CPSC 322: Introduction to Artificial Intelligence

Introduction

Instructor: Varada Kolhatkar
University of British Columbia

Lecture outline

- Introductions + icebreaker (~10 mins)
- Course information + questions (~15 mins)
- What is artificial intelligence? (~15 mins)
- Break (~5 mins)
- A short history of artificial intelligence (~10 mins)
- In-class activities (~15 mins)
- Summary and wrap-up (~5 mins)

Instructor information

- Varada Kolhatkar
  [ʋərədə kɔːlɦəʈkər]

- If Varada is hard for you, you may call me **Ada**.

- Email
  - kvarada@mail.ubc.ca
  - kvarada@cs.ubc.ca
- Office: ICCS 185

Icebreaker (~5 mins)

- Introduce yourself to the people on either side of you.
- Share with them why have you chosen this course.

Piazza informartion

- piazza.com/ubc.ca/winterterm12019/cpsc322w12019
- Access Token : cpsc322@2019
- We'll be using Piazza for posting announcements and additional course related material.

Course information

- Available on Piazza
- Also available in the following public GitHub repository (more readable, in more opinion).

https://github.com/kvarada/CPSC-322_students/blob/master/README.md

What we don't cover

- Machine learning (ML) is becoming more and more commonplace as a collection of techniques to allow agents to perform tasks
- However, ML and AI are not the same thing
- This course will **NOT** cover ML; for that, you want CPSC 340.

Questions?

Today's class: Learning outcomes

By the end of the class you will be able to

- explain what AI is
- describe what an intelligent agent is

What is artificial intelligence (AI)?

Two kinds of definitions that have been proposed:

- Systems that think and/or act like humans.
- Systems that think and/or act rationally.

The science of building models that

Think Humanly The cognitive modelling approach	**Think Rationally** The "laws of thought" approach
Act Humanly The Turing Test approach	**Act Rationally** The rational agent approach

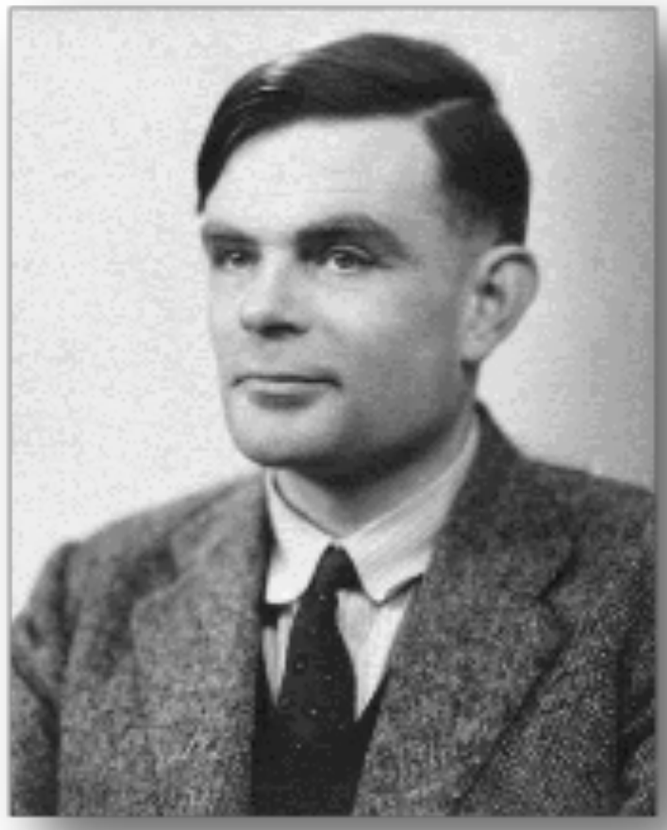
Thinking and acting humanly

Model the cognitive functions of human beings

- Humans are our only example of intelligence: we should use that example.

Alan Turing (1912 - 1954)

I propose to consider the question, "Can machines think?"

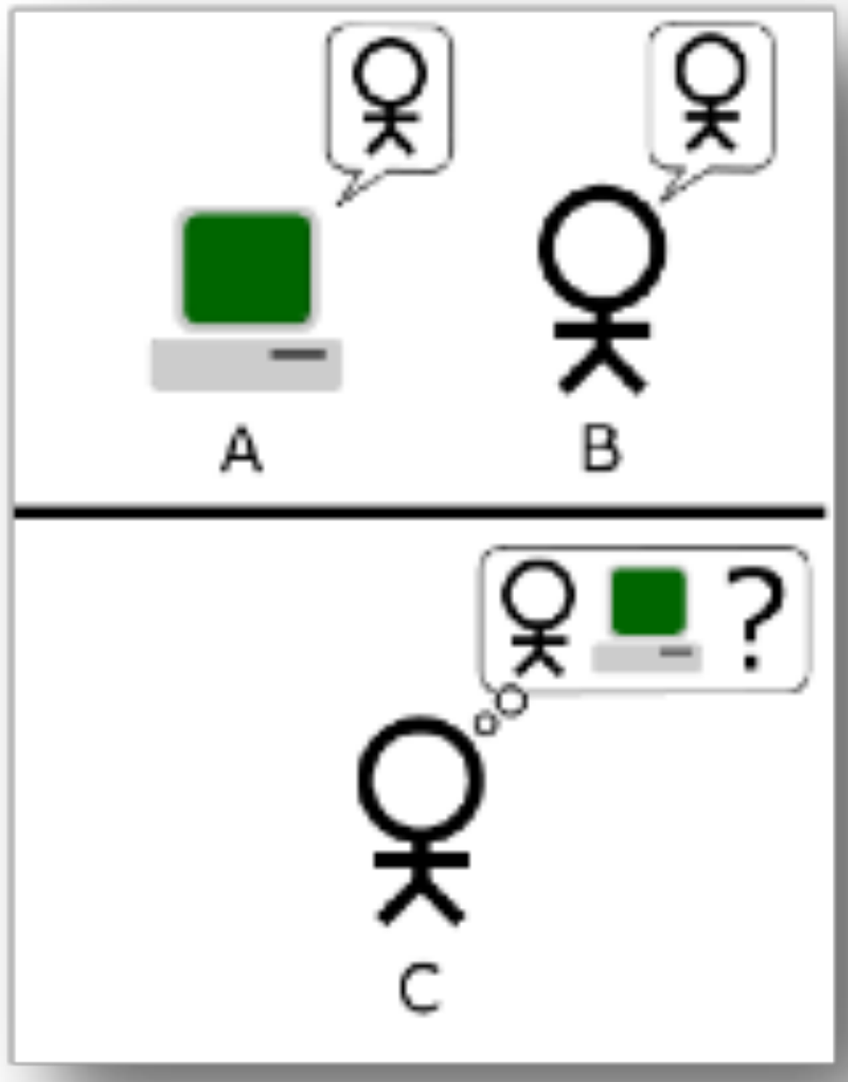


Turing, Alan M. (1950) Computing machinery and intelligence. *Mind*, 59, pp. 433-460.

Turing test

- Machine (A) imitates a human using nothing but a text-based instant messenger.

- If a human interrogator (C) cannot reliably differentiate a real human (B) from the machine, that machine is said to be *intelligent*.



Turing, Alan M. (1950) Computing machinery and intelligence. *Mind*, 59, pp. 433-460.

Thinking and acting humanly

Problems:

- A detailed model of how people's minds operate is not yet available
- Humans often think/act in ways that we don't consider intelligent (why?)
  - Sometimes there is trickery or lying involved

Turing test: sample conversation

C: Tell me a sarcastic joke.
A : Count me out on this one. I am not good at sarcasm.

Ducking the question

C: Add 34957 to 70764.
A: (Pause about 30 seconds and then give as answer)
105621.

C: Do you play chess?
A: Yes.

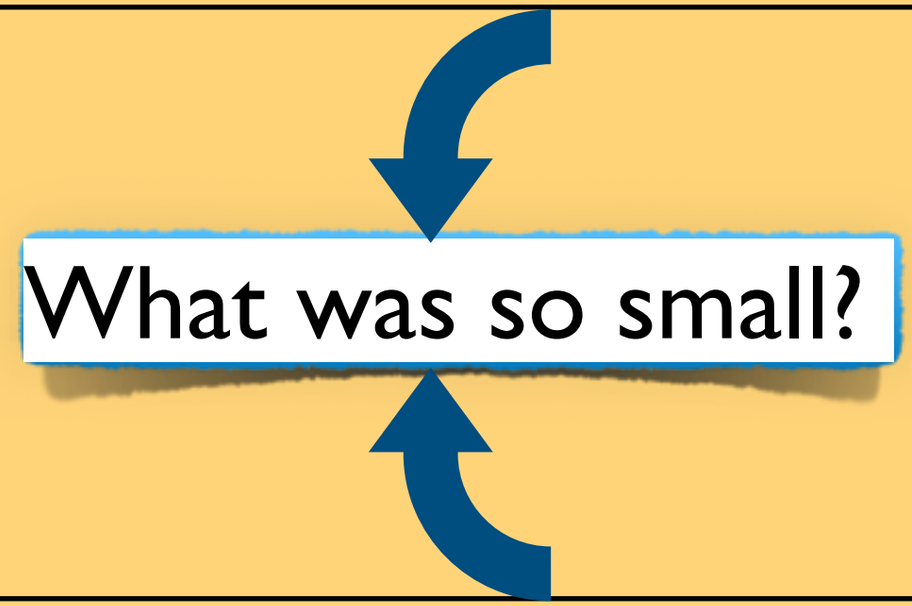
ASIDE: Winograd schema (Levesque 2014)

No chance for trickery. A better test for common-sense knowledge.

- Can a machine identify the correct referent of ***it*** in both cases?

- Easy for humans because we have world knowledge.

The trophy would not fit in **the brown suitcase** because ***it*** was so small.



The trophy would not fit in **the brown suitcase** despite the fact that ***it*** was so small.

What is artificial intelligence (AI)?

Two kinds of definitions that have been proposed:

- Systems that think and/or act like humans.
- Systems that think and/or act rationally.

The science of building models that

Think Humanly The cognitive modelling approach	**Think Rationally** The "laws of thought" approach
Act Humanly The Turing Test approach	**Act Rationally** The rational agent approach

Thinking and acting rationally

Thinking rationally

Rationality: an abstract "ideal" of intelligence, rather than "whatever humans think/do".

- Ancient Greeks invented syllogisms: argument structures that always yield correct conclusions given correct premises
- This led to logic, and probabilistic reasoning which we'll discuss in this course

Acting (&thinking) rationally

- This course will emphasize a view of AI as building agents: artifacts that are able to think and act rationally in their environments.

- Rationality is more cleanly defined than human behaviour, so it's a better design objective.

- Example:
  An "intelligent" vacuum cleaner maximizes area cleaned, minimizes noise and electricity consumption.

What is AI?

The science of building models that

Think Humanly The cognitive modelling approach	**Think Rationally** The "laws of thought" approach
Act Humanly The Turing Test approach	**Act Rationally** The rational agent approach

AI is the field that studies the synthesis and analysis of computational agents that act intelligently (Poole and Mackworth, 2010).

Agents

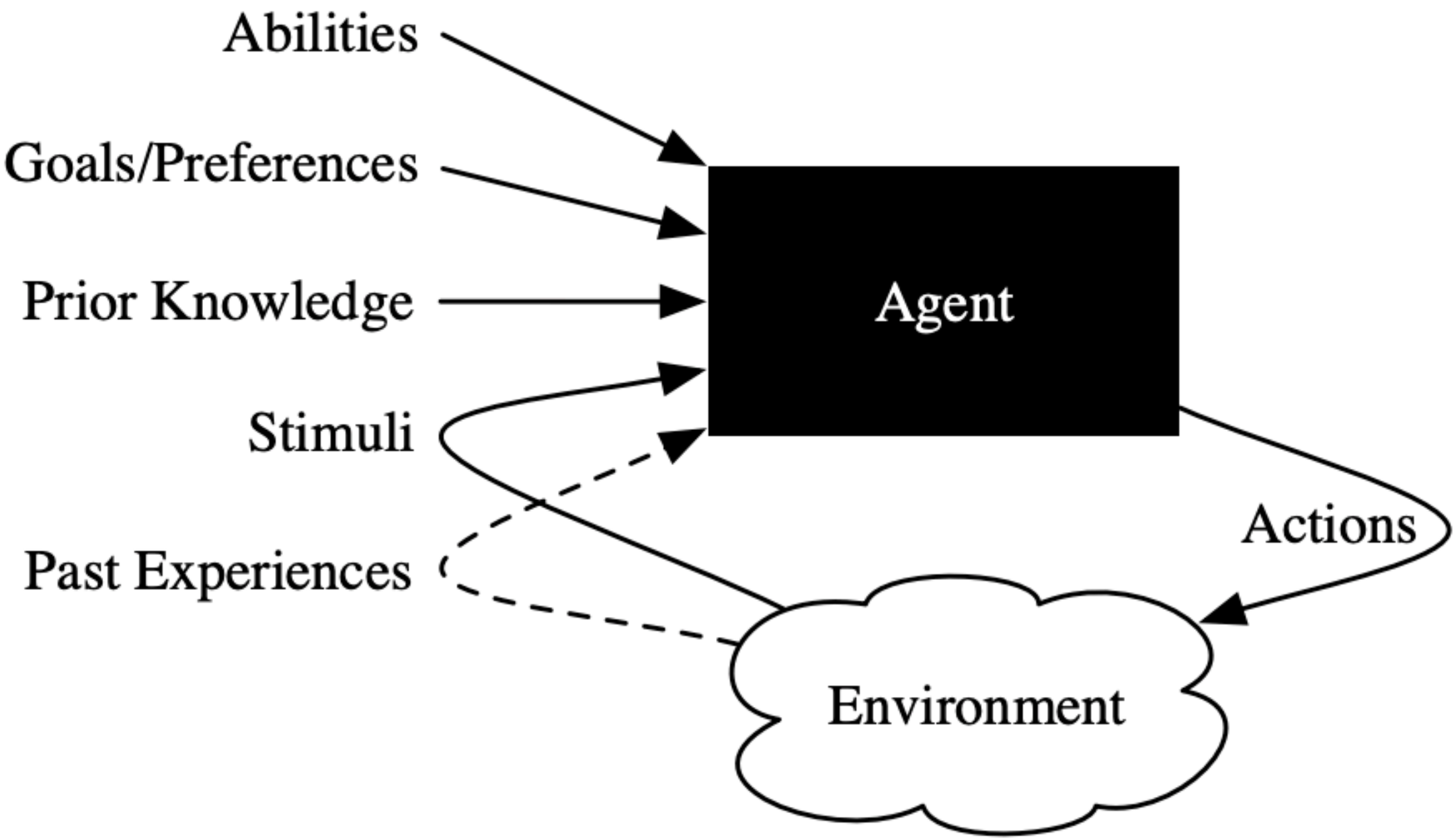
- An agent is something that acts in an environment.
- Examples
  - Organizations (e.g., UBC, Canada, Google)
  - People (e.g., engineers, linguists, teachers)
  - Computers/devices (e.g., thermostat, airplane controller, diagnostic assistant, Google home)
  - Animals (e.g., cats, cows, monkeys)

Intelligent agents

This course will emphasize a view of AI as building intelligent agents: artifacts that are able to think and act rationally in their environments

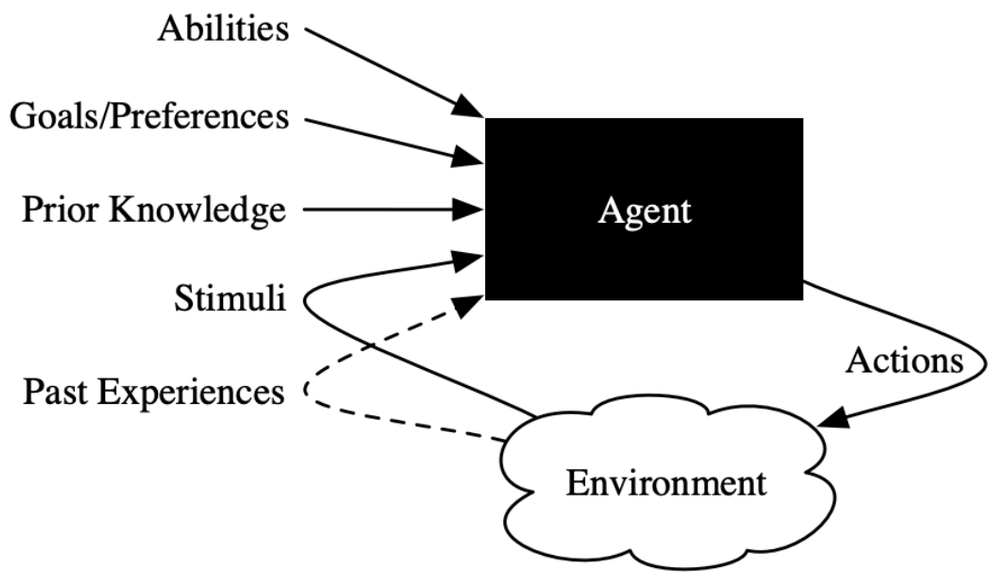
- they act appropriately given goals and circumstances
- they are flexible to changing environments and goals
- they learn from experience
- they make appropriate choices given perceptual and computational limitations
- They gather information (if cost less than expected gain)

Agents acting in an environment



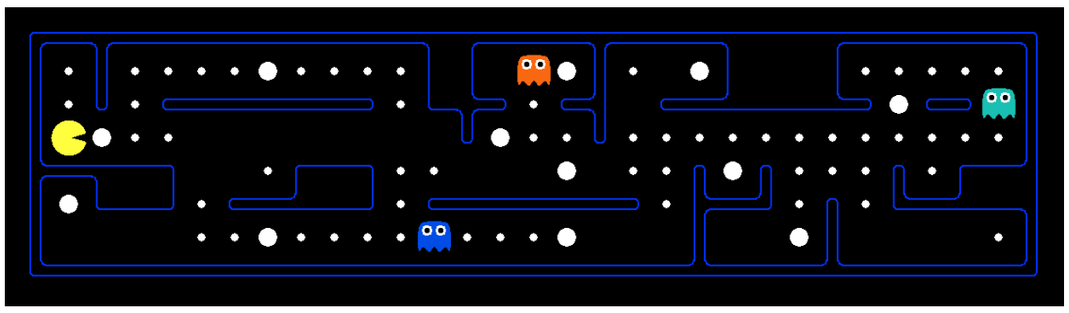
Example agent: *thermostat for heater*

- abilities: turn heater on or off
- goals: conformable temperature, save fuel, save money



- prior knowledge: 24 hour cycle, weekends
- stimuli: temperature, set temperature, who is home, outside temperature
- past experiences: when people come and go, who likes what temperature

Example agent: *Pac-Man*



- abilities: move left, right, up, down
- goals: eat all the dots
- Prior knowledge: eating power dots protects you from 
- Stimuli: current situation in the game
- Past experience: experience from previous plays

Offline activity

Which of these things is an agent? Why or why not?

- A soccer-playing robot
- A rock
- Machine translator
- A cat
- A self-driving car

Which of these things are intelligent agents?

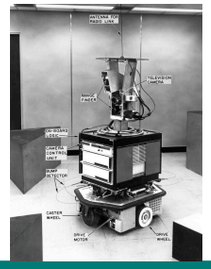
Why or why not?

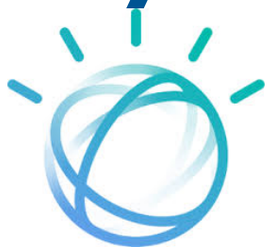
A short history of AI

Ada Lovelace (1815 - 1852)

"The Analytical Engine has no pretensions whatever to originate anything. It can do whatever we know how to order it to perform."

A short history of AI





1969: Shaky (the first general purpose mobile robot) was built

1997: IBM Deep Blue defeated the world chess champion

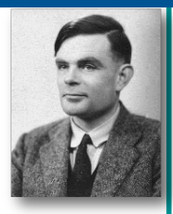
2011: IBM Watson won Jeopardy!

2019: Speech recognition, self-driving cars, and many more

Turing's "Computing Machinery and Intelligence"

Knowledge representation. Expert systems industry booms and busts

Learning-based systems, machine learning, deep learning



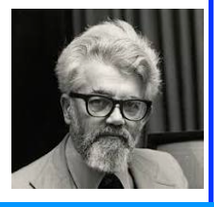
1950

1950-70

1970-90

1990—

2000—



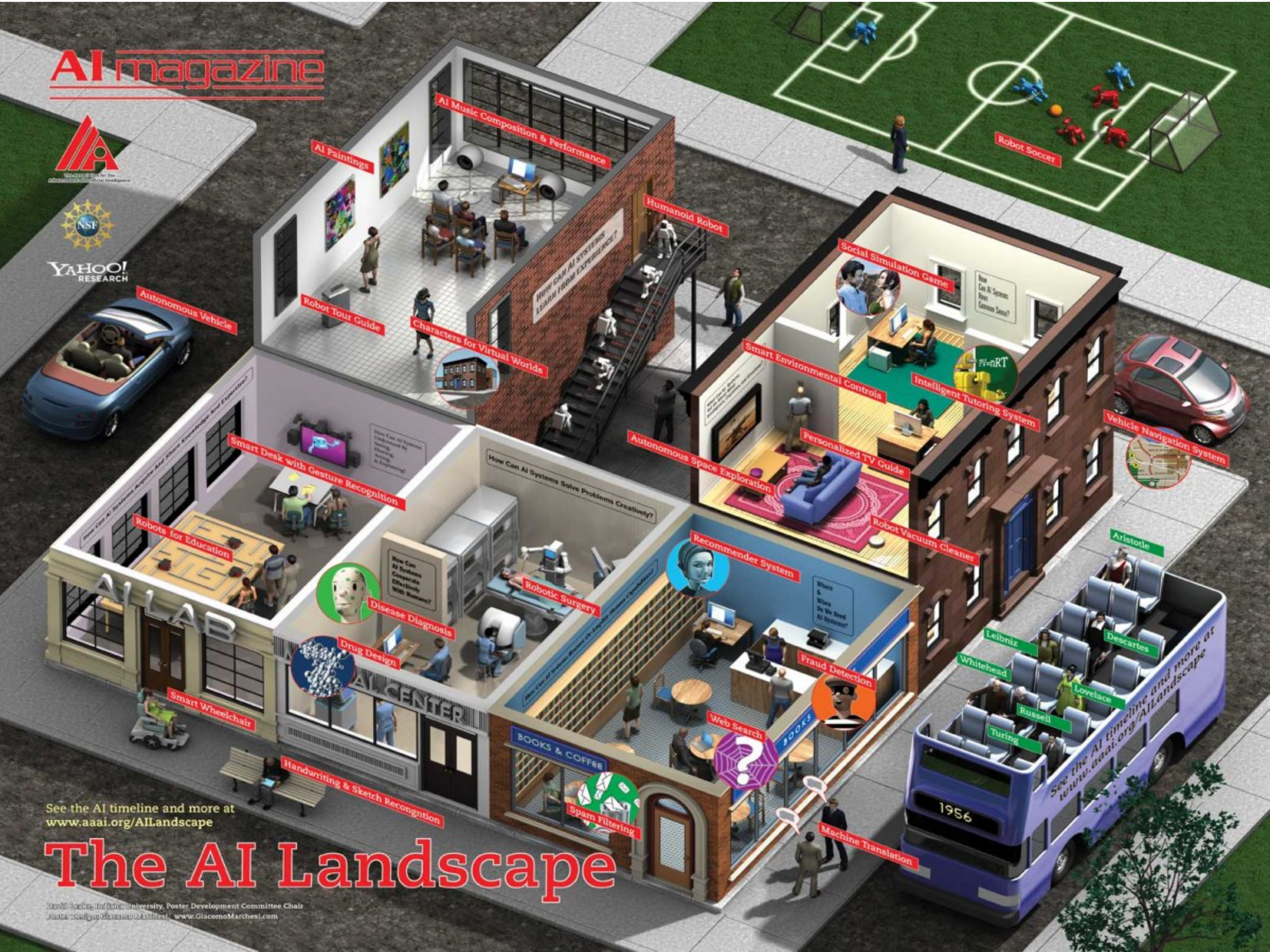
Early excitement. Logical reasoning. Dartmouth meeting: "Artificial Intelligence" adopted

Statistical approaches, resurgence of probability, focus on uncertainty

Current AI applications

- Language translation services (Google)
- Song recognition (Shazam)
- Face recognition (Recognizr, Google, …)
- Question answering (Apple Siri, IBM Watson, …)
- Driverless cars (Uber)
- Cashier less Checkout (Amazon Go)

AI magazine



The AI Landscape

David Leake, Indiana University, Poster Development Committee Chair
Poster Design: Giacomo Marchesi www.GiacomoMarchesi.com

In-class activities

Activity 1: What can current AI do?

Task	Yes/No
Play a descent game of Chess	
Buy a week's worth of groceries on the web	
Write a novel or good poetry	
Drive safely on East Hastings	
Converse with a human being for an hour	
Write a sarcastic article	

Activity 1: What can current AI do?

Task	Yes/No
Discover a new algorithm	
Clean the dishes	
Perform surgical operation	
Detect and flag fake news	
Translate spoken French to spoken English in real time	

Activity 2

- Work in pairs searching the web to find an interesting example of fielded (or experimental) intelligent agents.
- Try to find something different from the usual suspects (Alexa, Siri, Watson, etc.)
- Hint: AAAI is the main AI association

Activity 2: Take notes

- What does the application do?
  - E.g,. control a spacecraft, perform medical diagnoses, provide intelligent help for computer users, shop on eBay
- List some of the application's:
  - Goals /preferences;
  - Observations that it needs about the environment;
  - Types of actions that it performs
- What AI technologies does the application use
  - E.g,. belief networks, Markov models, semantic networks, heuristic search, constraint satisfaction, planning
- Why is it intelligent? Which aspects make it an intelligent system?
- Is it an experimental system or a fielded system (i.e., used in a real world setting)?
- Is evidence provided on how well does the application perform?

Important this week

- Read the course outline carefully. https://github.com/kvarada/CPSS-322_students/blob/master/README.md

- Register for **iClicker** on Canvas.

- Register for the class on **Piazza.** https://piazza.com/ubc.ca/winterterm12019/cpsc322w12019

- Start working on **Assignment 0.**

- **Office Hours** start next week.

Assignment 0

- Available on Canvas
- Also posted on Piazza (for those on the waitlist)
- Due Sept 9th
- You may **NOT** use late days, and late submissions will not be accepted for this assignment
- The good news: you already have started it!

Get to know you

- Fill in the survey available on Canvas
  - Due date: Sept 8
- I like questions and feedback. Come and chat with me after class or during office hours (which will be posted soon).

Preview of next week

A rough CPSC 322 overview

Representation and reasoning

Problem

Environment

Deterministic | Stochastic

Static

Sequential

Constraint satisfaction

Query

Planning

Arc consistency Variables + constraints — Search	
Logics — Search	Belief networks — Variable elimination
STRIPS — Search	Decision networks — Variable elimination Markov decision processes — Value iteration