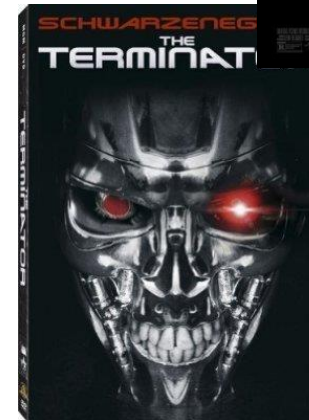
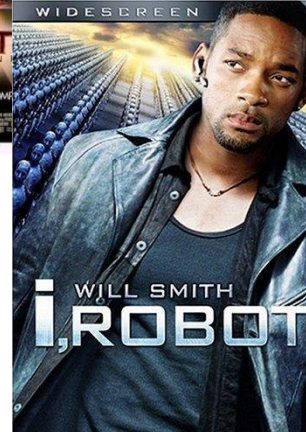
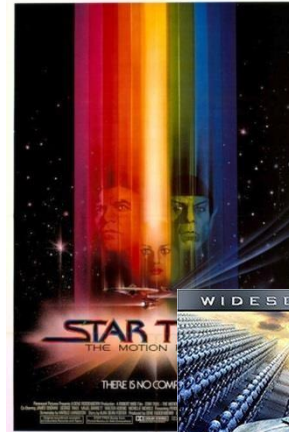
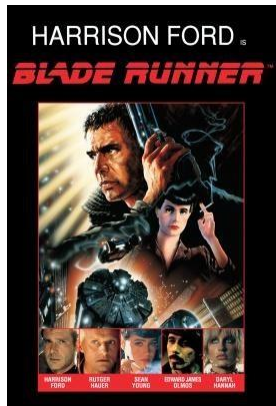
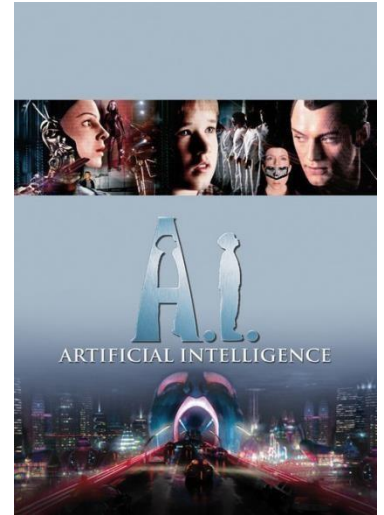
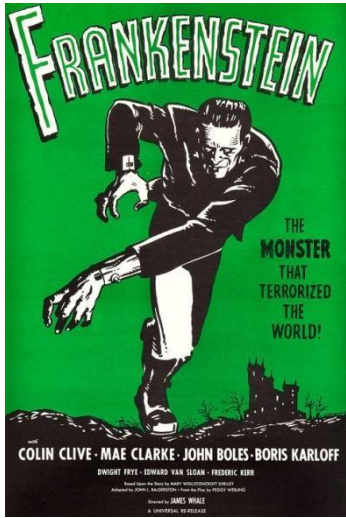


Introduction to Artificial Intelligence

Derek KD

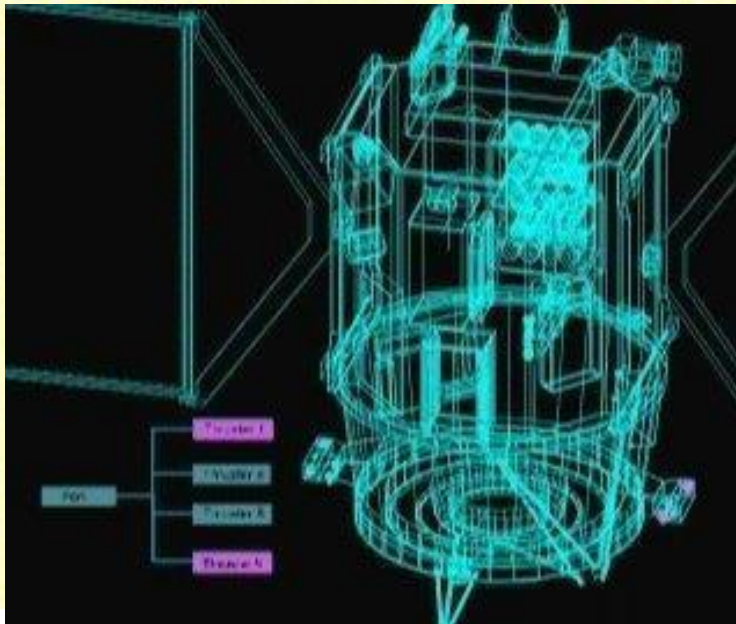
Artificial Intelligence in the Movies



Falling a Bit Behind

NASA: Deep Space One spacecraft

It's one small step in the history of space flight. But it was one giant leap for computer-kind, with a state of the art artificial intelligence system being given primary command of a spacecraft. Known as Remote Agent, the software operated NASA's Deep Space 1 spacecraft and its futuristic ion engine during two experiments that started on Monday, May 17, 1999. For two days Remote Agent ran on the on-board computer of Deep Space 1, more than 60,000,000 miles (96,500,000 kilometers) from Earth. The tests were a step toward robotic explorers of the 21st century that are less costly, more capable and more independent from ground control.



Artificial Intelligence Today

**'Whoever leads in AI will rule the world':
Putin to Russian children on Knowledge
Day**

rt.com, Sep 5 2017



**Inside Waymo's Secret World for Training
Self-Driving Cars**



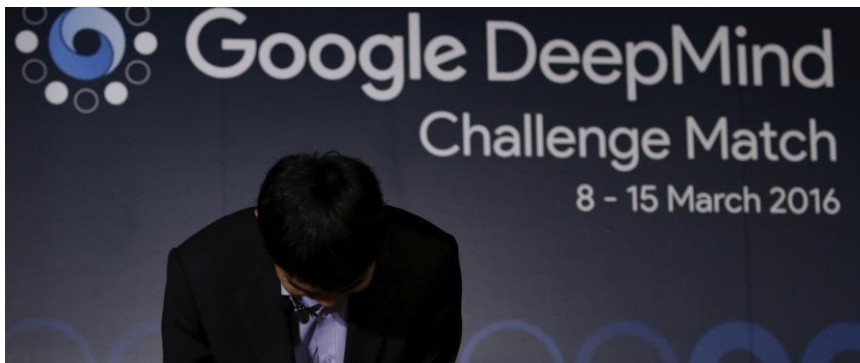
Alexa talks down to
voice rivals at IFA
2017



Amazon Alexa now
responds to certain
questions with
skills that can help yo...



Alexa will
recommend third-
party skills for
things it can't do



Artificial Intelligence Today

A young science (\approx 50 years old)

- Exciting and dynamic field, impressive success stories
- Lots uncharted territory left
- “Intelligent” in specialized domains



- Many application areas

AI in the Future

- Stanford University is hosting a study Examine Effects of Artificial Intelligence
- One Hundred Year Study on Artificial Intelligence (AI100).
- The study, funded by Microsoft research is to examine impacts of AI on society, including on the economy, war and crime, over the course of a century
- 2016 Report

This Course

- **Foundations** of artificial intelligence
- Focus on **core concepts**
 - ✓ They apply to wide variety of applications
 - Will mention example applications but they are not the focus
 - ✓ 422 covers applications in more detail
- There are many specialized subfields
 - ✓ Machine learning
 - ✓ Computer vision
 - ✓ Natural language processing
 - ✓ Robotics
 - ✓ Intelligent User Interfaces
 - ✓

Today's Lecture

- What is AI?
- What is an Intelligent Agent?
- Representation and Reasoning: Dimensions

Course Material (1)

- Main Textbook

- Artificial Intelligence: Foundations of Computational Agents. by Poole and Mackworth. (P&M)
- We will cover Chapters: 1, 3, 4, 5, 6, 8, 9
- Lecture Slides

- Additional Reference
- [Artificial Intelligence : A Modern Approach](#), by Russell and Norvig, 3rd Edition (Prentice-Hall, 2010)

Course Material (2)

- You are responsible for all the material in the assigned readings, regardless of whether it has been explicitly covered in class.

- You are also responsible for all the material covered in class, whether or not it is included
- It is strongly recommended that you read the assigned readings/ before each class. It will help you understand the material better when I lecture

How to Get Help?

- Post questions on course material
 - ✓ We will be answering these questions via SLACK
- Answer others' questions if you know the answer
- Learn from others' questions and answers
- Expect a 24h turnaround time from the teaching team

Assignments/Projects

- There will be **five** assignments in total
- You get **two** late days 😊
- to allow you the flexibility to manage unexpected issues

Collaboration on Assignments

- You **may** work with **one** other trainer, unless otherwise indicated (e.g., see assignment 0)

Assignment 0

- Part A of this assignment asks you to
- Find existing AI applications
- explain some high-level details about how they work
- Already in Connect today
 - ✓ To be done **alone**
 - ✓ Due **Wednesday, July 24, 4:30pm**
 - ✓ Submission via email
(derekjr560@gmail.com)
 - Submit a **single PDF file**
 - List your **name** and **name of hub**
 - **Read carefully the instructions** on the assignment: in you don't follow them we will **not be able to mark** your assignment
- Be ready to discuss your findings during that class!

- Part B of assignment 0 asks you to declare that you have **read** and **understood** the **course syllabus**

To Summarize

- All the course logistics are described in the course syllabus
- Make sure to read it and that you agree with the course rules before deciding to take the course
- **And complete the related part of Assignment 0**

Today's Lecture

What is AI?

- What is an Intelligent Agent?
- Representation and Reasoning: Dimensions

What is Artificial Intelligence?

- Some definitions that have been proposed
 1. Systems that think like humans
 2. Systems that act like humans
 3. Systems that think rationally

4. Systems that act rationally

Thinking Like Humans

Model the cognitive functions and behaviours of humans

- Human beings are our best example of intelligence
- We should use that example!
- But ... how do we measure thought?
 - ✓ We would have to spend most of our effort on studying **how people's minds operate (Cognitive Science)**
 - ✓ Rather than thinking about what intelligence ought to mean in various domains

Acting Like Humans

- Turing test (1950)
- operational definition of intelligent behavior
- Can a human interrogator tell whether (written) responses to her (written) questions come from a human or a machine?
- No system has fully passed the test yet • Yearly competition:
<http://www.loebner.net/Prizetf/loebner-prize.html>
- Is acting like humans really what we want?
- Humans often think/act in ways we don't consider intelligent

- Why?

So, Why Replicate Human Behavior,
Including its “Limitations”?

So, Why Replicate Human Behavior, Including its “Limitations”?

- AI and Entertainment
- E.g. Façade, a one-act interactive drama
- Sometime these limitations can be useful, e.g.
- Supporting Human Learning via teachable agents

(Leelawong, K., & Biswas, G. Designing Learning by Teaching Agents: The Betty's Brain System, International Journal of Artificial Intelligence in Education, vol. 18, no. 3, pp. 181-208, 2008)

- Simulations for military training
(<http://www.alelo.com/>)



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
- Is rational **thought** enough?
- A system that only thinks and doesn't do anything is quite useless

- Any means of communication would already be an **action**
- And it is hard to measure thought in the first place ...

Acting Rationally

We will emphasize this view of AI

- Rationality is **more cleanly defined** than human behaviour, so
 - ✓ it's a better design objective
 - ✓ in cases where human behaviour is not rational, often we'd prefer rationality
 - Example: you wouldn't want a shopping agent to make impulsive purchases!

✓ And once we have a rational agent, we can always tweak it to make it irrational!

- It's easier to define rational action than rational thought

Today's Lecture

- What is AI?

 • What is an Intelligent Agent?

- Representation and Reasoning: Dimensions

AI as Study and Design of Intelligent

Agents

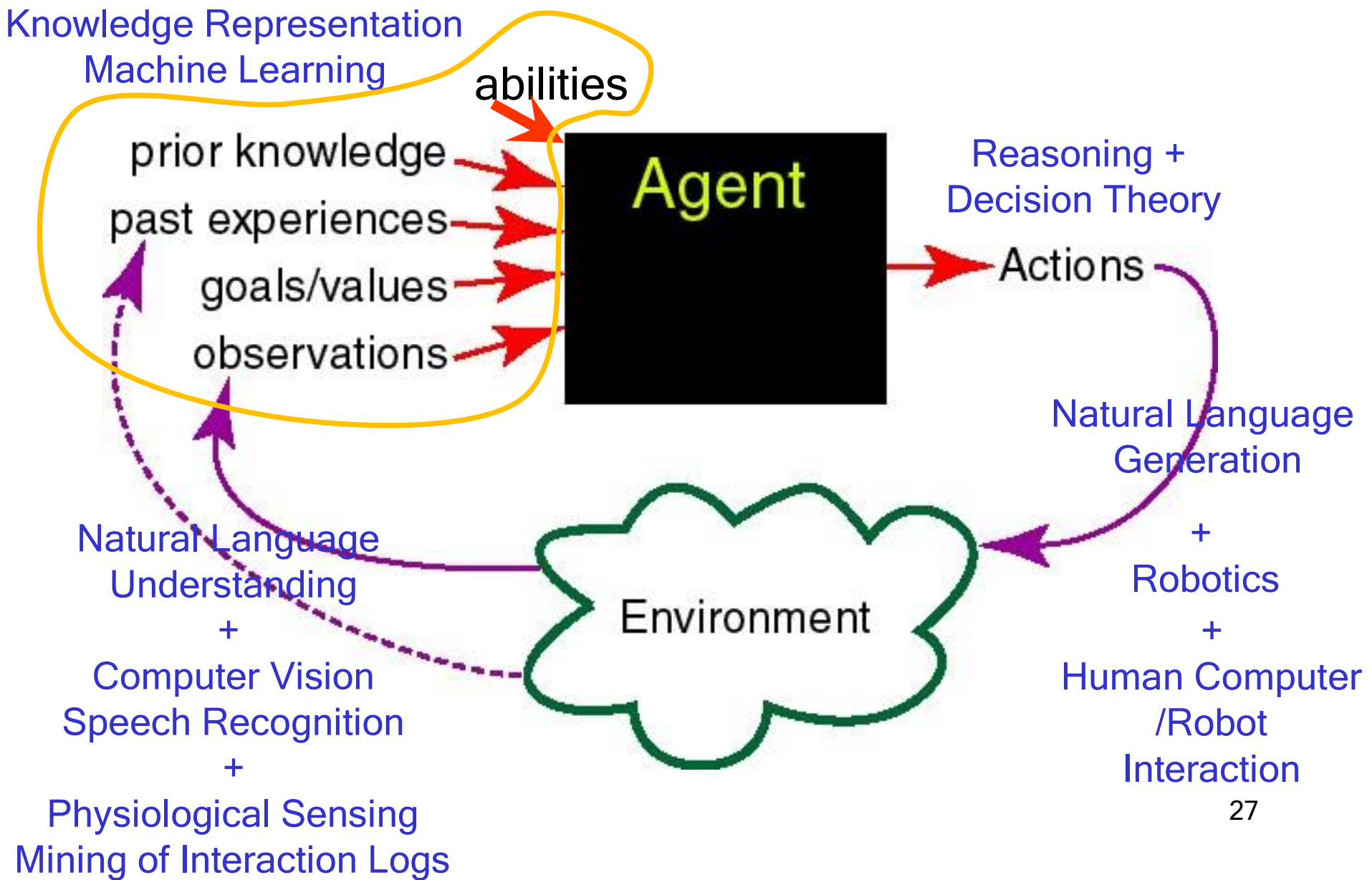
- **Intelligent agents**: artifacts that **act rationally** in their environment
- Their **actions** are **appropriate** for their goals and circumstances
- They are **flexible** to changing environments and goals
- They learn from experience
- They make **appropriate choices** given **perceptual limitations** and **limited resources**
- This definition drops the constraint of cognitive plausibility
- Same as building flying machines by understanding general principles of flying (aerodynamic) vs. by reproducing how birds fly

Robots vs. Other Intelligent Agents

- In AI, artificial agents that have a physical presence in the world are usually known as **robots**
- Robotics is the field primarily concerned with the implementation of the physical aspects of a robot
 - ✓ I.e., perception of and action in the physical environment
 - ✓ Sensors and actuators
- Agents without a physical presence: **software agents** • E.g. desktop assistants, decision support systems, web crawlers, text-based translation systems, intelligent tutoring systems, etc.
- They also interact with an environment, but not the physical world
- Software agents and robots
- differ in their interaction with the environment

- share all other fundamental components of intelligent behavior

Intelligent Agents in the World



Today's Lecture

- Administrivia
- What is AI?
- What is an Intelligent Agent?

 • Representation and Reasoning: Dimensions

NEXT TIME



TO DO for next classes

For Tuesday: Read Chapter 1 of textbook

For Wednesday: Assignment 0

- Asks you to find **examples of fielded or experimental AI agents**, and to explain some high-level details about how they work.
- The assignment is available via mail. To be **done alone**
- **Submit electronically** and you **can't use late days**
- Come prepared to discuss the applications you found