

Introduction

CS 486/686: Introduction to Artificial Intelligence

Outline

- Course administration
- What is AI? (Chapter 1)
 - Definitions
 - History
 - What we will cover
- Rational Agents (Chapter 2)

Course Administration

- CS 486/686: Introduction to Artificial Intelligence
 - MC 2054 Mon/Wed 11:30-12:50 (Sec 2)
 - MC 2054 Mon/Wed 4:00-5:20 (Sec 1)
- Course Personnel:
 - Kate Larson (klarson@uwaterloo.ca)
 - Alan Tsang (akhtsang@uwaterloo.ca)
 - TAs: Ben Armstrong, Milad Khaki, Jonathan Perrie, Mike Schaeckermann, Zhucheng Tu, Ankit Vadehra, Jia Rong Wu

Course Administration

- Website:
 - <http://www.cs.uwaterloo.ca/~klarson/teaching/F17-486>
 - Learn
- Newsgroup:
 - We will be using Piazza for the newsgroup. Details on how to sign up are in the syllabus.
- Texts:
 - Artificial Intelligence: A Modern Approach by S. Russell and P. Norvig (3rd Edition)
 - Artificial Intelligence: Foundations of Computational Agents, D. Poole and A. Mackworth (available online)

Evaluation

CS 486

- 5 Assignments: 40%
- Midterm: 15% (Oct 18)
- Final: 45%
- Project (Optional): Up to 5 bonus marks

CS 686

- 5 Assignments: 30%
- Midterm: 10% (Oct 18)
- Final: 40%
- Project: 20%

Assignment Late Policy

- Assignments are due as announced
 - For each assignment, you can pass it in up to 48 hours late
 - No doctor's note required, etc
- **BUT**
 - No assignment will be accepted after the 48 hour grace period
 - No questions about the assignment will be answered during the 48 hour period

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 - Definitions
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- Rational Agents (Chapter 2 R&N)

What is AI?

- According to media/popular perception
- Something that is changing the world somehow??
- “When Robots Attack”
- ...



What is AI?

- Definition of AI differ along two dimensions
 - Reasoning vs behaviour
 - Fidelity to human behaviour vs rationality

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

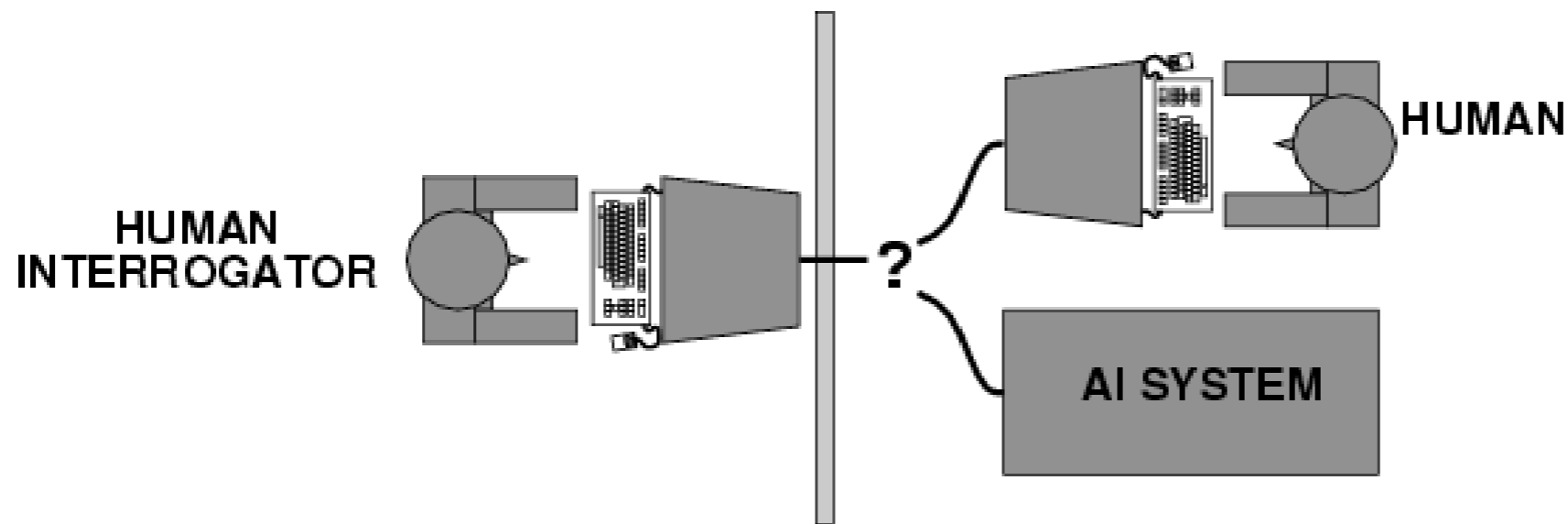
What are the Goals of AI?

- AI is about duplicating what the (human) brain **DOES**
 - Turing Test

- AI is about duplicating what the human brain **SHOULD DO**
 - Rationality

Behaving Like a Human

- Alan Turing (1950) “Computing machinery and intelligence”

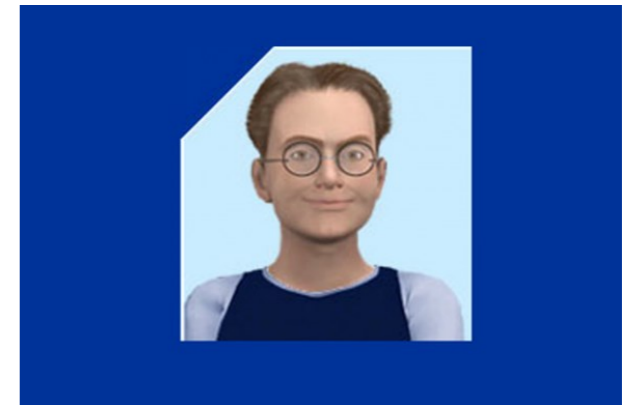


Computing Machinery and Intelligence

- Predicted that by 2000 a computer would have a 30% chance of fooling a lay person for 5 minutes
- Anticipated all major arguments against AI
- Suggested major components of AI:
 - Knowledge, Reasoning, Language Understanding, Learning

The Turing Test

- The test is still relevant today
 - The Loebner Prize
 - “Eugene Goostman”
- However,
 - It is not reproducible or amenable to mathematical analysis
 - More important to understand underlying principles of intelligence than copy them?



What are the Goals of AI?

- AI is about duplicating what the (human) brain **DOES**
 - Turing Test
- AI is about duplicating what the human brain **SHOULD DO**
 - **Rationality**

Rational Behaviour

Doing the Right Thing

- Doing what is expected to maximize goal achievement, given available information
- Does not *necessarily* require thinking
 - But thinking can help

Abridged History of AI

- 1943: McCulloch & Pitts: Boolean circuit of the brain
 - 1950: Turing's "Computing machinery and intelligence"
 - 1950s: Early AI Programs including Samuel's checkers, Newell and Simon's Logic Theorist
 - **1956: Dartmouth meeting: "Artificial Intelligence"**
 - 1966-1973: Problems with scalability, Perceptron paper
 - 1970s: Knowledge-based systems
 - 1980's: Expert-systems industry
 - 1988-now: Probabilistic and decision theoretic methods
 - Now- : Significant progress in machine learning and industry interest
- "The AI Winter"**

Classical AI

- Reasoning was seen as *THE* AI problem
 - Chess was considered pivotal to understanding intelligence
- Goal: General Problem Solver

Recent AI

- Focus on solving specific problems
- Heavy use of probability theory, decision theory, statistics,...
- Collection of subfields
 - Perception (including vision) is usually separate
 - Robotics is mostly separate
 - Deliberative reasoning is “AI”
 - But lots of different approaches

Course Contents

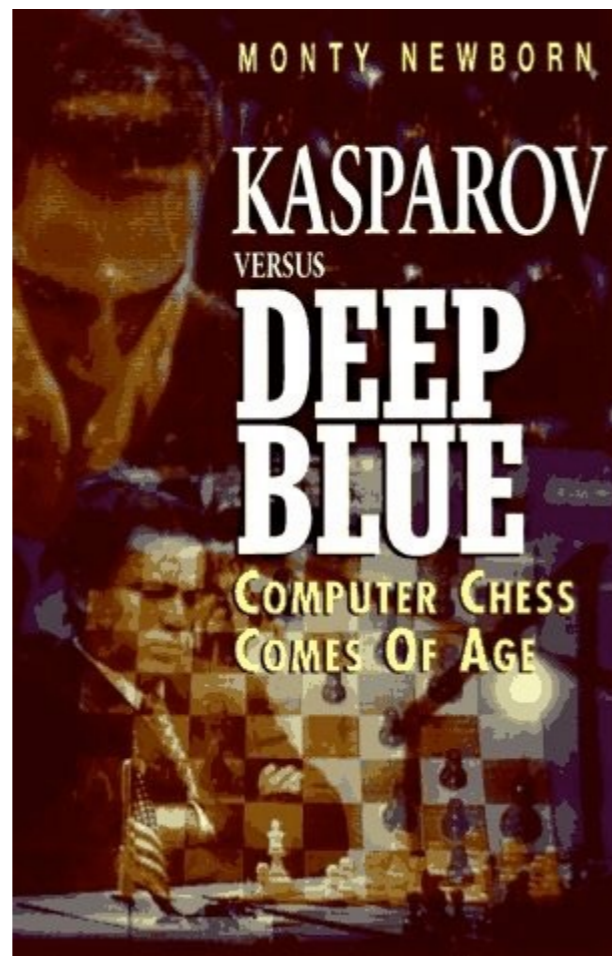
- Search
- Knowledge Representation and Reasoning
- Reasoning Under Uncertainty and Decision Making
- Learning

State of the Art

- Chess was **THE** AI challenge for decades

“I could feel – I could smell – a new kind of intelligence across the table”

-Gary Kasparov



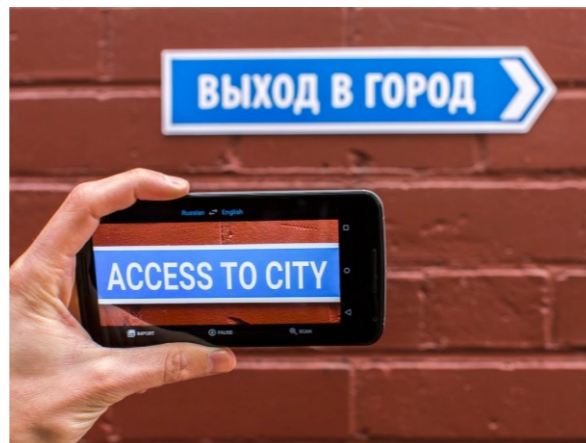
“Saying Deep Blue doesn’t really think about chess is like saying an airplane doesn’t really fly because it doesn’t flap its wings.”

- Drew McDermott

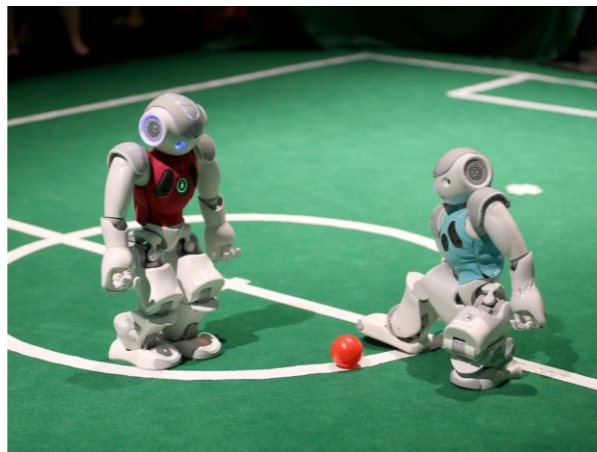
State of the Art

- Play soccer?
- Play a decent game of Go?
- Play poker?
- Drive along a curving mountain road?
- Drive safely along King St in Waterloo?
- Buy a weeks' worth of groceries on the Internet?
- Buy a week's worth of groceries at the grocery store?
- Discover and prove a new mathematical theorem?
- Converse successfully with another person for one hour?
- Perform a surgical operation?
- Put away the dishes and fold the laundry?
- Translate spoken Chinese into spoken English in real time?
- Write a news story?
- Write an intentionally funny story?

State of the Art



House-hold chores



State of the Art

Toronto-Dominion Bank posts fourth-quarter profit of \$1.38 billion

BY THE ASSOCIATED PRESS DECEMBER 3, 2015



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TORONTO - TORONTO (AP) _ The Toronto-Dominion Bank (TD) on Thursday reported fiscal fourth-quarter profit of \$1.38 billion.

The bank, based in Toronto, said it had earnings of 73 cents per share. Earnings, adjusted for one-time gains and costs, came to 87 cents per share.

The results surpassed Wall Street expectations. The average estimate of four analysts surveyed by Zacks Investment Research was for earnings of 85 cents per share.

The retail and wholesale bank posted revenue of \$6.12 billion in the period.

For the year, the company reported profit of \$6.38 billion, or \$3.40 per share. Revenue was reported as \$25.32 billion.

Toronto-Dominion shares have dropped 14 per cent since the beginning of the year. The stock has decreased 17 per cent in the last 12 months.

This story was generated by Automated Insights (<http://automatedinsights.com/ap>) using data from Zacks Investment Research. Access a Zacks stock report on TD at <http://www.zacks.com/ap/TD>

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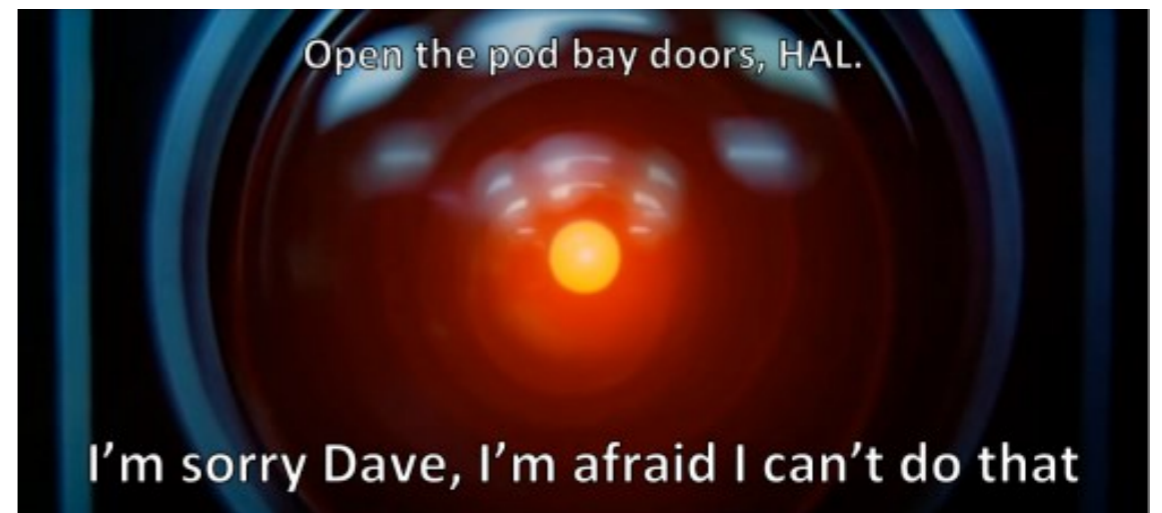
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SPOTLIGHTS

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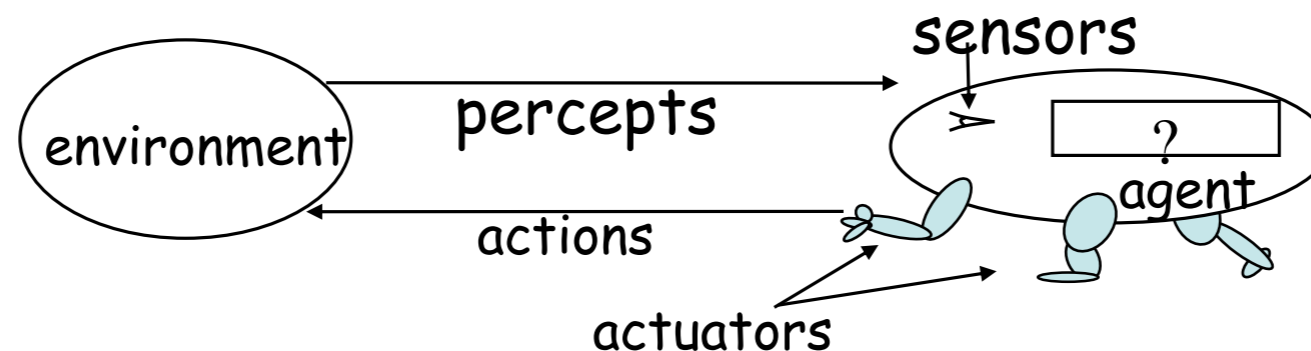
State of the Art

They can even question our commands!



Rational Agents

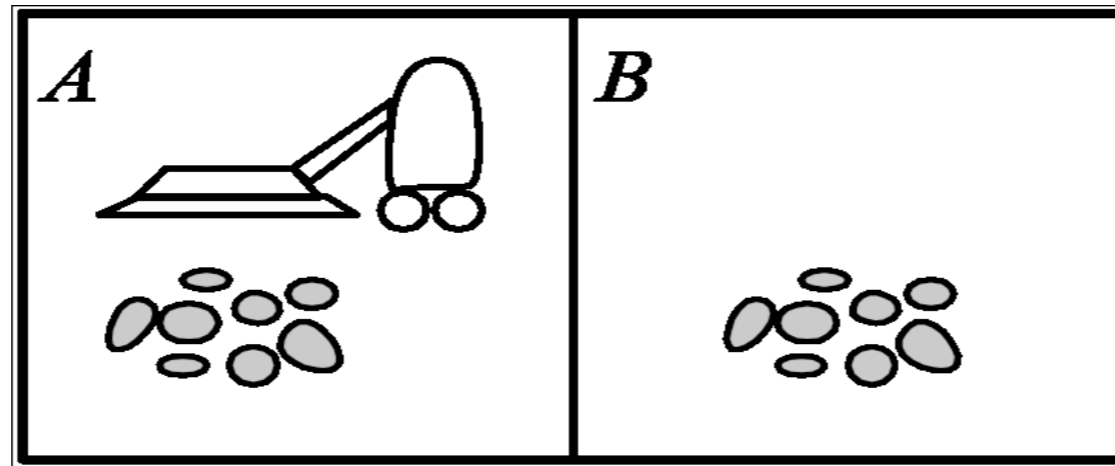
- An entity that perceives and acts
 - Function from percept to actions $f:P \rightarrow A$
- Performance measures
 - Goal achievement, resource consumption,...
- **Caveat:** Computational limitations and environmental constraints mean we do not have perfect rationality



Task Environment

- To design a rational agent, the **task environment** must be specified
 - Performance measure
 - Environment
 - Actuators
 - Sensors

Performance Measures



- **Percepts:** [Location, Dirty or Clean]
- **Actions:** Right, Left, Vacuum, NoOp, Dump
- **Function:** ([A,Clean],Right), ([A, Dirty], Vacuum), ([B, Dirty], Vacuum), ([B, Clean], Left)...

Properties of Task Environment

- Fully Observable vs Partially Observable
- Deterministic vs Stochastic
- Episodic vs Dynamic
- Discrete vs Continuous
- Single agent vs Multi agent

Questions?

- Next lecture: Problem Solving Agents (Chapter 3 R&N)