Welcome to COMP3702 Artificial Intelligence!

Acknowledgement of Country

The University of Queensland (UQ) acknowledges the Traditional Owners and their custodianship of the lands on which we meet.

We pay our respects to their Ancestors and their descendants, who continue cultural and spiritual connections to Country.

We recognise their valuable contributions to Australian and global society.

The Brisbane River pattern from *A Guidance Through Time*
by Casey Coolwell and Kyra Mancktelow.

Week 1: Overview

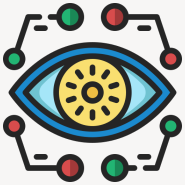
- Course overview
- Introduction to Artificial Intelligence
- Admin:
  - Sign up to an applied class (starts next week)
  - Work on Assignment 0
    - Due: 1pm, Wednesday 9 August

Week 1: Readings

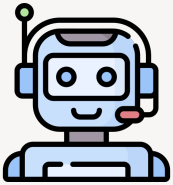
- Course Profile:
  `https://course-profiles.uq.edu.au/course-profiles/COMP3702-60786-7560`
- Russell & Norvig: Chapters 1 & 2
- Poole & Mackworth: Chapters 1 & 2

Artificial Intelligence

Natural Language Processing (NLP)
(text, speech)



Computer vision

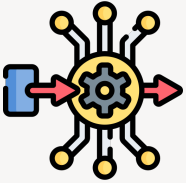


Robotics

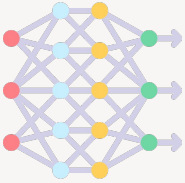
Games

Expert Systems

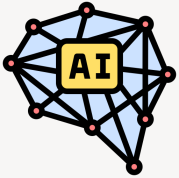
Logic /
Fuzzy Logic



Machine Learning



Neural Networks



Deep Learning

Icons created by Freepik https://www.flaticon.com/free-icons

Teaching Staff

Course-coordinator and Lecturer:

Name: Alina Bialkowski

Email: alina.bialkowski@uq.edu.au

Teaching: Artificial intelligence, signal processing, research methods

Research: Machine Learning; Computer Vision; Explainable AI, Human-AI Decision Support, Deployable Deep Learning (model compression, uncertainty quantification, domain adaptation), Medical Imaging (incl. electromagnetic imaging)

Tutors: Aakash, Amy, Benjamin, Calvin, Claudia, Ella, Jack, Renée, Samuel, Winston, Yuvraj

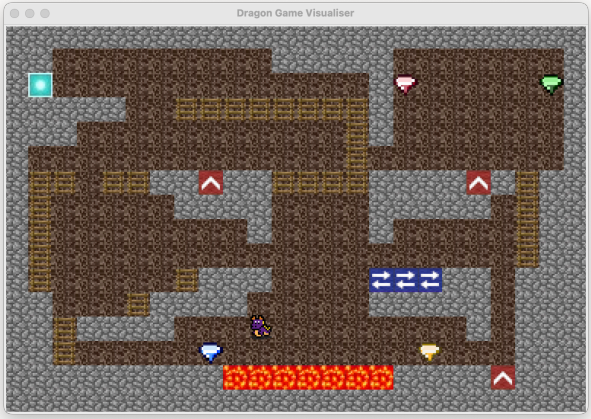
Primary goals of this course

In COMP3702, we aim to introduce the foundational concepts and methods used in the field of artificial intelligence, split into 5 modules, namely:

1. searching for solutions to problems,
2. reasoning and planning with certainty,
3. reasoning and planning under uncertainty,
4. learning to act, and
5. reasoning about other agents & the human-aspects of AI

and to develop the skills needed to apply these techniques to real–world problems.

Past assignments



Tentative weekly plan (see *Course Resources* on BB, and watch for updates)

COMP3702 Artificial Intelligence

		LECTURES			ASSESSMENT
MODULES	*Week*		*Topics*	*Reading*	*Assignments*
Module 0: Introduction	Week 1	Lecture 1	Course overview; Introduction to AI and rational agents	R&N Ch 1,2 P&M Ch 1,2	
Module 1: Search	Week 2	Lecture 2	Introduction to search; Blind/Uninformed search	R&N Ch 3.1-3.4 P&M Ch 3.1-3.5	**Assignment 0 (no marks) 11 August**
	Week 3	Lecture 3	Informed/Heuristic search & optimisations	R&N 3.5 P&M 3.6	
Module 2: Reasoning and planning with certainty (CSPs & Logic)	Week 4	Lecture 4	Constraint satisfaction problems (CSPs)	R&N 6.1-3 P&M 4.1-4.4	
	Week 5	Lecture 5	Logic: Propositions and Inference Logic: CNF, satisfiability & verification	R&N 7 P&M 5.1-5.5	**Assignment 1 Fri 29 August**
Module 3: Reasoning and planning under uncertainty (MDPs)	Week 6	Lecture 6	Search with non-deterministic actions (AND-OR trees); Decision theory	R&N Ch 4.3 R&N 16.1-16.4,	
	Week 7	Lecture 7	MDPs 1: value iteration	R&N 17.1-17.2 P&M 9.5, MRL Ch5	
	Week 8	Lecture 8	MDPs 2: policy iteration	MRL Ch13	
Module 4: Learning to act (RL)	Week 9	Lecture 9.1	Multi-armed bandits & Exploration vs exploitation trade-off	R&N 17.3, P&M 12.5, MRL Ch6	
		Lecture 9.2	Reinforcement Learning 1	R&N 22 (Pu) / 23 (Gr), P&M 12	
	Mid semester break				
	Week 10	Lecture 10	Reinforcement Learning 2		**Assignment 2 Tue 7 October**
	Week 11	Lecture 11	Intro to Deep Reinforcement Learning		
Module 5: Reasoning about other agents	Week 12	Lecture 12	Adversarial search (minimax) & Game theory	R&N Ch 5, P&M 11.3 R&N 3Ed: 17.5-17.6, R&N 4Ed: 18.1-18.2	
	Week 13	Lecture 13	Human centred AI & Revision		**Assignment 3 Fri 31 October**
	Study break				
	Exam week 1				Final exam
	Exam week 2				

Some AI topics we do not cover in depth in this course

- Natural language processing (see COMP4703 – new in 2024),
- Machine learning (see COMP4702/COMP7703),
- Pattern Recognition and Analysis (see COMP3710),
- Human-Centred AI (see DECO2801/DECO7281 – new in 2025),
- Deep Learning (STAT3007),
- Computer Vision and Deep Learning (see ELEC4630),
- Data Mining (see INFS4203)
- User experience and user interaction (UX/UI) design — see the the BInfTech User Experience Design Major, and/or the Master of Interaction Design for more.

Pre-requisites

- (CSSE1001 or CSSE7030) or ENGG1001: Introduction to Software Engineering / Programming for Engineers – i.e. Python programming
- Recommended courses and knowledge:
  - MATH1061: Discrete Mathematics (logic)
  - COMP3506/COMP7505: Data Structures and Algorithms
  - Mathematics: basic probability, linear algebra (matrices) and calculus (derivatives and gradients). We cover the necessary components, but it is easier if you have completed some previous mathematics courses.
- Note that COMP3702 is a third level course and an advanced elective, so while the pre-requisites are quite limited, it is expected that you will have gained a couple of years of programming experience before attempting the course.

You'll learn the most by *doing*

To help, we will provide:

Active lectures: Provide an introduction to various concepts and techniques in AI combined with a series of in-class activities.

Weekly tutorials: Provide opportunity to practice the techniques introduced in lectures.

Assignments: design and implement AI systems in three take-home assignments.

Discussion forums: Ed Discussion provides an opportunity for you to ask questions and engage with responding to questions posted by your peers, moderated by the teaching team.

Applied classes

Tutorial exercises are provided to help you understand the materials discussed in lectures, and to improve your skills in solving AI problems, with support from tutors.

- Tutorial worksheets will be available on BB each week.
- Tutorials follow the lecture schedule, one week behind.
- Tutorial exercises are not graded, but you are highly encouraged to do them.
- The skills you acquire in completing the tutorials will help you complete the assignments.
- You'll get the best learning outcome when you try to solve the tutorial exercises on your own before your tutorial session, and then use your tutorial session to ask about the difficulties you face when trying to solve the exercises.
- **BYO laptop!**

Ed Discussion Board

- **Ed Discussion** is a Q&A web service.
- Peer-led discussions about the course content,
- Lecture Q&A, and
- General questions about course logistics (i.e. things everyone might want to know).
- Register for the COMP3702 Ed Discussion forum via the Blackboard
- Use descriptive titles and search for existing answers before posting new questions
- NO "code dumps", instead describe what you've tried and which error/part you're stuck on

Assignments (60% of final mark)

Assignment 0 (0%): The purpose of Assignment 0 is to:

- refresh some of the core mathematical concepts and methods used in AI,
- introduce you to some of the programming tricks and tools needed for your assignments,
- give you a chance to learn how to the Gradescope code autograder.

Three graded assignments:

Assignment 1 (20%): due 29 Aug @1pm (Friday, Week 5)
Assignment 2 (25%): due 7 Oct @1pm (Tuesday, Week 10)
Assignment 3 (15%): due 31 Oct @1pm (Friday, Week 13)

- Involves problem solving + code + report
- Coding language: Python
- Interviews with a subset of students about their submissions for the purpose of establishing genuine authorship.

Final Exam

- Final exam during examination period
- Practice exam will be provided to help you effectively prepare.
- Final exam has a hurdle of $>50\%$.

Assessment weightings and due dates

Task	*Weighting*	*Due date*
Assignments	60%	Weeks 5, 10, and 13
Final Exam	40%	Exam period

Academic Integrity and AI tools like ChatGPT in COMP3702

Artificial Intelligence (AI) tools are permitted to be used in this course, but they are not required to be used and not recommended to be used as they may inhibit learning and introduce bugs into your code. You must always follow the referencing requirements set out in the assignment specification and documents referenced from the assignment specification. Failure to appropriately reference the resources (tools and information sources) used in your work may result in misconduct allegations against you. You must clearly reference any use of AI in each instance.

Note that LLMs ("Generative AI"):

- May hallucinate or fabricate information
- May have reasoning errors
- May have knowledge cutoffs
- Does not cite its sources, careful of plagiarism

All assignment submissions will be subject to electronic plagiarism and collusion detection.

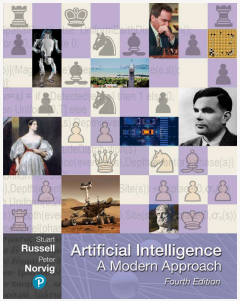
Academic Integrity and Collusion in COMP3702

You are encouraged to discuss the concepts behind the assignments but under no circumstances should you show your code to, or allow your code to be seen by, another student. You should not look at the code of any other student. You must sufficiently protect all electronic and paper copies of your code. All submitted code will be subject to electronic plagiarism and collusion detection. Assignments with no academic merit will be awarded a mark of zero. You may have to verbally answer questions about your submission as part of the assignment marking process.

Get organised!

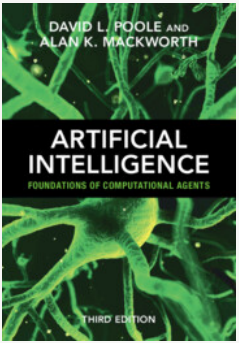
- Read the course profile
- Make sure that you can access the Blackboard site for the course
- Sign up for a tutorial session, and attend!
- Sign up for Ed Discussion
- Review the material on Blackboard, and start using it as soon as it is made available.
- Watch out for announcements and updates through BB.

Additional learning resources: Textbooks



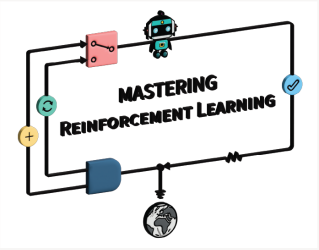
Russell& Norvig, 4e (R&N)

(Nb: 3e and green 4e are fine)



Poole and Mackworth, 3e (P&M)

`https://artint.info/`



Miller: Mastering RL

`https://uq.pressbooks.pub/mastering-reinforcement-learning`

Anonymous feedback

- You can submit anonymous feedback to me and the tutors via Ed Discussion, at any time.
- This provides you with the opportunity to express what you like or dislike about the course.
- Feedback of all kinds are welcome! We are always trying to improve COMP3702.
- Please submit feedback as private posts.
- If appropriate, I might paraphrase your comment on the discussion boards and respond to it, or raise it in the lectures (anonymously, of course).

THE UNIVERSITY OF QUEENSLAND
AUSTRALIA
CREATE CHANGE

COMP3702
Artificial Intelligence

Module 0: Introduction

Dr Alina Bialkowski

Semester 2, 2025

The University of Queensland
School of Electrical Engineering and Computer Science

Overview of Module 0

1. What is AI?
2. History of Artificial Intelligence
3. Intelligent agents
4. Intelligent agents acting in an environment
5. Agent design problem
6. Dimensions of complexity

What is AI?

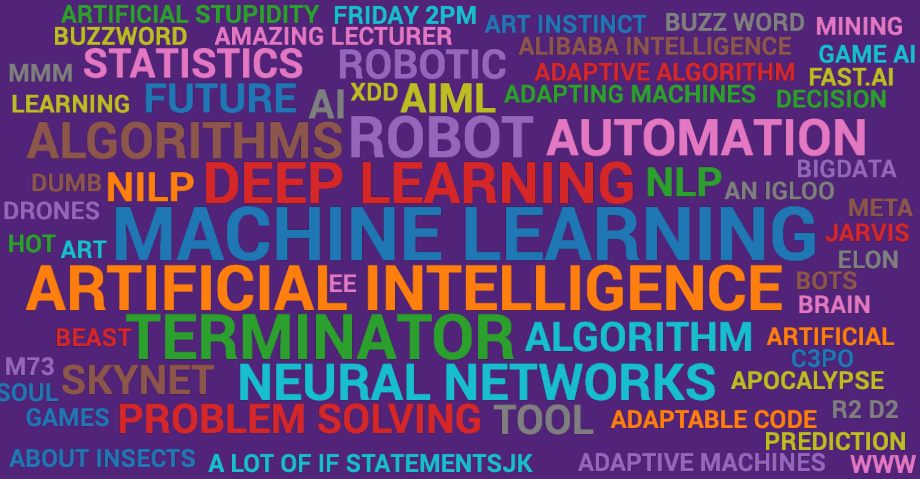
What do you think AI is? Live lecture wordcloud:

Enter your answers here:

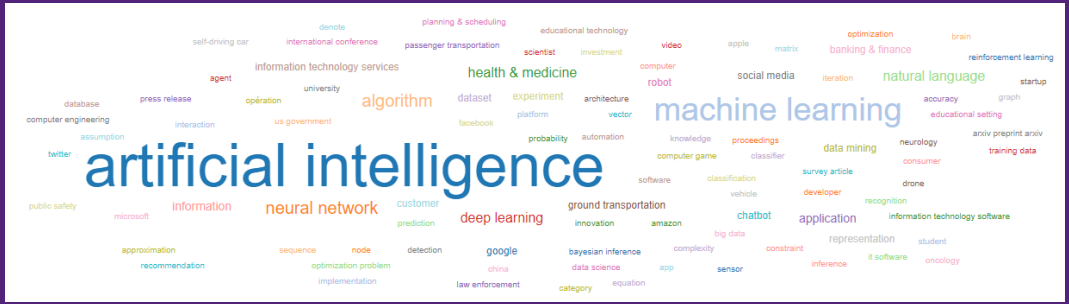
EchoPoll

https://au.echopoll.io/c/b3dc8dee-436f-4775-96c2-29ebbf643b3a/583a5734-4f82-49e8-a410-2cff16efcfb6

What do you think AI is? Results in 2022:



What is AI? Whatever AI researchers do! AAAI conference alert cloud



Source: `https://aitopics.org/search`

What is AI?

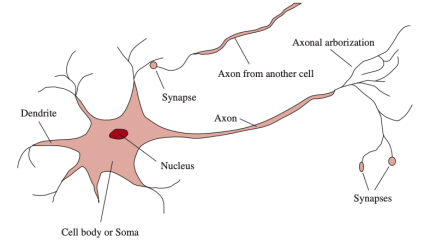
AI is an attempt to build “intelligent” computers, but what is “intelligence”?

- think like humans?
- think rationally?
- act like humans?
- act rationally?

What is AI?

AI is an attempt to build "intelligent" computers, but what is "intelligence"?

- **think like humans?** Build something like a brain! But how does a human brain work?
- think rationally?
- act like humans?
- act rationally?



Maybe machines can reach intelligence a different way to the human brain?

What is AI?

AI is an attempt to build "intelligent" computers, but what is "intelligence"?

- think like humans?
- **think rationally?** Automated reasoning and logic are foundational topics in AI.
- act like humans?
- act rationally?

It is unclear if logic really captures the type of knowledge that people have or need help with.

Plus, it's really hard to search through logical statements...

What is AI? The Turing Test

AI is an attempt to build "intelligent" computers, but what is "intelligence"?

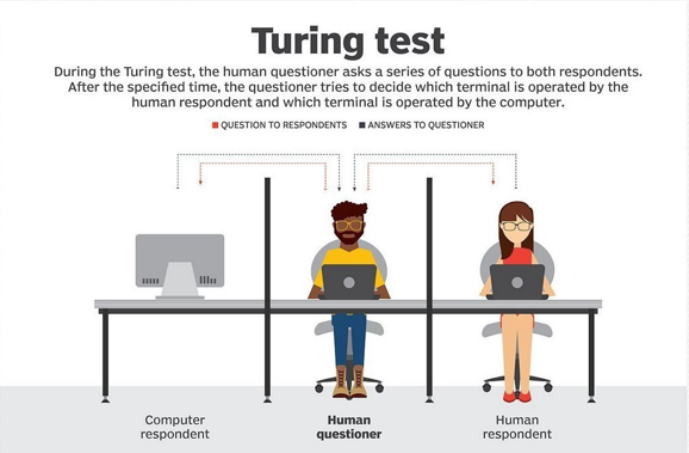
- think like humans?
- think rationally?
- **act like humans?** The Turing test: can a human tell if a computer is a computer?
- act rationally?

The Turing Test — Alan Turing (1950)

In the Turing test, the computer is asked questions by a human interrogator.

Computer passes the test if the interrogator cannot tell whether the responses come from a human or a computer.

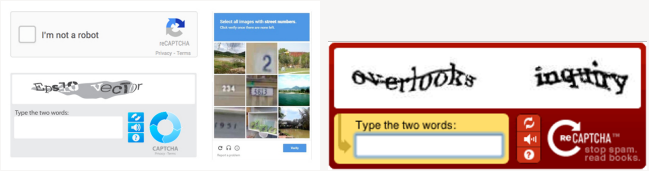
The Turing test simplifies the question "is the machine intelligent" into "can the machine imitate a human?"



Source: https://medium.com/@fatihbildiriciii/yapay-zeka-e%C4%9Fitim-serisi-b%C3%B61%C3%BCm-3-69884059e2c1

Applications of Turing Test

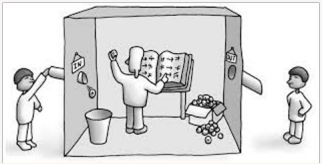
- Turing's idea to try to define "(artificial) intelligence" more concretely has yielded useful results
- Chat bots: Eliza, A.L.I.C.E., automated online assistance, etc.
- CAPTCHA: Completely Automated Public Turing test to tell Computers and Humans Apart.
  - Turing test, but the "interrogator" is a computer



Critique to the Turing Test: The Chinese Room

- Thought experiment by Searle 1980
- A person who only knows English is locked in a room with:
  - Stack of papers containing Chinese symbols
  - An instruction manual in English
- People outside the room send questions in Chinese
- Suppose by following the instruction manual, the man in the room can pass out Chinese symbols which are correct answers to the questions
- The person appears to understand Chinese even though he does not!

→ Turing test is inadequate to test intelligence: it may appear to understand language but has no understanding of meaning or semantics.



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- act rationally?

Stop and think: Do we really want computers to act like humans?

Do we really want computers to think and act like humans?

What is AI?

AI is an attempt to build "intelligent" computers, but what is "intelligence"?

- think like humans?
- think rationally?
- act like humans?
- **act rationally?** Aka intelligent agents (approach taken in R&N and P&M texts)

Not sure that this *truly* captures the variety of AI research going on right now, but it is a good place to start...

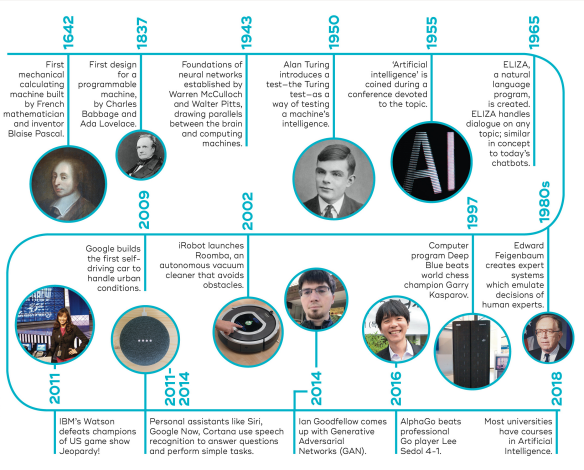
What is AI? Definitions

- Association for the Advancement of Artificial Intelligence (AAAI) offers this on its home page: **AI is "the scientific understanding of the mechanisms underlying thought and intelligent behavior and their embodiment in machines."**
- Poole and Mackworth say Artificial intelligence is "**the synthesis and analysis of computational agents that act intelligently**."
- We say: "AI is the study and development of algorithms for solving problems that we typically associate with intelligence."
- AI is a disperse collection of topics. We address core methods and models in this course, which have widespread applications and can be used as building-blocks in more sophisticated AI systems.

We won't do all of AI in this course!

History of Artificial Intelligence

A brief history of Artificial Intelligence



Source: `https://qbi.uq.edu.au/brain/intelligent-machines/history-artificial-intelligence`

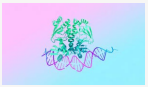
For more of the history and development of AI, read Chapter 1 of R&N or P&M.

More recent Artificial Intelligence

2016

AlphaGo beats Lee Sedol

Autonomous vehicles (Tesla, Waymo, Uber, Ford, Argo AI, etc.)



2020

GPT-3;

DeepMind's **AlphaFold**

ChatGPT

2022

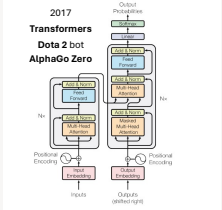
ChatGPT released in November

2017

Transformers

Dota 2 bot

AlphaGo Zero



2019

AlphaStar

StarCraft II

2021

DALL·E

Image generation

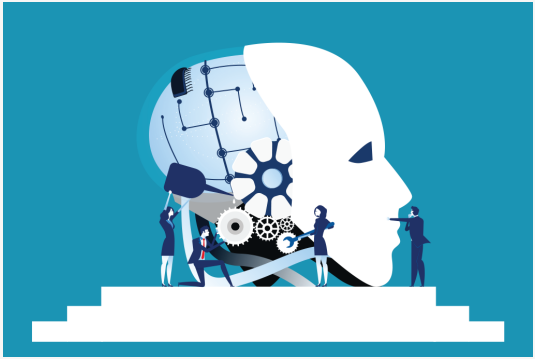
2023 AI pause letter

2025: AI wins gold medal in International Math Olympiad (IMO)

For more of the history and development of AI, read Chapter 1 of R&N or P&M.

Open Problems

- Handling uncertainty e.g. in self-driving cars
- Data, bias, and distribution shifts
- Value misalignment problem
- Ethics, fairness, privacy, safety, legal issues



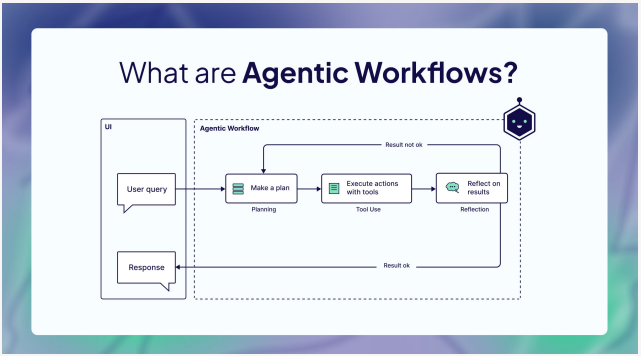
Source: https://innovationatwork.ieee.org/five-major-ethical-challenges-ai-developers-should-consider/

Intelligent agents

What is an intelligent agent?

- An **agent** is something that **acts** in an environment.
- An agent acts **intelligently** if:
  - its actions are appropriate for its goals and circumstances
  - it is flexible to changing environments and goals
  - it learns from experience
  - it makes appropriate choices given perceptual and computational limitations
- Examples: Organisations (Microsoft, Facebook); People (doctor, teacher); Computers (thermostat); Animals (dog); Bacteria
- What about book(?), sentence(?), word(?), letter(?)
- Can a book or article *do* things?
  Convince? Argue? Inspire? Cause people to act differently? *Learn* from experience?

Agentic AI



"AI agents are systems that combine LLMs for reasoning and decision-making with tools for real-world interaction, enabling them to complete complex tasks with limited human involvement"

https://weaviate.io/blog/what-are-agentic-workflows https://huyenchip.com/2025/01/07/agents.html

In this class...

- We are interested in building software systems (called **agents**) that behave **rationally**
- i.e. systems that accomplish what they are supposed to do, well, given the available resources
- Don't worry about how close the systems resemble humans and about philosophical questions on what "intelligence" is (not that we are not interested in this!)
- But we may use inspirations from humans or other "intelligent" beings and systems

agent

Intelligent agents acting in an environment

Recall our goal: To build a useful, intelligent agent

An agent is a computer program that:

- Gathers information about an environment, perceiving the world using sensors, and takes actions autonomously based on that information
- Maintains models/representations of the world and uses them for reasoning.
- May potentially learn from data.

So, to achieve our goal, we need to define our "agent" in a way that we can program it:

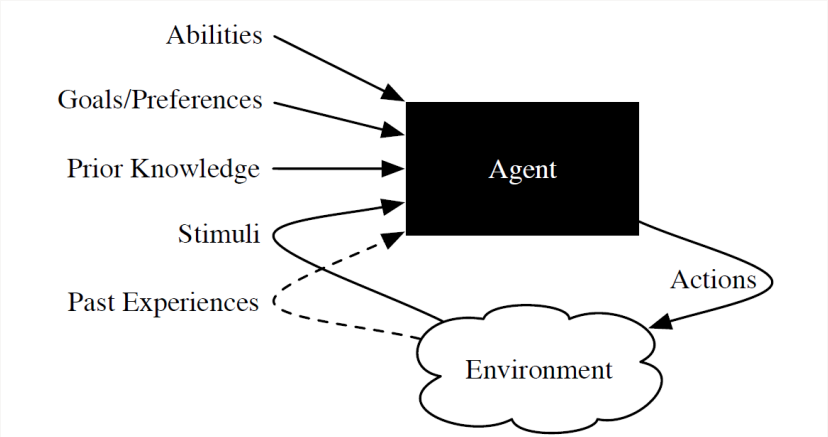
- The problem of constructing an agent is usually called the agent design problem
- Simply, it's about defining the components of the agent, so that when the agent acts rationally, it will accomplish the task it is supposed to perform, and do it well.

Some *important* things we only briefly touch on

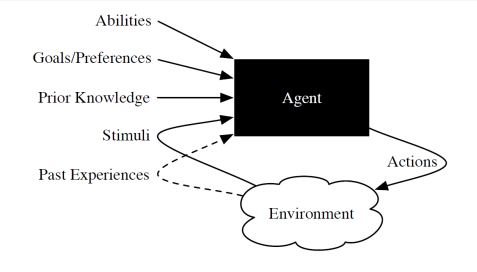
- **User interaction**: Making agents interact comfortably with humans is a substantial challenge for AI developers.
- **Ethics of AI**: AI applications can impact society in both positive and negative ways.

Agents acting in an environment: inputs and output

An agent performs an action in the environment; the environment generates a percept or stimuli. The percept generated by the environment may depend on the sequence of actions the agent has done.



Inputs to an agent



- **Abilities** — the set of possible actions it can perform
- **Goals/Preferences** — what it wants, its desires, its values...
- **Prior Knowledge** — what it knows and believes initially, what it doesn't get from experience...
- **History of stimuli**
  - (current) **stimuli** — what it receives from environment now (observations, percepts)
  - **past experiences** — what it has received in the past

Autonomous car

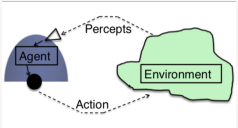
- **abilities:** steer, accelerate, brake
- **goals:** safety, get to destination, timeliness ...
- **prior knowledge:** street maps, what signs mean, what to stop for ...
- **stimuli:** vision, laser, GPS, voice commands ...
- **past experiences:** how braking and steering affects direction and speed...

Agent design problem

Agent design components

The following **components** are required to solve an agent design problem:

- **Action Space** (A): The set of all possible actions the agent can perform.
- **Percept Space** (P): The set of all possible things the agent can perceive.
- **State Space** (S): The set of all possible configurations of the world the agent is operating in.
- **World Dynamics/Transition Function** ($T : S \times A \to S'$): A function that specifies how the configuration of the world changes when the agent performs actions in it.
- **Perception Function** ($Z : S \to P$): A function that maps a state to a perception.
- **Utility Function** ($U : S \to \mathbb{R}$): A function that maps a state (or a sequence of states) to a real number, indicating how desirable it is for the agent to occupy that state/sequence of states.



The agent design components

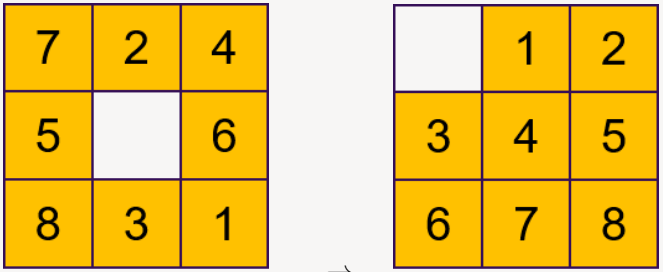
Recall:

- Best action: the action that maximizes a given performance criteria
- A rational agent selects an action that it believes will maximize its performance criteria, given the available knowledge, time, and computational resources.

Utility function, $U : S \to \mathbb{R}$:

- A function that maps a state (or a sequence of states) to a real number, indicating how desirable it is for the agent to occupy that state/sequence of states.
- Crafting the utility function is a key step in the agent design process.

Example: 8-puzzle



Initial state Goal state

A classic search problem

Example: 8-puzzle

- Action space (A)
  - Move the empty cell left (L), right (R), up (U), down (D)
- Percept space (P)
  - The sequence of numbers in left-right and up-down direction, where the empty cell is marked with an underscore
- State space(S)
  - Same as P
- World dynamics (T)
  - The change from one state to another, given a particular movement of the empty cell
  - Can be represented as a table
- Percept function ($Z = S \rightarrow P$)
  - Identity map
- Utility function (U)
  - $+1$ for the goal state; 0 for all other states;
  - (Alternatively the utility function could take a sequence of states as input and output a real number based on cost / number of moves taken)

Defining the environment

Properties about the environment itself or the agent's knowledge about the environment:

- Environment Type: **Discrete** vs. **continuous**
  - Are the state / action / percept spaces finite?
- Sensing Uncertainty: **Fully observable** vs. **partially observable**
  - Does the agent know the state of the world/itself exactly?
  - Is the percept function (Z) a bijection? [one-to-one mapping]
- Effect uncertainty: **Deterministic** vs. **stochastic/non-deterministic**
  - Does the agent always know exactly which state it will be in after performing an action from a state?
  - Is the world dynamics (T) a function, i.e. does it map each (state, action) pair to exactly one next state?
- Number of agents: **Single agent** vs. **multiple agents**
  - Are there other agents interacting?
- Environment: **Static** vs. **dynamic**
  - Can the world change while the agent is "thinking"?

Dimensions of complexity

Dimensions of complexity in agent design (P&M Ch 1.5)

- Research proceeds by making simplifying assumptions, and gradually reducing them.
- Each simplifying assumption gives a dimension of complexity
  - multiple values in a dimension: from simple to complex
  - simplifying assumptions can be relaxed in various combinations
- Much of the history of AI can be seen as starting from the simple and adding in complexity in some of these dimensions.

Dimensions of complexity in agent design

From P&M Ch 1.5:

Dimension	Values
Modularity:	flat, modular, hierarchical
Planning horizon:	non-planning, finite stage, indefinite stage, infinite stage
Representation:	states, features, relations
Computational limits:	perfect rationality, bounded rationality
Learning:	knowledge is given, knowledge is learned
Sensing uncertainty:	fully observable, partially observable
Effect uncertainty:	deterministic, stochastic
Preference:	goals, complex preferences
Number of agents:	single agent, multiple agents
Interaction:	offline, online

Planning horizon

... how far the agent looks into the future when deciding what to do.

- **Finite stage:** agent reasons about a fixed finite number of time steps
- **Indefinite stage:** agent reasons about a finite, but not predetermined, number of time steps
- **Infinite stage:** the agent plans for going on forever (i.e. process oriented)

Representation

Much of modern AI is about finding compact representations and exploiting the compactness for computational gains.

An agent can reason in terms of:

- Explicit **states** — a state is one way the world could be
- **Features** or **propositions**.
  - States can be described or approximated using features.
  - A proposition is a boolean feature which means that its value is either `true` or `false`. 30 binary features can represent
  - e.g. $2^{30} = 1,073,741,824$ states – it may be easier to specify and reason with the thirty propositions than with more than a billion states
- **Individuals** and **relations**
  - There is a feature for each relationship on each tuple of individuals.
  - Often an agent can reason without knowing the individuals or when there are infinitely many individuals.

Computational limits

- **Perfect rationality:** the agent can determine the best course of action, without taking into account its limited computational resources.
- **Bounded rationality:** the agent must make good decisions based on its perceptual, computational and memory limitations.

IBM Watson: computer system that could answer questions posed in natural language (2011)

Learning from experience

Whether the model is fully specified a priori:

- **Knowledge is given.**
- **Knowledge is learned from data or past experience.**

...always some mix of prior (innate, programmed) knowledge and learning (nature vs nurture).

Uncertainty

There are two dimensions for uncertainty:

- **Sensing uncertainty** or noisy perception
- **Effect uncertainty**

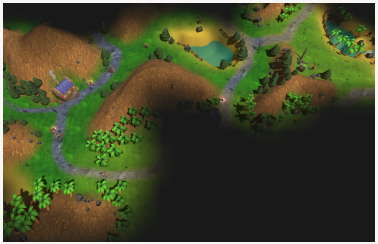
In this course, we restrict our focus to **probabilistic** models of uncertainty. Why?

- Agents need to act even if they are uncertain.
- Predictions are needed to decide what to do:
  - definitive predictions: you will be run over tomorrow
  - point probabilities: probability you will be run over tomorrow is 0.002 if you are careful and 0.05 if you are not careful
  - probability ranges: you will be run over with probability in range [0.001,0.34]
- Acting is gambling: agents who don't use probabilities will lose to those who do.
- Probabilities can be learned from data and prior knowledge.

Sensing uncertainty

Whether an agent can determine the state from its stimuli:

- **Fully-observable**: the agent can observe the state of the world.
- **Partially-observable**: there can be a number states that are possible given the agent's stimuli.



e.g. Fog of war in games like "Might is Right"; `https://medium.com/@travnick/fog-of-war-282c8335a355`

Effect uncertainty

If an agent knew the initial state and its action, could it predict the resulting state?

The dynamics can be:

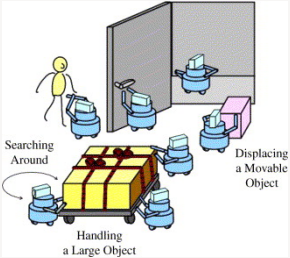
- **Deterministic**: the resulting state is determined from the action and the state
- **Stochastic**: there is uncertainty about the resulting state.

Number of agents

Are there multiple reasoning agents that need to be taken into account?

- **Single agent** reasoning: any other agents are part of the environment.
- **Multiple agent** reasoning: an agent reasons strategically about the reasoning of other agents.

Agents can have their own goals: cooperative, competitive, or goals can be independent of each other



Ota (2006) https://www.sciencedirect.com/science/article/pii/S1474034605000509

Interaction

When does the agent reason to determine what to do?

- **reason offline**: before acting
- **reason online**: while interacting with environment

Dimensions of complexity in agent design

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Problem classes in this course

- State-space search (Module 1) ; Planning horizon: indefinite stage
- Deterministic planning using CSP (Module 2) ; Planning horizon: may have finite stage; Representation: may use features
- Markov decision processes (MDPs, Module 3) ; Effect uncertainty: stochastic
- Reinforcement learning (Module 4) ; Learning: knowledge is learned; Interaction: online
- Classical game theory (Module 5) ; Number of agents: multiple agents

The real world: Humans

Dimension	Values
Modularity	flat, modular, hierarchical
Planning horizon	non-planning, finite stage, indefinite stage, infinite stage
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Summary of today's lecture

- What is Artificial Intelligence?
- History of AI
- Defined AI in this course as designing "rational agents"
  - How to design an agent so that we can program it
- Properties of an agent and its environment
  - What representations and methods should be used, so that the agent can solve its problem(s) well?

Next week

- Introduction to search
  - A way for an agent to solve its problem(s)
- For you to do:
  - Assignment 0
  - Tutorial 1
  - Read chapters in textbook
  - Review computational complexity:
    - Examples with code: `https://rob-bell.net/2009/06/a-beginners-guide-to-big-o-notation/`
    - Asymptotic notation: `https://www.khanacademy.org/computing/computer-science/algorithms/asymptotic-notation/a/asymptotic-notation`

Attributions and References

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