CS 540 Intro to AI

section 2
1:00-2:15 Tue / Thur
Room 1325 CS&S

Administrative Details

- Lecturer: Louis Oliphant
  - Office: 5390 CS
  - Phone: 262-0018
  - Email: oliphant@cs.wisc.edu
  - Hours: TR 2:30 – 4:00 PM
- TA: Voon-Fee Yong
  - Office: 5364 CS
  - Email: yong@cs.wisc.edu
  - Hours: MW 2:00-3:00 PM

Administrative Details

- Mailing List
  - mailing list: compsci540-2-f05@wisc.edu
- Course home page:
  http://www.cs.wisc.edu/~cs540-2
- Textbook: S. Russell and P. Norvig
  Artificial Intelligence: A Modern Approach
  Prentice Hall, 2003, Second Edition

Administrative Details

- Prerequisites
  - CS302 or Java programming experience
  - CS367 or Data structures experience
- Grading
  - Homeworks ~45%
  - Project ~ 15%
  - Midterm ~ 15%
  - Final ~25%

Homeworks

- 5 homework assignments
- Written and programmed portions
  - Written handed in at beginning of class
  - Programs handed in electronically
  - Only turn in source code
- Programming in Java
- 3 late days to be used anytime throughout semester after that 10% off each day (max 3 days late on any assignment)
- Assignments are to be done individually
- Attend Unix orientation of you don't know Unix

Projects

- Do in groups of 3 to 4
- Dig deep into topic not covered in class
- Can involve programming + lab report (3 pages) or Written report (5 pages)
- 15 minute presentation at end of semester
- More on this later

Exams

- Midterm and Final
- Dates:
  - Midterm around Nov 1st 7:00-9:00pm
  - Final Dec 19th 10am-12noon
- If you have a conflict with these dates/times see me to reschedule

First Assignment

- Read Chapters 1 and 2 in Russell and Norvig
- Email me with the following info:
  - Name
  - Major
  - Year in school
  - Why you are taking the course
  - What you hope to get out of the course
  - A picture of yourself
    (use Camera Kiosk in room 1359 if needed)

Syllabus

- Week 1: - Intro to AI, Agents
- Week 2: - Uninformed Search
- Week 3: - Informed Search, Escaping Local Maxima
- Week 4: - Game Playing
- Week 5: - Logical Agents
- Week 6: - First Order Logic
- Week 7: - Inference in FOL, Prolog

----------Midterm----------

- Week 8: - Decision Trees
- Week 9: - Perceptron
- Week 10: - Neural Networks
- Week 11: - Uncertainty
- Week 12: - Bayesian Networks
- Week 13: - Markov Models
- Week 14: - Project Presentations
- Week 15: - Project Presentations/Conclusions

Introduction to Artificial Intelligence

- What is intelligence?
  - The capacity to acquire and apply knowledge.
  - The faculty of thought and reason.
  - The ability to learn or understand or to deal with new or trying situations.

Introduction to Artificial Intelligence

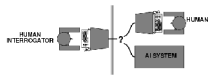
- What is Artificial Intelligence?

Thinking humanly	Thinking rationally
Acting humanly	Acting rationally

The textbook advocates "acting rationally"

Acting humanly: Turing Test

- Turing (1950) "Computing machinery and intelligence":
- "Can machines think?" → "Can machines behave intelligently?"
- Operational test for intelligent behavior: the Imitation Game



- Predicted that by 2000, a machine might have a 30% chance of fooling a lay person for 5 minutes
- Anticipated all major arguments against AI in following 50 years
- Suggested major components of AI: knowledge, reasoning, language understanding, learning
- Check out http://cogsci.ucsd.edu/~asaygin/tt/ttest.html

Thinking humanly: cognitive modeling

- 1960s "cognitive revolution": information-processing psychology
- Scientific theories of internal activities of brain
  - Validation Requires:
    - Predict and test behavior of humans (top-down)
    - Identification from neurological data (bottom-up)
- Both approaches, Cognitive Science and Cognitive Neuroscience, distinct from AI

Thinking rationally: "laws of thought"

- Aristotle: what are correct arguments/thought processes?
  "Socrates is a man"
  "All men are mortal"
  "Therefore Socrates is mortal"
- Logical systems developed for rational deduction and inference
  - syntax
  - semantics
- Problems
  - Not all intelligent behavior is mediated by logical deliberation
  - Big difference in solving problems "in theory" and in practice

Acting rationally: rational agent

- Rational behavior: doing the right thing
- The right thing: that which is expected to maximize goal achievement, given the available information
- Doesn't necessarily involve thinking – e.g., blinking reflex – but thinking should be in the service of rational action

AI prehistory

• Philosophy	syllogism, boolean logic, first order logic, induction
• Mathematics	Formal representation and proof algorithms, computation, (un)decidability, (in)tractability, probability
• Economics	utility, decision theory, game 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 if AI

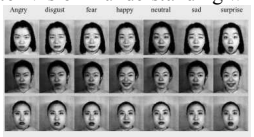
• 1943	McCulloch & Pitts: Boolean circuit model of brain
• 1950	Turing's "Computing Machinery and Intelligence"
• 1956	Dartmouth meeting: "Artificial Intelligence" adopted
• 1952—69	Look, Ma, no hands!
• 1950s	Early AI programs, including Samuel's checkers program, Newell & Simon's Logic Theorist, Gelernter's 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

Major Subdivisions of AI

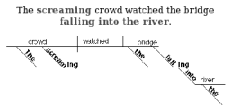
- Understanding
- Thinking
- Acting

AI: Understanding

- Computer Vision – understanding what you see



- Natural Language Processing – understanding the written (spoken) word



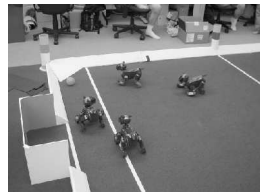
AI: Thinking

- Capturing Structure and Reaching Goals
  - Machine Learning
  - Planning
  - Clustering

AI: Acting

- Robotics

Mars Rover



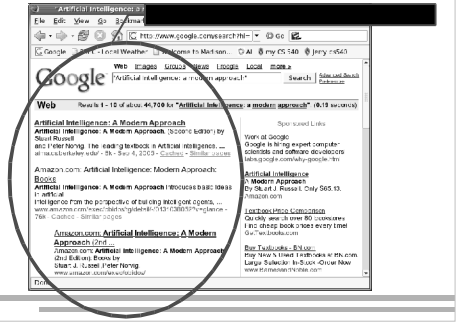
RoboSoccer

State of the art

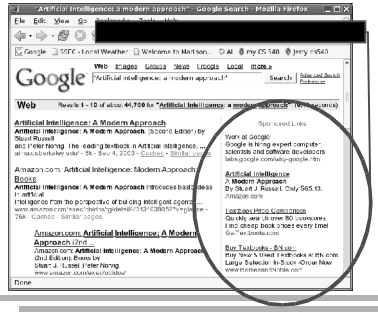
- Deep Blue defeated the reigning world chess champion Garry Kasparov in 1997
- No hands across America (driving autonomously 98% of the time from Pittsburgh to San Diego) http://www.cs.cmu.edu/afs/cs/user/tjochem/www/nhaa/nhaa_home_pa
- Logistics and planning of 1991 Gulf War involved up to 50,000 vehicles, cargo, and people
- NASA's on-board autonomous planning program controlled the scheduling of operations for a spacecraft: http://www.stsci.edu/hst/HST_overview/
- `Proverb` solves crossword puzzles better than most humans http://oneacross.com/, http://puzzles.usatoday.com/
- Recommendations at on-line shopping sites
- Just where are we now? http://www.captcha.net/

Consider AI use in one company

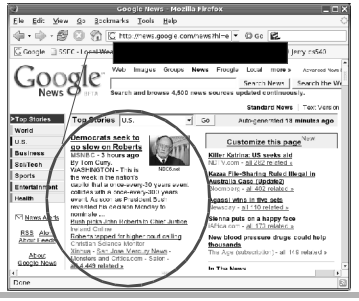
Search



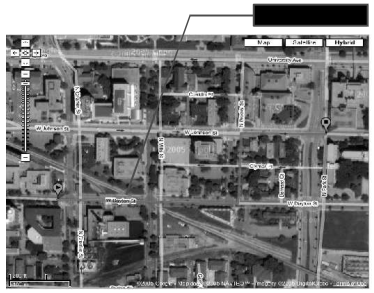
Sponsered Links



Google News



Google maps



Conclusions

- AI is big business
- Still can't do most things
- What it can do it does extremely well
- Major Subdivision of AI
  - vision and language
  - robotics
  - machine learning

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