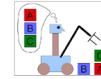
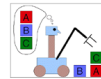


CS440 - Introduction to Artificial Intelligence

1



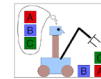
2



Course staff

- Instructor: Adele Howe
 - Office: 446
 - Office Hours: TBD, or by appt.
 - Email: howe@colostate.edu
 - Teaching Assistant:
 - Ali Ebrahimpour
-

3



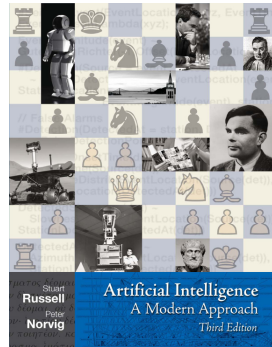
Course website

- Web Site: www.cs.colostate.edu/~cs440
 - All slides (after or shortly before class)
 - All homework assignments
 - Important announcements
 - Resources for additional information
 - Canvas:
 - Grades
 - Assignment submission
 - Exams
 - Discussion board: clarifications and changes to assignments will be posted there
-

4

Textbook

- Textbook: S. Russell and P. Norvig. *Artificial Intelligence: A Modern Approach*. Prentice Hall, 2010, 3rd edition.



5

Work Expectations

- Written/programming assignments (5-6): 40%
- Project: 21%
- Exams (2 midterms, one during finals week): 35%
- Participation: 4 %
 - non-trivial asking/answering questions during lecture, office hours and posting to the discussion board
 - Some evidence at least every 2 weeks gets you 80 on this category

6

Professionalism Expectations

- Academic integrity
 - This course carefully follows CSU's policies.
 - Your assignments and exams must be your own work. Your project must be the work of you and your partner.
 - If you have questions about what is acceptable, please ask!
- Professional conduct
 - See syllabus for links
 - Strive to behave in a professional manner at all times and to promote an atmosphere conducive to learning

7

Tools

- Languages
 - Python: Interactive, newer language that is actively used in AI – will be required for programming assignments
 - C, C++, Java, Prolog, Lisp...
 - Specialized languages: R, PDDL...
- Myriad software packages for ML, NLP, Planning, etc.

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- 9

- 10

February 19, 2007

[illegible]

All images are movie posters taken from imdb.com.

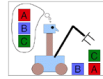
What is Artificial Intelligence?

Definition

- "the scientific understanding of the mechanisms underlying thought and intelligent behavior and their embodiment in machines."

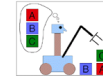
Association for the Advancement of Artificial Intelligence
(www.aaai.org)

- Interdisciplinary field with connections to computer science, mathematics, psychology, engineering, linguistics, economics, statistics, philosophy, neuroscience, physics, operations research, biology...



AI: Thinking rationally

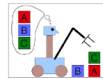
- The logicist approach.
 - Logic: notation and rules of derivation for thoughts
- Problems:
 - Not all intelligent behavior is mediated by logical deliberation
 - What is the purpose of thinking? What thoughts should I (bother to) have?



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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.



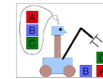
15

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: rationality.

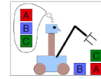


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What is Artificial Intelligence?

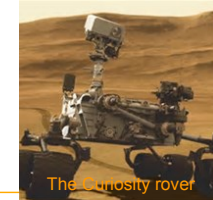
A Day in a Life

1. Wake up, get dressed, eat breakfast [*power optimization*]
2. Check email [*spam filter, security agent*]
3. Read news [*personalized presentation, information agent*]
4. Drive to work [*traffic light control, collision avoidance, route planning, GPS network maintenance*]
5. Teach and/or do service [*search engine*]
6. Work on research projects [*search engine*]
7. Meet with collaborators [*scheduling*]
8. Go grocery shopping [*data mining, machine learning, fraud detection*]
9. Have dinner [*search engine*]
10. Watch video [*collaborative filtering*]
11. Read [*collaborative filtering*]



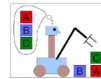
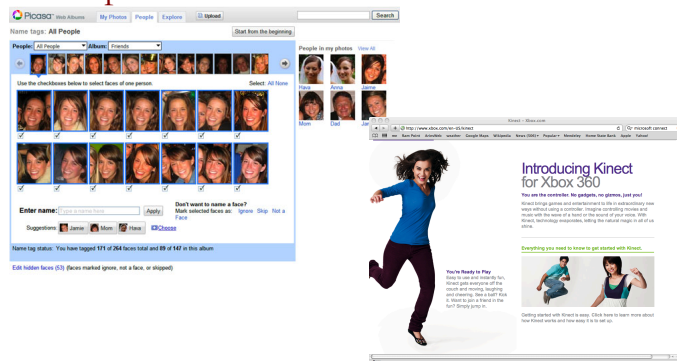
AI Systems: Some Past Milestones

- 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



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AI Technologies: Computer Vision

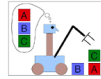


AI Technologies: Genetic Algorithms

"A genetic algorithm is any population-based model that uses selection, recombination and mutation operators to generate new sample points in a search space." *D. Whitley*



AI Technologies: Natural Language Understanding

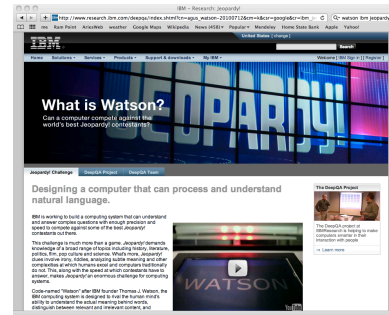
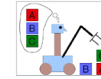


Siri. Sports. Restaurants. Movies.
Now ask even more of Siri.

With iOS 6, Siri understands more languages and works in more countries.¹ 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: NLP/Question answering, Game Players



<http://www.research.ibm.com/deepqa>

AI Technologies: Robotics

Boston Dynamics
DARPA challenge



Texas A&M

Search and rescue



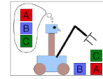
Amazon Warehouse robots

AI in Vehicles

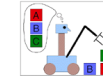
- Google/Tesla
automated driving
- Freightliner
automated trucks
- BMW, Infiniti,
Mercedes...
semi-automated



AI in Medicine



Mundane Versus Expert Tasks

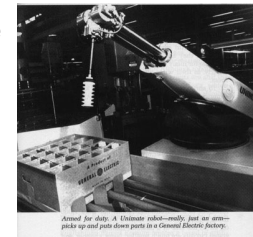


Mundane

- Identifying objects in an image
- Answering a question
- Picking up an arbitrary object

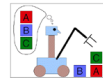
Expert

- Chess ✓
- Medical diagnosis ✓
- Configuring computer hardware (circuit layout) ✓
- Special purpose robots ✓



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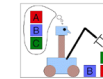
Foundations of AI



- 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
- ...

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Beware of combinatorics!

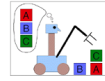


- “Solvable in Principle”: little help in practice
- Beware of intractability...
 - Considering all possibilities often leads to correct, but intractable, algorithms.
 - Intractable means exponential time to solution.
- NP-Complete Problems
 - Class of intractable problems

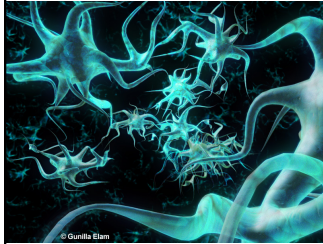
One View: AI proposes imperfect, but practical, algorithms to solve NP-Complete problems.

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Foundations of AI: Neuroscience

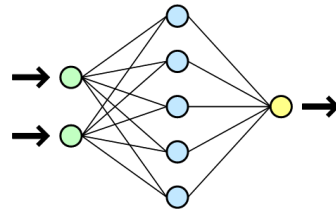


Use ideas from neuroscience to design computer architectures that “learn”.



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

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