

Artificial Intelligence

Context for AI
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Agenda

- Course overview
- What is AI?
- Approaches

Course Overview

- tigerram.com/cosc/418/
- AI/MA Russell and Norvig
- Agents, advanced search techniques, constraint satisfaction, logic, knowledge representation and reasoning, possibly VR/avatars, philosophical issues
- Primarily *symbolic* approach

Artificial Intelligence

- A field devoted to building intelligent agents
- Foundations in philosophy, mathematics, psychology, linguistics
- Connections to cognitive science, cognitive neuroscience

Foundations

- Philosophy
- Mathematics
- Psychology
- Computer engineering
- Linguistics

Philosophy

- Socrates-Plato-Aristotle
- Dualism (Descartes)
- Materialism (Leibniz)
- Empiricism (Bacon, Locke)

Mathematics

- Syntax of formal logic (Boole, Frege)
- Semantics of formal logic (Tarski)

Psychology

- Cognitive Science (top-down, prediction of human behavior)
- Cognitive Neuroscience (bottom-up, based on neural data, e.g., architecture and function)

Linguistics

- Panini (350 BC): one of the earliest recorded analytical descriptions of a language
- Plato (in Cratylus): relationship between language and reality -- conventionalism & naturalism
- Chomsky -- formal properties of languages

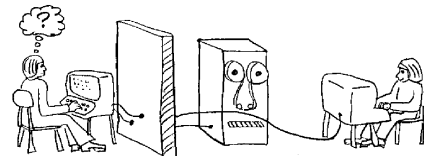
Intelligence

- Hard to evaluate!
 - Perception
 - Consciousness
 - Judgment
- P+C = Sentience
- P+C+J = Sapience

Characteristics of Intelligence

- Ability to Communicate
- Creativity
- Internal Knowledge
- Ability to Learn
- World Knowledge
- Goal-Directed Behavior
- Self Awareness

Turing Test (1950)



AI Fields

- Agents
- Search methods
- Game theory
- Knowledge representation
- Communication

Searching

- Degrees of intelligence
- Size of KB
- Use of heuristics

Games

- Simple models are useful for exploring complex problems
- Checkers, Chess, Go

Communication

- With human users
- With other agents
- With electronic sources/DB's

What sorts of issues will we consider?

<p>Technical How do we build intelligent systems?</p>	<p>Philosophical Can they think? Are they alive?</p>
<p>Ethical Who is responsible for their behavior? How do we make sure they do no harm?</p>	<p>Religious How does this impact our understanding of ourselves?</p>

Textbook Questions

- “Surely computers cannot be intelligent—they can only do what their programmers tell them.” Is the latter statement true and does it entail the former?
- “Surely animals cannot be intelligent—they can only do what their genes tell them.” Is the latter statement true and does it entail the former?

AI Applications

- Expert Systems
- Robotics
- NLP
- Intelligent Tutorials
- Computer vision
- Virtual reality
- Augmented reality
- Virtual telepresence
- Game playing
- Intelligence Amplification
- Automatic programming
- Simulation
- Real-time planning
- Adaptive systems
- Autonomous systems
- Biometric security

AI Techniques

- Statistical / Stochastic / Probabilistic
 - Fuzzy logic, genetic algorithms, neural networks
- Symbolic
 - Knowledge representation and reasoning,

Undecidable

- “In any language expressive enough to describe properties of natural numbers there are true statements whose truth cannot be established by any algorithm.”

Intractable

- “A class of problems is called intractable if the time required to solve instances of of the class grows at least exponentially with the size of the instances.”