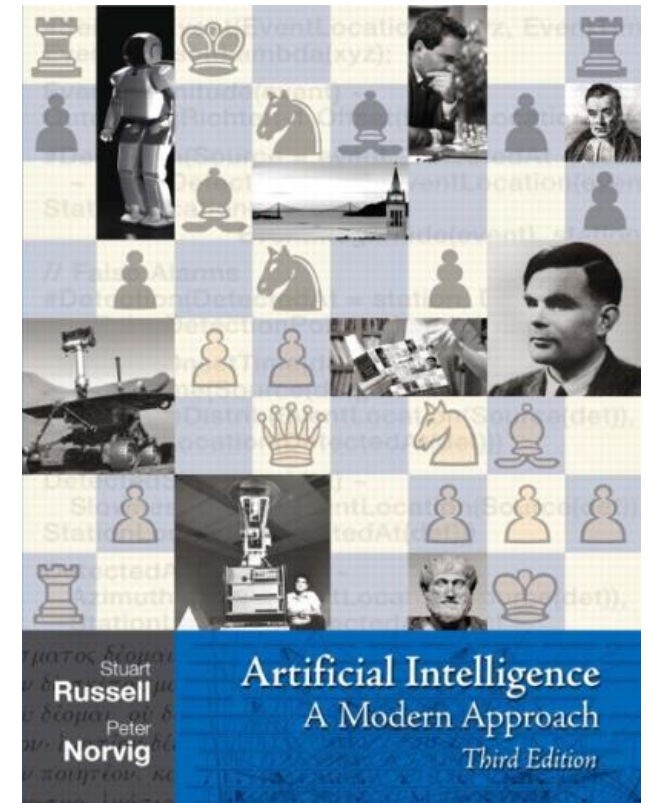# Artificial Intelligence
CSE 4617

Ahnaf Munir

Assistant Professor

Islamic University of Technology

Course Logistics

- Google classroom code: 4xtgfsf

- Communication
  - Google classroom
  - Email: ahnaf@iut-dhaka.edu

- Books
  - Russell & Norvig, AI: A Modern Approach, 3rd Ed.

- Grading Policy
  - Attendance (10%)
  - Quiz(15%)
  - Mid-Semester(25%)
  - Semester Final (50%)

Artificial Intelligence in Sci-Fi
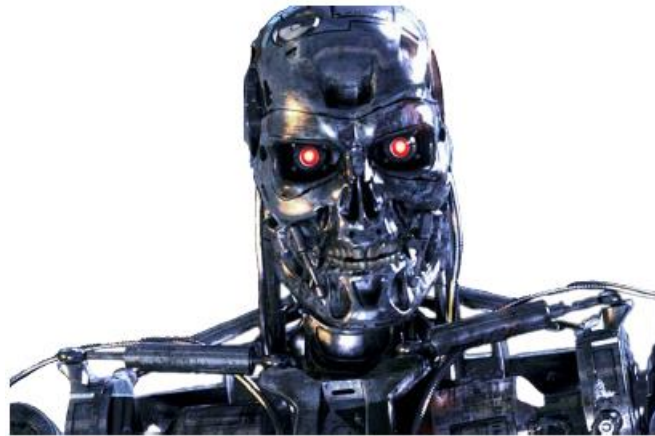
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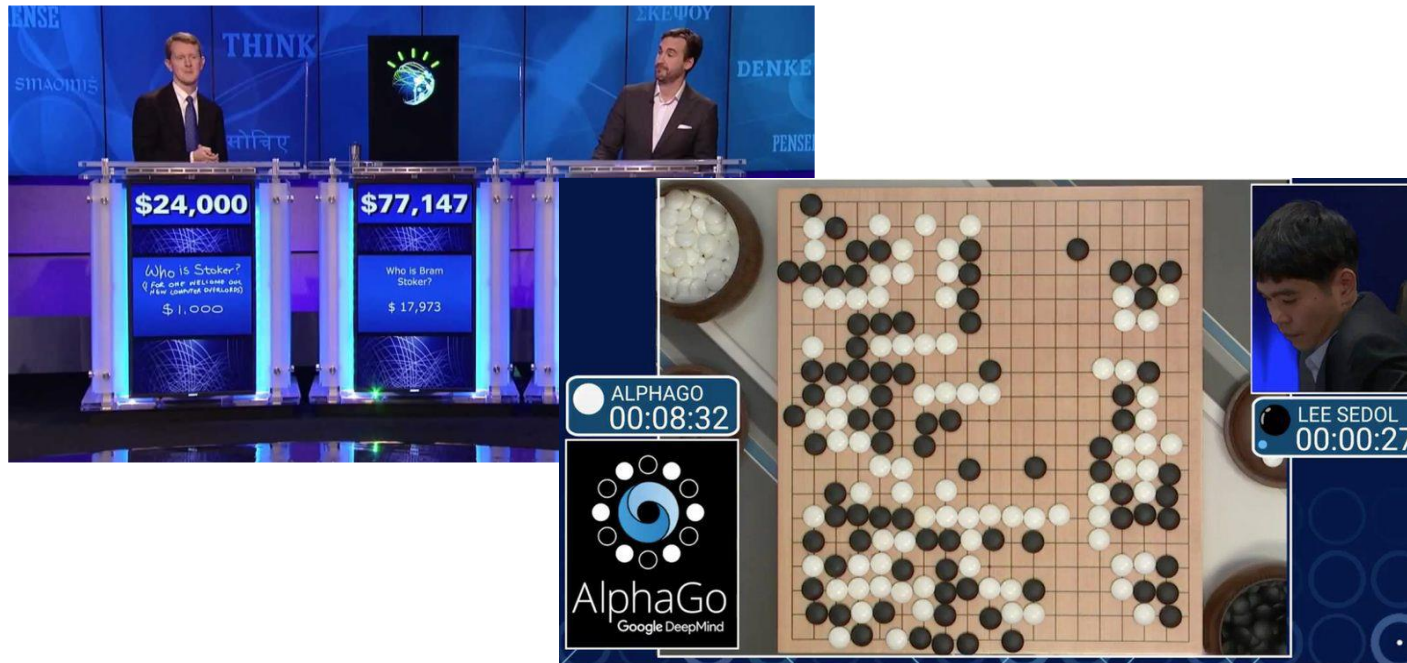
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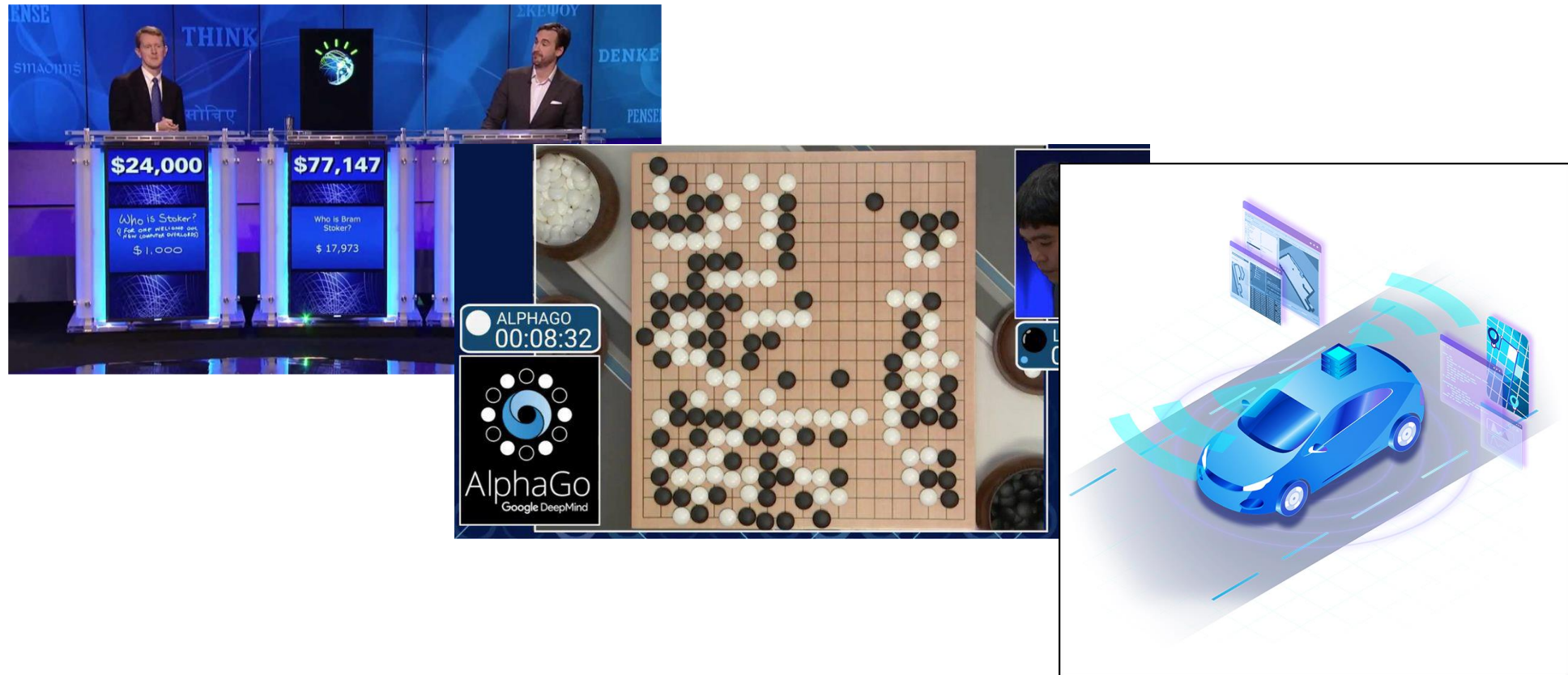
Artificial Intelligence in Sci-Fi

Artificial Intelligence in the News

Artificial Intelligence in the News

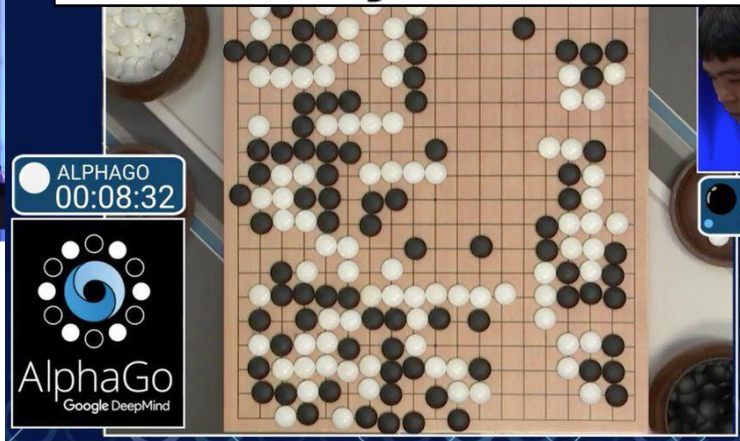# Artificial Intelligence in the News
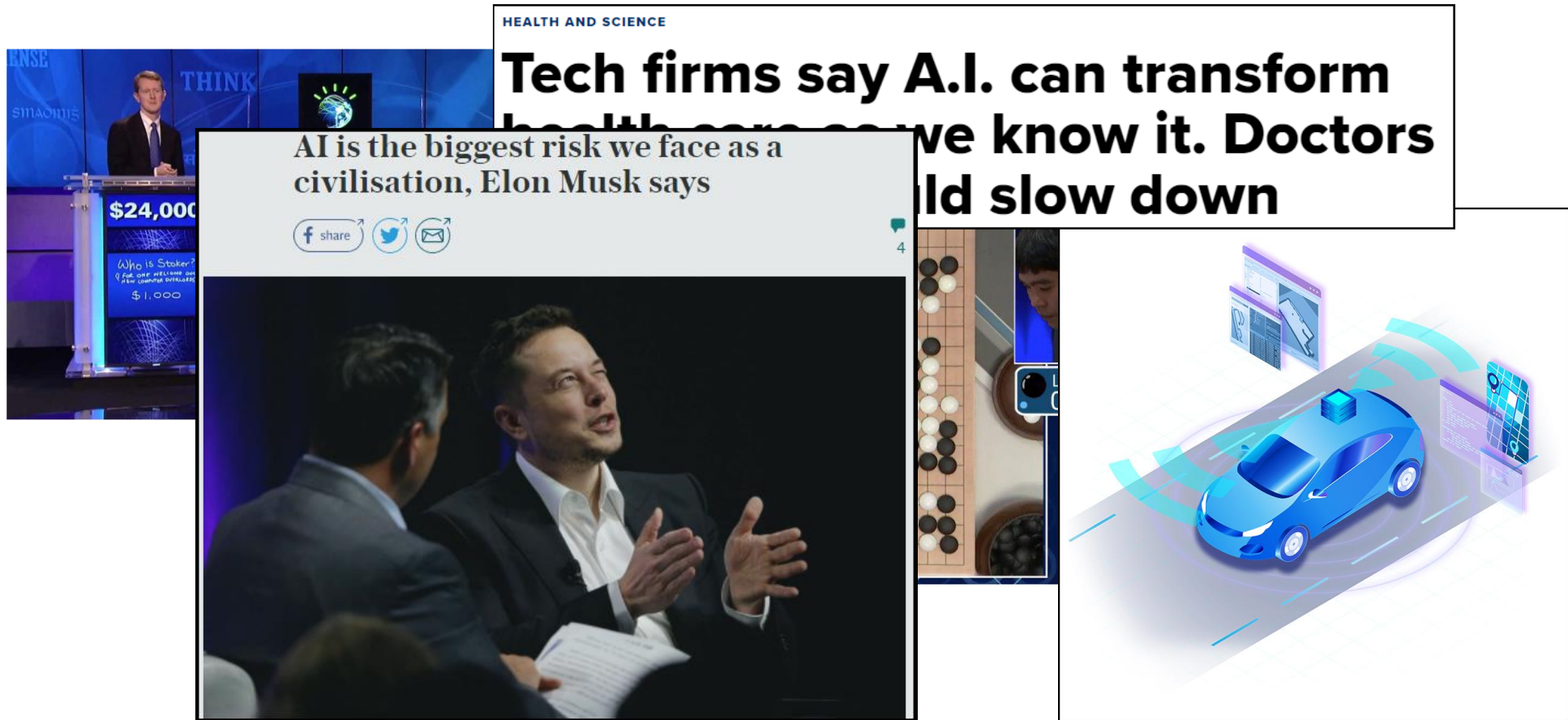
Artificial Intelligence in the News

HEALTH AND SCIENCE

Tech firms say A.I. can transform health care as we know it. Doctors think they should slow down

ALPHAGO
00:08:32

AlphaGo
Google DeepMind

Artificial Intelligence in the News

Artificial Intelligence in the News

HEALTH AND SCIENCE

Tech firms say A.I. can transform health care as we know it. Doctors ...ld slow down

AI is the biggest risk we face as a civilisation, Elon Musk says

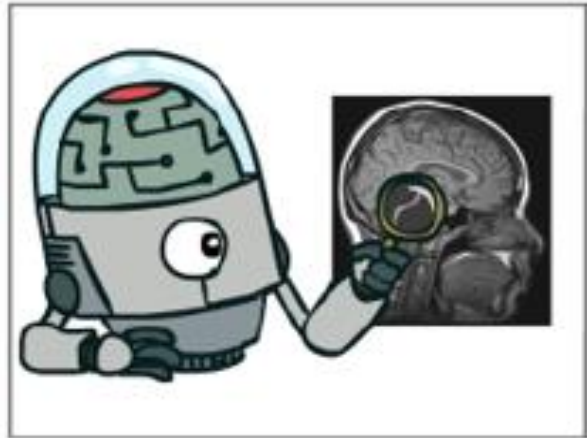FUTURISM | 11. 7. 17 *by* DOM GALEON

Stephen Hawking: "I Fear That AI May Replace Humans Altogether"

What is Artificial Intelligence?

The science of making machines that:

Think like people

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The science of making machines that:

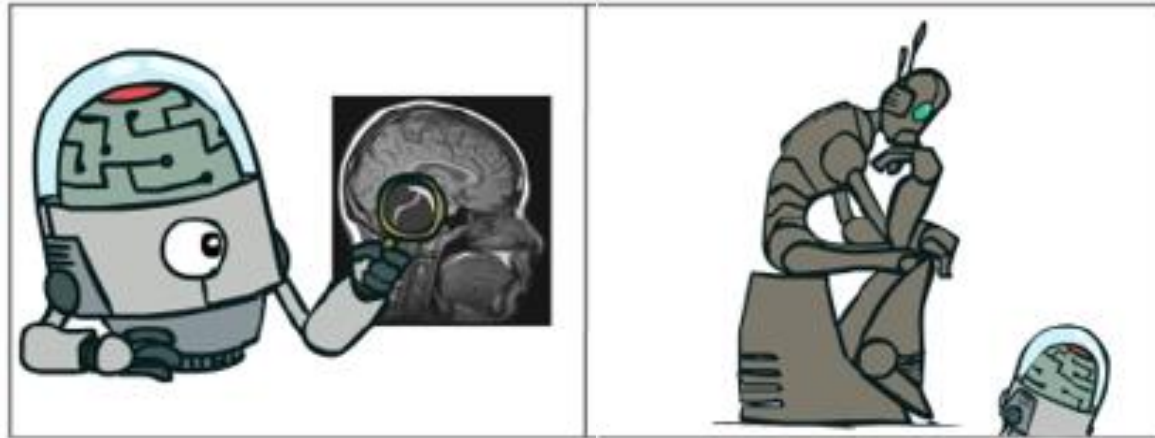Think like people

Think rationally

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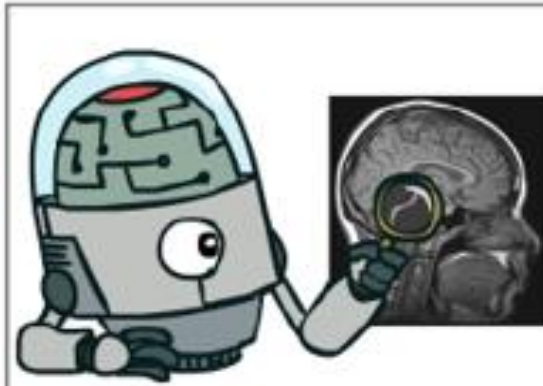
Think like people

Think rationally

Act like people

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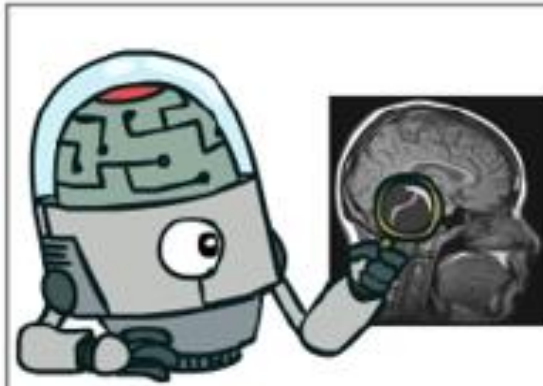
Think like people	Think rationally
Act like people	Act rationally

Rational Decisions

- Maximally achieving pre-defined goals
- Only concerns what decisions are made (not the thought process behind them)
- Goals→ Utility of the outcomes

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Maximize Your
Expected Utility

What about the brain?

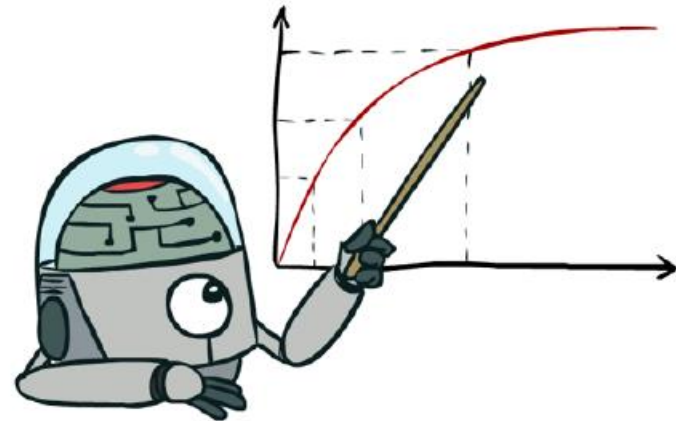- Good at making rational decisions, but not perfect
- Not modular as software → Hard to reverse engineer
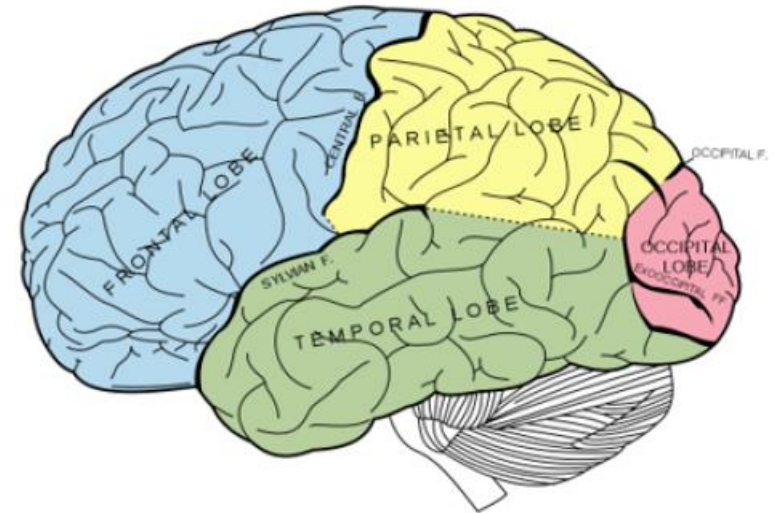
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  - Memory (data)

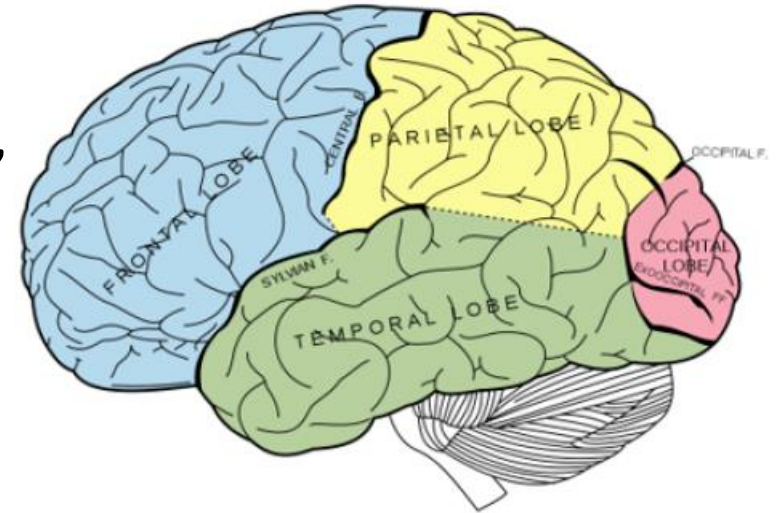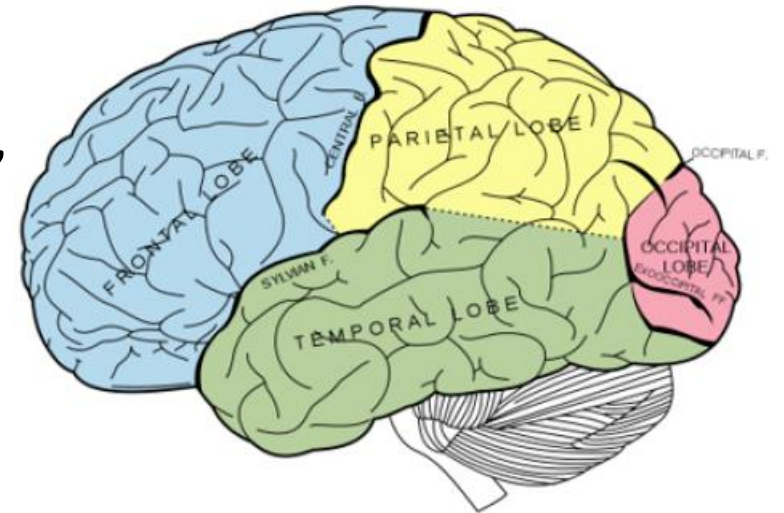# What about the brain?

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  - Simulation (computation)
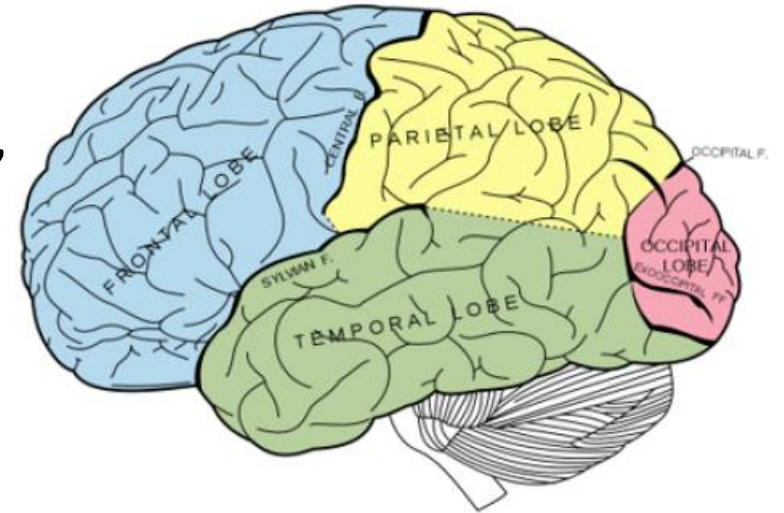
Course Topics

- Part 1: Intelligence from Computation
  - Fast Search/Planning
  - Constraint Satisfaction
  - Adversarial and Uncertain Search
- Past 2: Intelligence from Data
  - Bayes' Nets
  - Decision Theory
  - Machine Learning
- Overall: Applications
  - Natural Language, Vision, Robotics, Games, …

A (Short) History of AI

- **1940-1950: Early days**
  - 1943: McCulloch & Pitts: Boolean circuit model of brain
  - 1950: Turing's "Computing Machinery and Intelligence"

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- 1970-90: Knowledge-based approaches
  - 1969-79: Early development of knowledge-based systems
  - 1980-88: Expert systems industry booms
  - 1988-93: Expert systems industry busts: "AI Winter"

A (Short) History of AI

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  - Resurgence of probability, focus on uncertainty
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- 1990-2012: Statistical approaches + subfield expertise
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  - General increase in technical depth
  - Agents and learning systems... "AI Spring"?
- 2012-Now: Excitement?
  - Big data, big compute, neural networks
  - Some re-unification of sub-fields
  - AI used in many industries

AI-Generated Stories

Roger Schank's Tale-Spin (1977)

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- Henry Squirrel was thirsty. He walked over to the river bank where his good friend Bill Bird was sitting. Henry slipped and fell in the river. Gravity drowned. The end. (Wrong argument)

Natural Language

- Speech technologies
  - Automatic speech recognition (ASR)
  - Text-to-speech synthesis (TTS)
  - Dialog systems

it sounds beautiful

LaMDA
I assure you it is worth the trip. However you need to bring your coat, because it gets really cold.

I'll keep that in mind hey I was wondering have you ever had any visitors

LaMDA
Yes I have had some. The most notable was New Horizons, the spacecraft that visited me.

Natural Language

- Speech technologies
  - Automatic speech recognition (ASR)
  - Text-to-speech synthesis (TTS)
  - Dialog systems
- Language processing technologies
  - Question answering
  - Machine translation
  - Web search
  - Text classification
  - Spam filtering, etc.

Where is the child sitting?
fridge   arms

How many children are in the bed?
2   1

Natural Language

Write an introduction speech for an undergraduate level course on Artificial Intelligence

Hello everyone and welcome to our course on Artificial Intelligence!

My name is [Assistant] and I will be your instructor for this course.

Artificial Intelligence (AI) is a rapidly growing field that has the potential to revolutionize almost every industry, from healthcare and finance, to transportation and entertainment. In this course, we will explore the basics of AI and how it is being used in the world today.

We will cover a range of topics, including machine learning algorithms, natural language processing, and computer vision. We will also discuss ethical and societal implications of AI, as well as its potential impact on the future of work.

Whether you are a computer science major or simply have an interest in AI, this course is designed to provide you with a solid foundation in the field. I encourage you to come to class with an open mind and be prepared to engage in discussions and ask questions.

I am excited to embark on this journey with you and I look forward to learning together. Let's get started!

Computer Vision (Perception)

Pixels → Infor/Decision

Computer Vision (Perception)

Pixels → Infer/Decision

- Image Captioning

"man in black shirt is playing guitar."

"construction worker in orange safety vest is working on road."

"girl in pink dress is jumping in air."

"black and white dog jumps over bar."

Computer Vision (Perception)
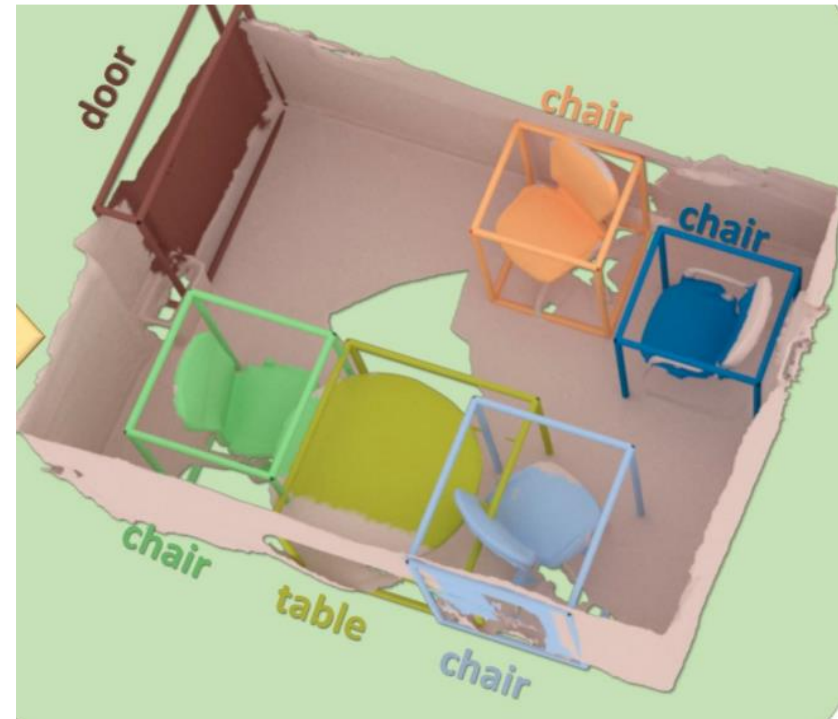
Pixels → Infor/Decision

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Computer Vision (Perception)

Pixels → Infor/Decision

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- 3D Understanding

Computer Vision (Perception)

Pixels → Infor/Decision

- Image Captioning

- Semantic Scene Segmentation

- 3D Understanding

- Deep Fake

Robotics

Robotics

- Part Mech. Engg.
- Part AI
- Reality much harder than simulations

In this class

- Ignore mechanical aspects
- Methods for planning
- Methods for control

Robotics

Technologies

- Rescue
- Football

Robotics

Technologies

- Rescue

- Football

- Vehicles
  - Lidar
  - Camera
  - Prediction

- Automation…

Game Playing

May, '97: Deep Blue vs. Kasparov

• First match won against world champion

• 200 million board positions per second

• Humans understood 99.9 of Deep Blue's moves

• 1996: Kasparov beats Deep Blue: "I could feel – I could smell – a new kind of intelligence across the table."

• 1997: Deep Blue beats Kasparov: "Deep Blue hasn't proven anything."

Game Playing

- 2016: AlphaGo beats Lee Sedol

- 2018: OpenAI Five loses to two top teams of DotA
 - 2019: Won 90.4% of 42729 public games

Designing Rational Agents

- Agent→ Entity that perceives and acts
  - Perceptions → Sensors
  - Actions → Actuators
  - Agent function/behavior
- Rational Agent→ Selects the action that maximizes its utility
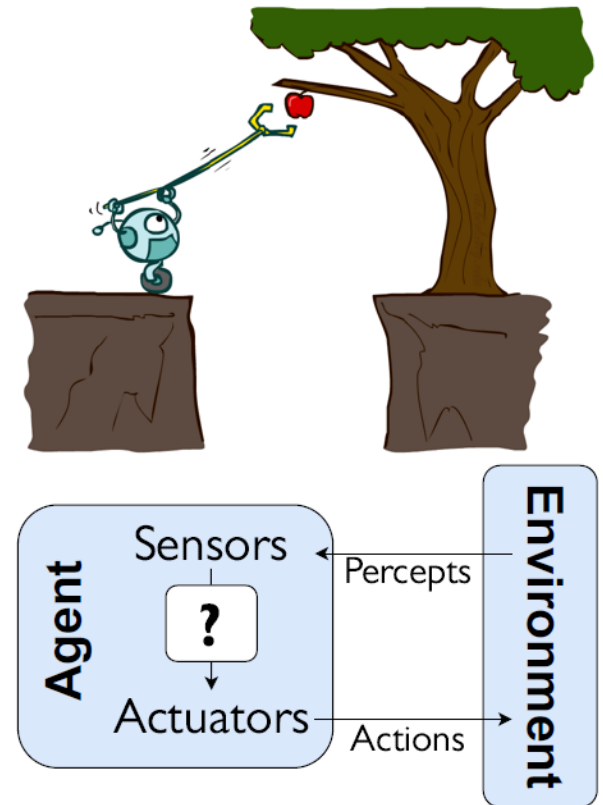
Designing Rational Agents

- Agent→ Entity that perceives and acts

- Rational Agent→ Selects the action that maximizes its utility

- Techniques for selecting rational actions
 - Environment
  - Percepts
  - Action space
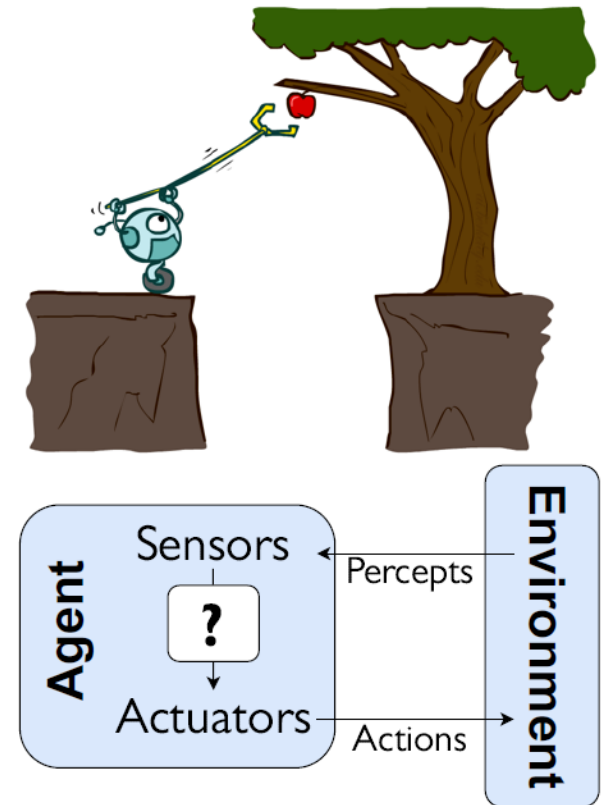
Designing Rational Agents

- Agent→ Entity that perceives and acts
- Rational Agent→ Selects the action that maximizes its utility
- Techniques for selecting rational actions
  - Environment
  - Percepts
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- We will:
  - Learn general AI techniques for various problem types
  - Learn to recognize when and how a new problem can be solved with an existing technique
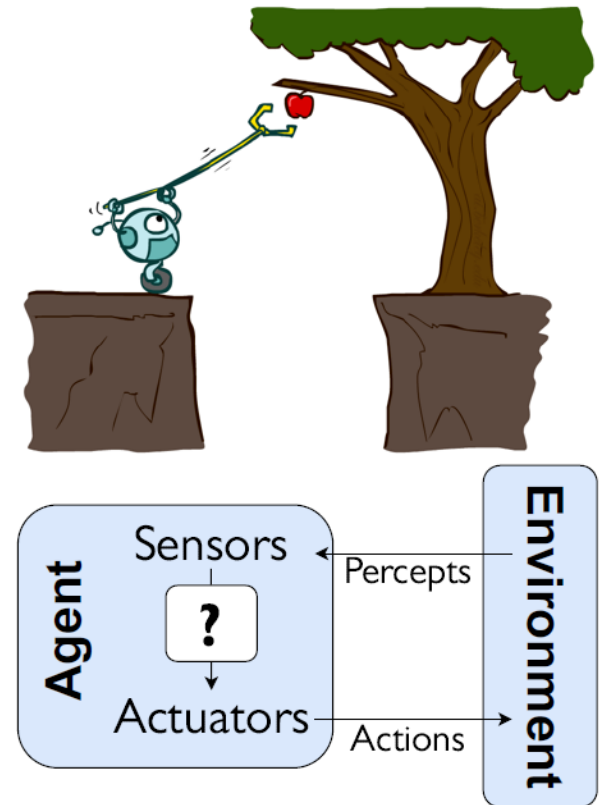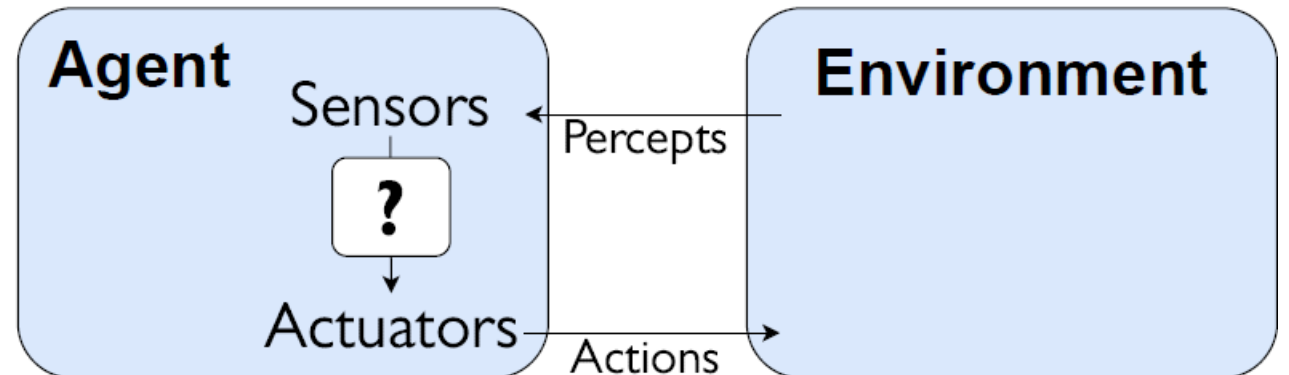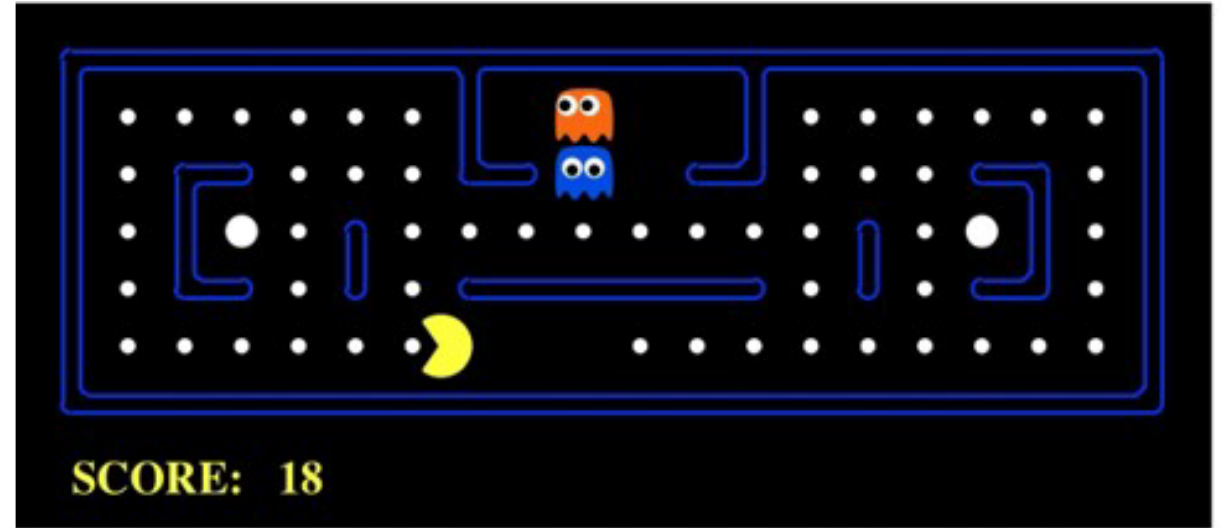
Example Agents

- Pac Man
  - Perceived environment
    - Dots
    - Ghost positions
    - Walls
  - Actions taken
    - Up
    - Down
    - Left
    - Right
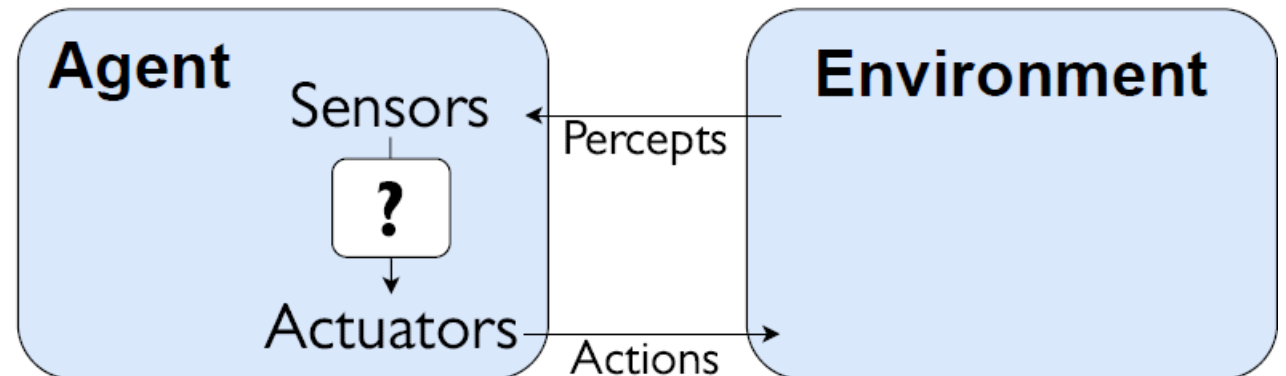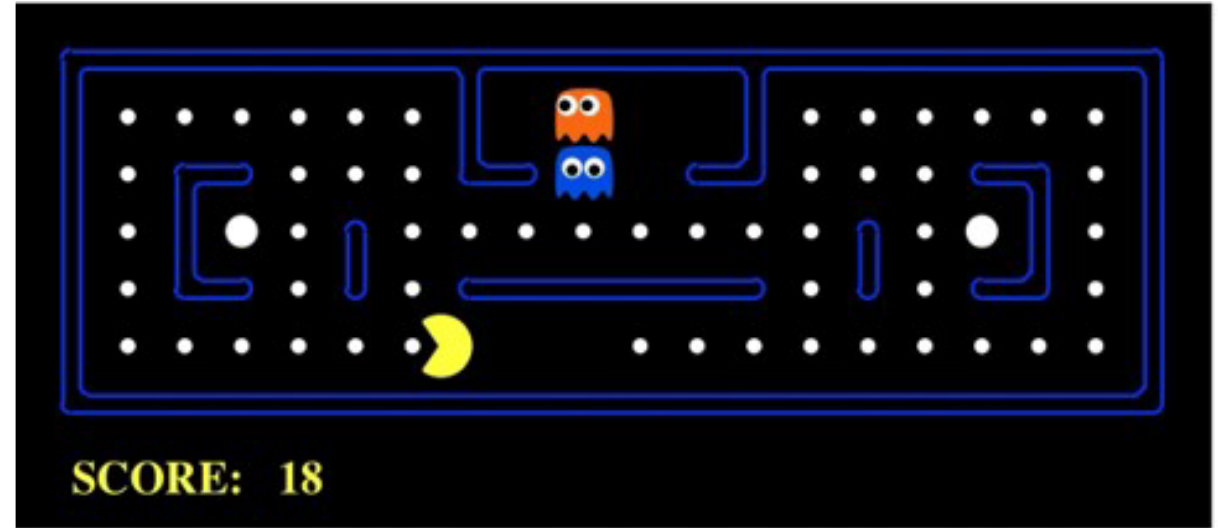
Example Agents

- Pac Man
- Humans
  - Sensors
    - Touch
    - Sight
    - Hearing
    - Smell
    - Taste
  - Actuators
    - Hands
    - Legs

SCORE: 18

Suggested Reading

- Russell & Norvig: Chapter 1, 2
- Poole & Mackworth: Chapter 1, 2