

Artificial Intelligence

An Introductory Lecture
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Syllabus

- Lets go over the syllabus so that there are no misunderstandings
- grading
- academic integrity, etc.

Labs/projects

- There will be a significant lab/project component to this course
 - ┌ programming language
 - traditionally lisp
 - python as well in this class -will go over basics
 - ┌ Python canonical version – as on the machines here in the lab.
 - ┌ If it works here it works for grading
 - ┌ If it works at your house – I won't be coming for dinner.
 - c/c++/java much less suited to this sort of work
 - ┌ some perhaps later.

And now, AI

- A fun course in the program
 - ┌ maybe not as central as OS or Algos, but more fun

What is AI?

- The hardest question of the course
 - ┌ the field that focuses on getting computers to do things that only people are good at
 - a self defeating definition
 - but one often used
 - ┌ once an application is successfully deployed, often not considered AI any more
 - ┌ Corollary definitions:
 - a field devoted to exploring the cutting edge of what a computer can do
 - a field on the fringes of computer science (detractors version)

Als Place in Computer Science

- AI and AI researchers have made many contributions to computer science
 - ┌ and rely on many other disciplines as well
 - especially theory of computation
 - ┌ Contributions
 - “expert systems’
 - time shared operating systems
 - optimized search techniques
 - Machine learning
 - Pattern recognition
 - Data mining
 - Etc.

History of AI

- Early computers essentially used as calculators
 - ┌ and had far less capability than the average calculator today.
 - ┌ little expectation that they would do much more in the 1940s
 - ┌ “programmed” by adjusting the wiring on the “front panel”
 - ┌ As computers gained power (and computer scientists used a programming language rather than wire adjustments)
 - expectations grew for an intelligent program

AI officially begins

- Minsky/McCarthy organize the Dartmouth conference(1956)
 - ┌ Minsky → Ben Kuipers
 - ┌ McCarthy: AAAI/OOPSLA
 - ┌ 10 young turks got together for a summer of research.
 - ┌ got to know each other, show off what they were doing
 - ┌ Started the discipline.

Great Expectations

- At this point there were great expectations
 - ┌ Turing predicts intelligent conversing agent in another couple of decades
 - ┌ other elaborate predictions
 - ┌ robot in every home etc.
 - ┌ Didn't quite work out.
 - equipment getting faster,
 - what's going on?

Early successes

- Physical symbol system hypothesis
 - ┌ physical symbol system has necessary and sufficient means for general intelligent action
- chess and checkers playing programs
 - ┌ search
- LISP (1958)
- logic theorem provers
- micro world problems
 - ┌ blocks world.
- early neural nets

Then reality set in

- Wait, you mean for more than limited success the program needs to know something about its domain?
- Scaling up
 - ┌ P vs NP
 - ┌ NP-Complete
 - ┌ Exponential algorithms etc

And so knowledge systems ruled

- Neural nets disappeared
 - ┌ two level nets had limited representational power (proved) – got ignored
- Knowledge systems thrived
- By mid 1980s
 - ┌ large “expert systems” full of rules were being deployed in industry.
 - ┌ Now many/most industries use AI tech (or tech once considered AI
 - some results better than others

Sometimes I just popup for no particular reason, like now.



The pendulum swings

- By the late 1980s non-logic/knowledge techniques were back with a vengeance
 - ┌ Neural nets were huge again
 - multi-level this time
 - ┌ Computational vision was a big thing
 - ┌ Rod Brooks telling everyone who would listen that reactive robots were the way to go and knowledge was useless.

More Swinging

- By Late 90's early 2000 knowledge based systems were doing fine
- Today statistical methods have once again pushed out knowledge based systems
- In 15 more years??

And now

- AI has become an established scientific branch of CS
 - ┌ hypothesize and prove theory holds in exemplar programs
 - rather than “hey look what I made the computer do”
- AI embraces wide variety of techniques
 - ┌ different techniques often used together at different levels of large AI systems.
 - Though statistical systems are currently the getting all the good press.

Early idea about AI

- Turing (1950) "Computing machinery and intelligence":
 - "Can machines think?" → "Can machines behave intelligently?"
 - Operational test for intelligent behavior: the Imitation Game
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- 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
 - ┌ Discuss turing test and Loebner Prize.
 - ┌ eliza program.
 - ┌ Of course many people looking for refresh of this test

Cognitive AI

- 1960s "cognitive revolution": information-processing psychology
- Requires scientific theories of internal activities of the brain
- -- How to validate? Requires
 - 1) Predicting and testing behavior of human subjects (top-down)
 - or 2) Direct identification from neurological data (bottom-up)
- Both approaches (roughly, Cognitive Science and Cognitive Neuroscience)
- are now distinct from AI

Rational Action

- **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
- in service of intelligent agents. Some rational behavior not intelligent, for harder problems it is.

Assignment

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- How many people know python?
- Learn it if not.
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