

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
 - PHY 313 Mon/Wed 11:30-12:50
 - PHY 313 Mon/Wed 1:00-2:20
- Course Personnel:
 - Kate Larson (klarson@uwaterloo.ca)
 - Office Hours: Mondays from 3:00-4:00pm in DC 2518
 - TAs: Chanheum Cho, Milad Khaki, Marta Kryven, Vijay Menon, Alan Tsang

Course Administration

- Website:
 - <http://www.cs.uwaterloo.ca/~klarson/teaching/W17-486>
 - 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%
- Final: 45%
- Project (Optional): Up to 5 bonus marks

CS 686

- 5 Assignments: 30%
- Midterm: 10%
- 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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- What is AI? (Chapter 1 R&N)
 - Definitions
 - History
 - What we will cover
- Rational Agents (Chapter 2 R&N)

What is AI?

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



What is AI?

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

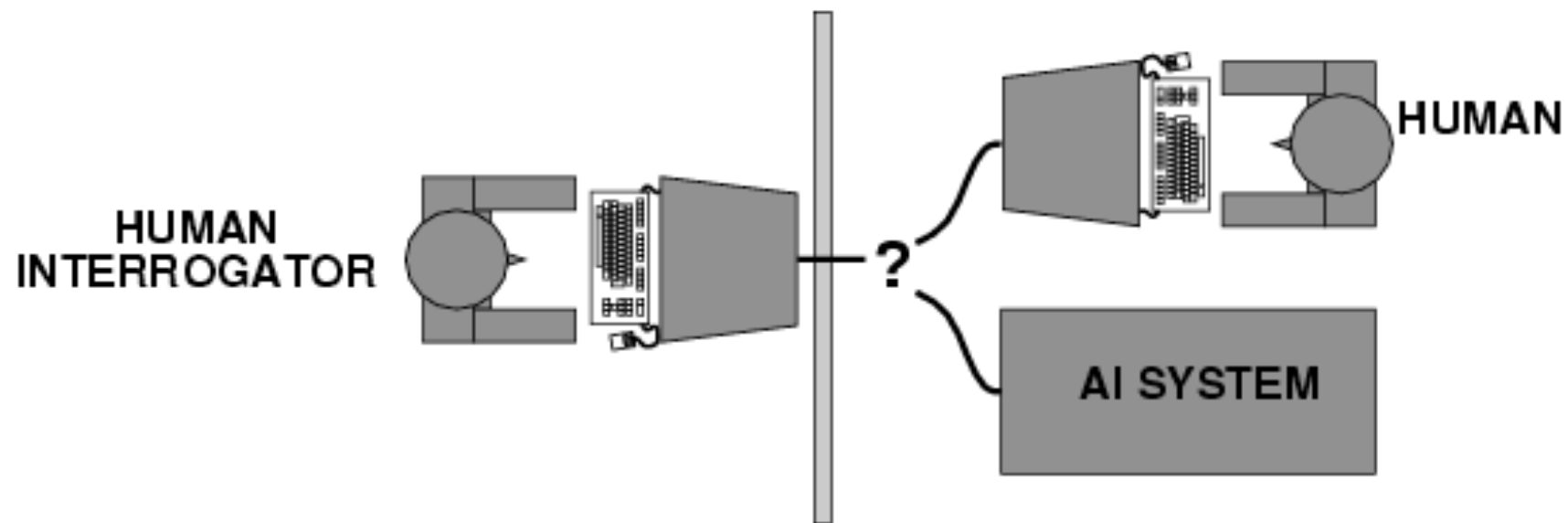
Systems that think like humans	Systems that think rationally
Systems that act like humans	Systems that act rationally

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

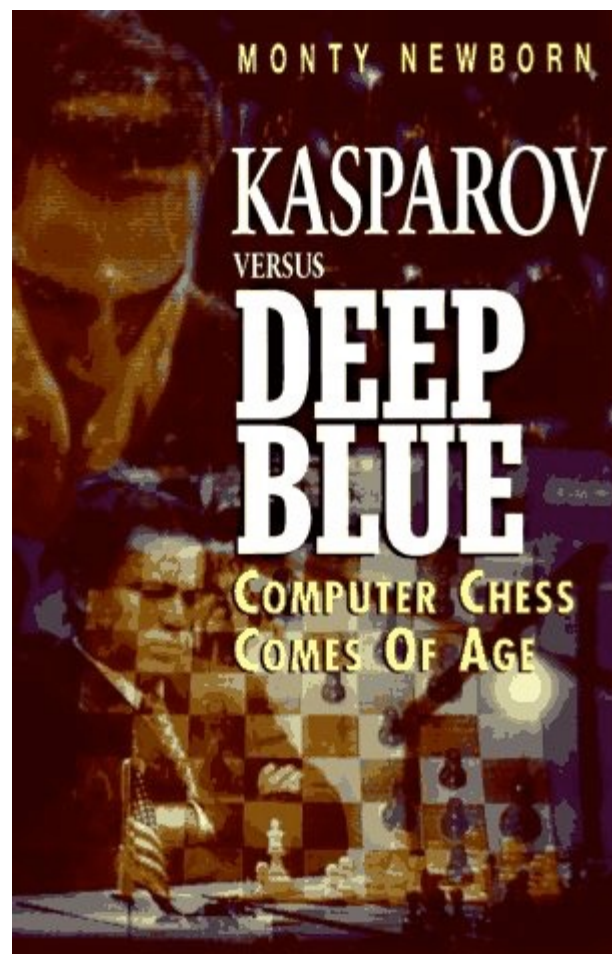
- Search
- Knowledge Representation and Reasoning
- Reasoning Under Uncertainty and Decision Making
- Learning

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

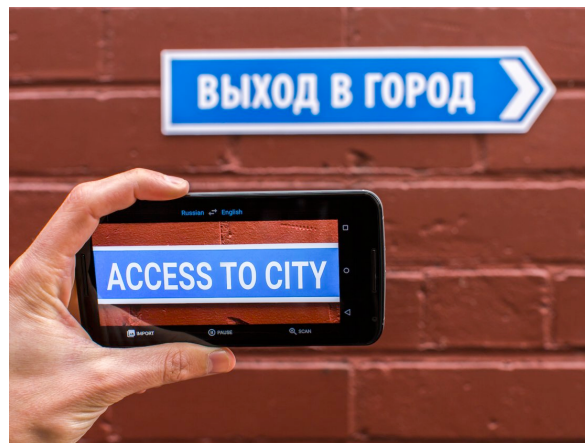
State of the Art

- 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?

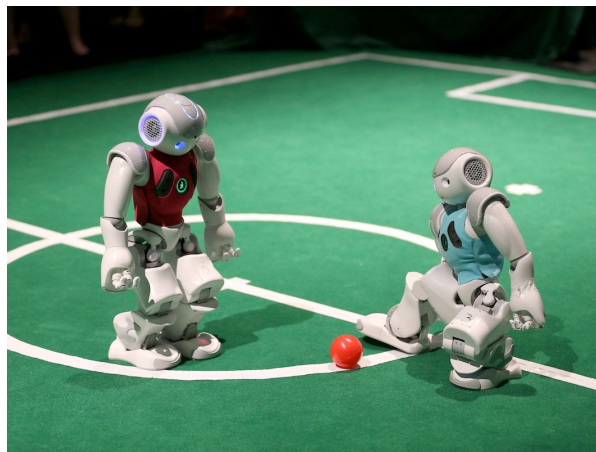
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State of the Art



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



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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State of the Art



White House Frames AI Policy: "Technology is Not Destiny"

TOP500 News - 17 hours ago

The report begins by reviewing what has brought AI into the mainstream, namely the availability of big data that underpins much of AI training, ...



Algorithms: AI's creepy control must be open to inspection

The Guardian - Jan 1, 2017

The past year marked the 60th year of artificial intelligence – and, boy, did it have a lively birthday. Pop open a computer science journal on ...



Charting Our AI Future

Project Syndicate - Jan 2, 2017

It is a world in which artificial-intelligence (AI) applications perform many tasks better than we can. Like fish in water, digital technologies are our ...



How AI startups can affect employment

VentureBeat - 16 hours ago

Moreover, the technology itself, due to the progress in artificial intelligence (AI), is getting closer to performing all imaginable tasks and taking ...



AI Is Assisting In Making Digital Marketing Campaigns More Effective

PSFK (subscription) - 3 hours ago

When a marketing team is allocating their budget, they often need to know the best people to speak to and where their audience is, in order to ...



AI gives 'objective' advice for daily decisions

The Japan News - 2 hours ago

AI's ability to recognize languages and images has been improving, as well as its ability to "study" a large volume of data and analyze it.



'Artificial Intelligence' was 2016's fake news

The Register - Jan 2, 2017

Almost everything you read about AI is fake news. The AI coverage comes from a media willing itself into a mind of a three year old child, ...



2017 Will Be the Year of AI

Fortune - Dec 30, 2016

Greetings from the end of the relative calm of the tweener holiday week, or what we in the technology industry like to call the calm before the ...



How AI will help knowledge workers

VentureBeat - Dec 31, 2016

This is a question knowledge workers have started asking themselves as AI is becoming more capable and widely adopted. Atlassian ...



2017 will be big year for AI thanks to tech giants

CIO - Dec 29, 2016

Machine learning and other variations of artificial intelligence (AI) are expected to proliferate in the enterprise in 2017. The majority of IT players ...

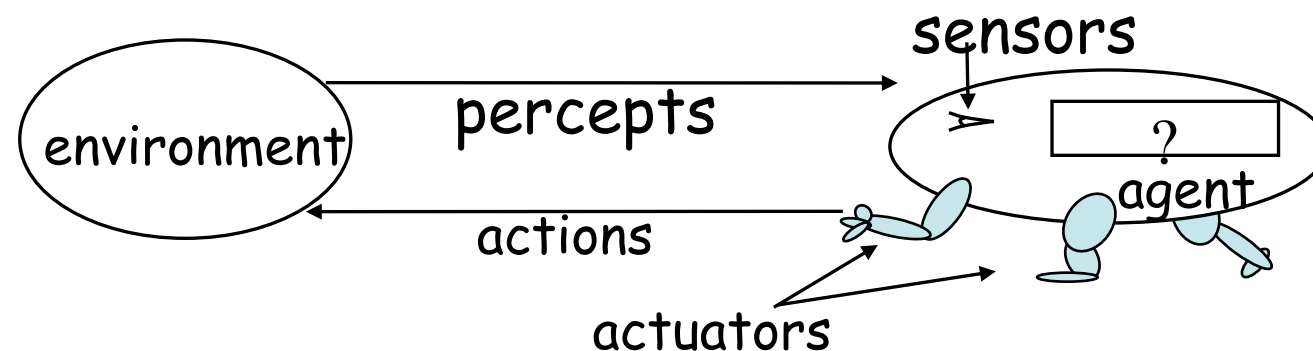
State of the Art

They can even question our commands!



Rational Agents

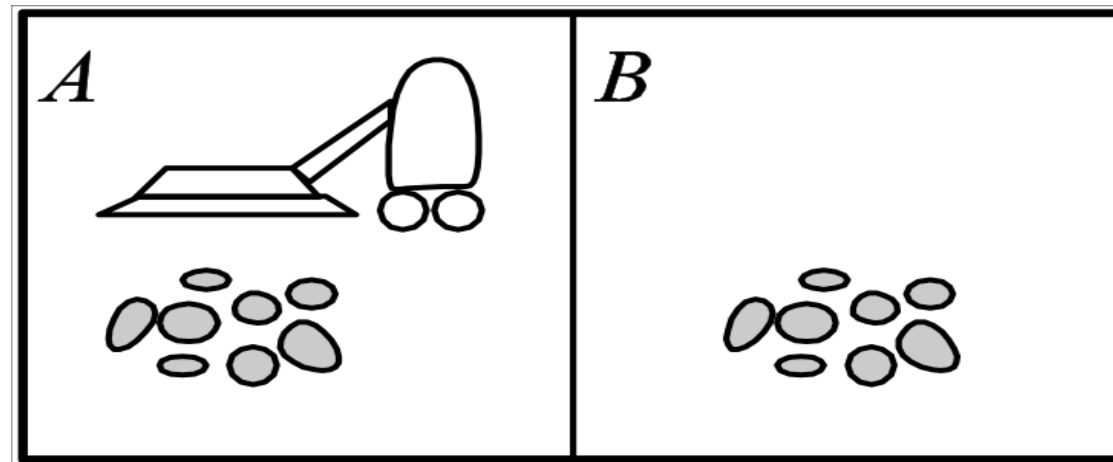
- An entity that perceives and acts
 - Function from percept to actions $f:P \rightarrow A$
- Performance measures
 - Goal achievement, resource consumption,...
- **Caveat:** Computational limitations and environmental constraints mean we do not have perfect rationality



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)