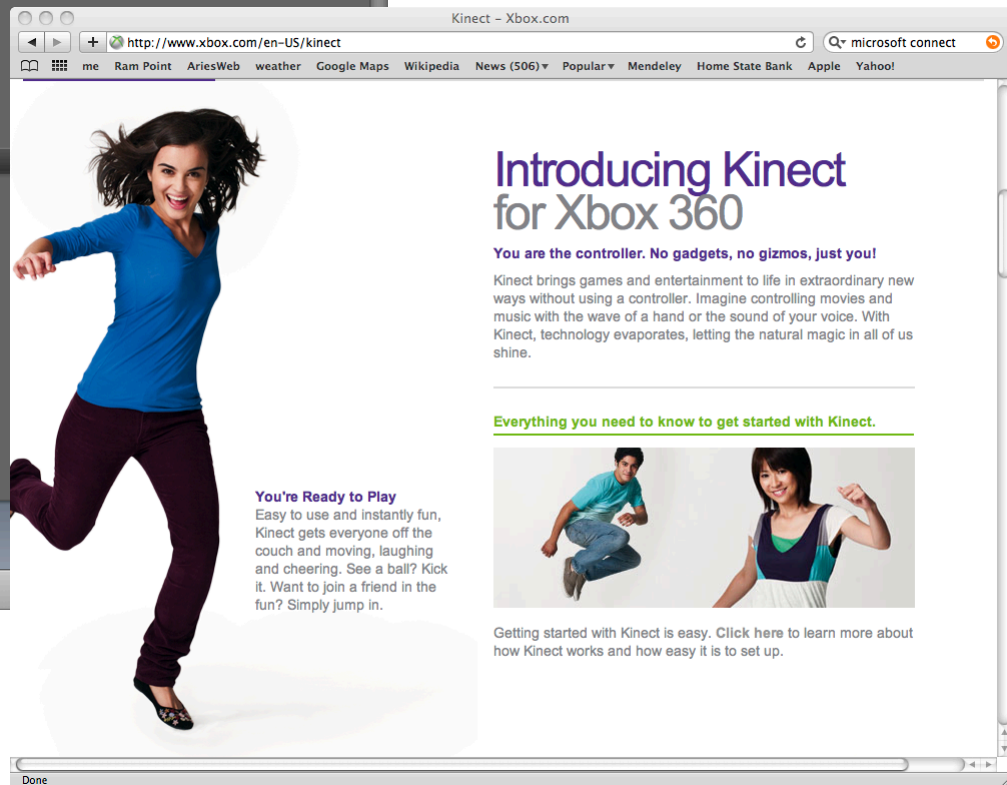
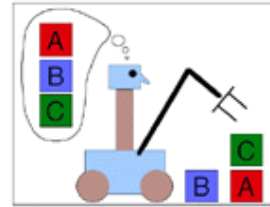
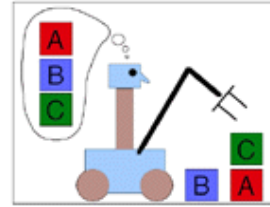


Image from http://en.wikipedia.org/wiki/Google_driverless_car

AI Technologies: Computer Vision



AI Technologies: Natural Language Understanding



Siri. Sports. Restaurants. Movies.
Now ask even more of Siri.

With iOS 6, Siri understands more languages and works in more countries.² So you can get more things done in more places around the world. Want to know the latest scores and stats for your favorite teams and players? Thanks to iOS 6, Siri knows the answers. Or maybe it's movie night. Siri can show you the latest reviews and showtimes. Find the best restaurants in town and make reservations. Even have Siri open your apps for you — no tapping required. Say "Launch Flight Tracker" or "Open Angry Birds" and Siri does just that. You can also use Siri to post Facebook updates and tweet for you. [Learn more about Siri](#) ▶



AI Technologies: Robotics

Boston Dynamics
DARPA challenge



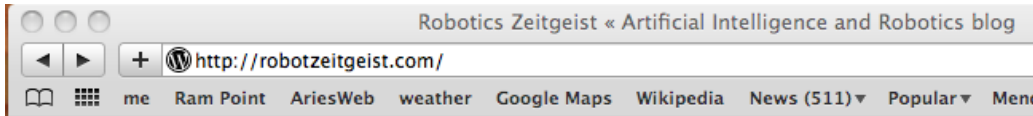
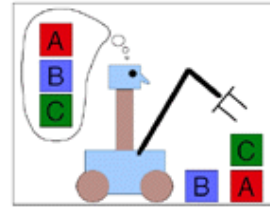
Texas A&M

Search and rescue



MBARI Fish tracking

AI in Medicine



The first-ever all-robotic surgery

OCT 25TH

Posted by [Rossum](#) in [Robotics](#)



It's been coming for quite some time now, and it's finally here. The world's first all-robotic a Canadian man at Montreal General Hospital, who had his prostate successfully removed. performed by two main robots – McSleepy, which, as the name suggests, provides anesthetic. The [DaVinci system](#) uses tools and performs movements way too delicate for any human to



oncotype DX[®]
Breast Cancer Assay

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PATIENTS & CAREGIVERS

HEALTHCARE PROFESSIONALS

MANAGED CARE ORGANIZATIONS

CUSTOMER SUPPORT



The **Oncotype DX[®]** Breast Cancer Assay helps you find an answer

oncotype DX[®]
Breast Cancer Assay
© 2010 Genomic Health, Inc.

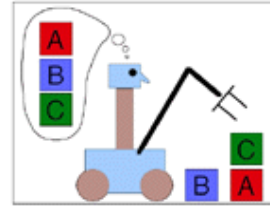
Patients & Caregivers
Is the Oncotype DX test right for you?

Professional Guidelines
ASCO and NCCN guidelines include recommendations for Oncotype DX assay usage.

Video
A complete step-by-step introduction to the Oncotype DX assay.

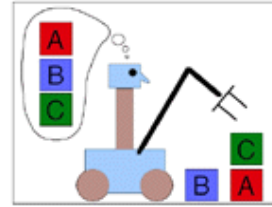
www.UntilEveryWomanKnows.com
pass it on
until every woman knows
...About Personalized Breast Cancer Treatment

Foundations of AI



- **Philosophy:** Logic, reasoning, rationality.
- **Mathematics:** Logic, computability, tractability
- **Psychology:** understanding how humans think and act.
- **Neuroscience:** how do brains process information?
- **Economics:** theory of rational decisions, game theory.
- **Computer Engineering:** building the hardware and software that make AI
- **Linguistics:** how to deal with language
- ...

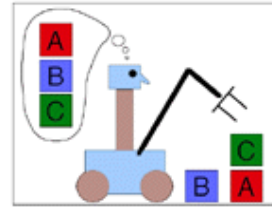
Beware of combinatorics!



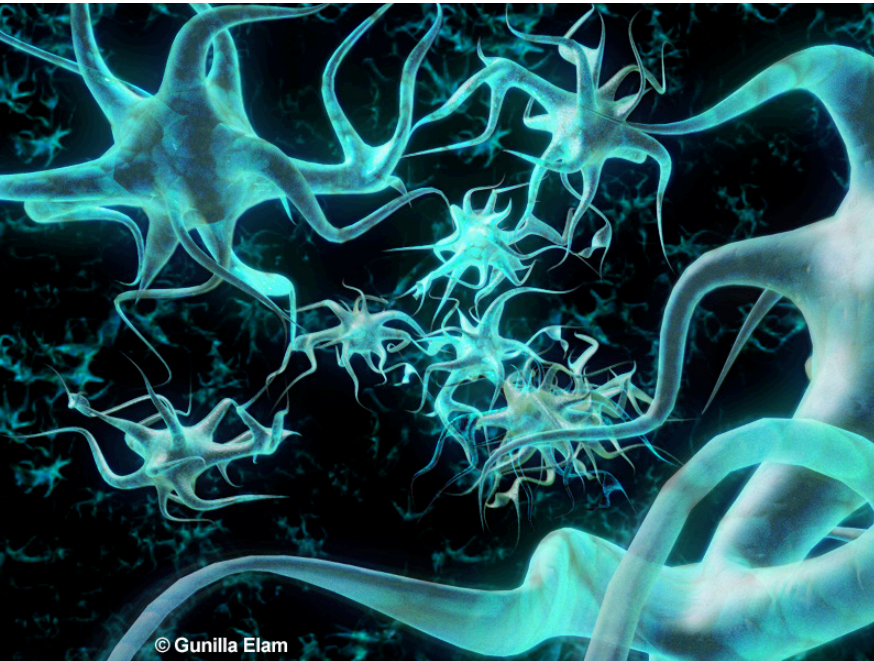
- “Solvable in Principle”: little help in practice
- Beware of intractability...
 - Considering all possibilities often leads to correct, but intractable, algorithms.
 - Intractable means exponential time to solution.
- NP-Complete Problems
 - Class of intractable problems

One View: AI proposes imperfect, but practical, algorithms to solve NP-Complete problems.

Foundations of AI: Neuroscience

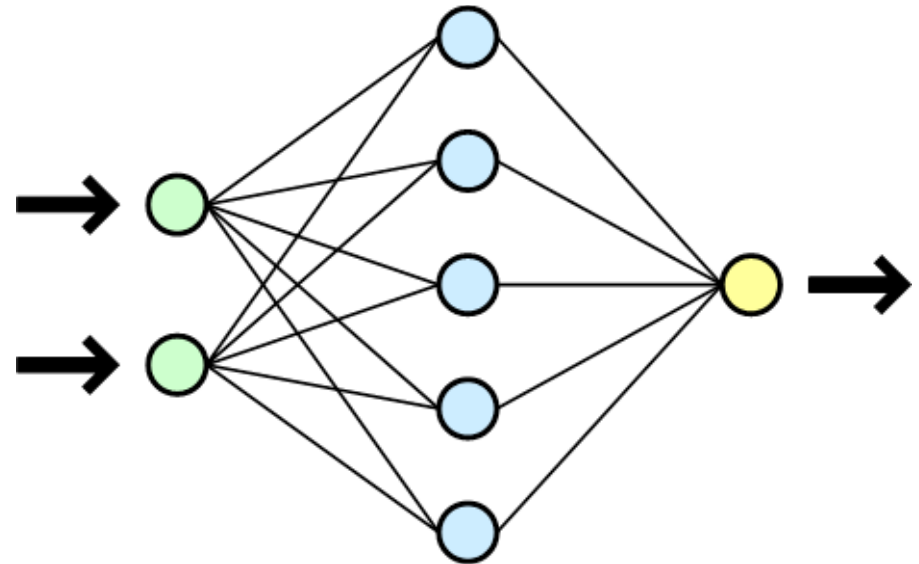


Use ideas from neuroscience to design computer architectures that “learn”.



Artist's depiction of a neural network

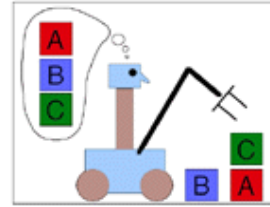
<http://www.bitspin.net/images/neuron.jpg>



Abstraction as an artificial neural network

http://en.wikipedia.org/wiki/Neural_network

Primary Areas of AI



- Knowledge Representation
- Automated Reasoning
- Game Playing
- Planning
- Machine Learning
- Search and Optimization
- Computer Vision
- Robotics
- Natural Language Processing