Intro to Artificial Intelligence Lecture 1

Ahmed Sallam { http://sallam.cf }

Purpose of this course

- **Understand AI Basics**
- **Excite you about this field**

Definitions of AI

Thinking Rationally

Acting Rationally

Thinking Humanly

Acting Humanly
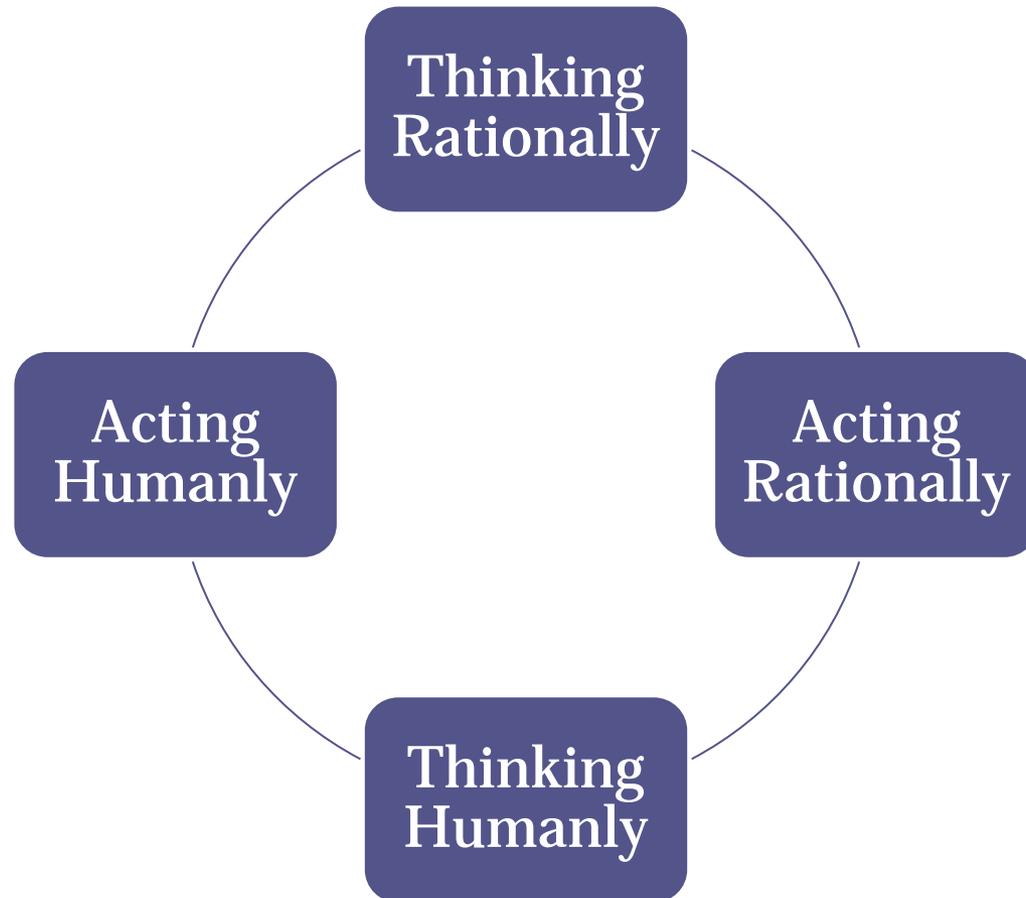
Foundations of AI

- **Philosophy** (384 B.C.)
- **Mathematics** (George Boole 1815-1864)
- **Economics** (Adam Smith (1723-1790) published An Inquiry into the Nature and Causes of the Wealth of Nations)
- **Neuroscience** (Paul Broca's (1824-1880) study of aphasia (speech deficit) in brain-damaged patients)
- **Psychology** (Hermann von Helmholtz (1821-1894) applied the scientific method to the study of human vision, and his Handbook of Physiological Optics)

Foundations of AI cont.

- **Computer engineering :** (For artificial intelligence to succeed, we need two things: intelligence and an artifact. The computer has been the artifact of choice)
- **Control theory and cybernetics:**
  - a water clock 250 B.C. and thermostat.
  - Wiener's book Cybernetics (1948) be-came a bestseller and awoke the public to the possibility of artificially intelligent machines
- **Linguistics:** Noam Chomsky, wrote the book Syntactic Structures. He pointed out that the behaviorist theory did not address the notion of creativity in language-it did not explain how a child could understand and make up sentences that he or she had never heard before.

History of AI

The gestation of AI

- Warren McCulloch and Walter Pins (1943): build a neuron model to represent prepositional logic.

- SNARC: first neural network computer in 1950 by Marvin Minsky and Dean Edmonds at Harvard.

The birth of AI

- McCarthy called for two months workshop at Dartmouth (1956).
- McCarthy invite Minsky, Claude Shannon, and Nathaniel Rochester.
- There were 10 attendees in all, including Trenchard More from Princeton, Arthur Samuel from IBM, and Ray Solomonoff and Oliver Selfridge from MIT.
- **Newell and Simon** stole the show by reasoning program, the Logic Theorist (LT), about which Simon claimed, "We have invented a computer program capable of thinking non-numerically, and thereby solved the venerable mind—body problem.

Great expectations (1952-1969)

- **Newell and Simon developed the** GPS to imitate human.
- **Arthur Samuel** wrote a series of programs for checkers.
- **Minsky** supervised a series of students who chose limited problems that appeared to require intelligence to solve which known by Microworlds
- **McCarthy** defined the high-level language Lisp

A dose of reality (1966-1973)

- U.S. National Research Council funded an attempt to speed up the translation of Russian scientific papers in 1957.
- This project failed.

A dose of reality (1966-1973) cont.

- Herbert Simon (1957) said:

"It is not my aim to surprise or shock you but the simplest way I can summarize is to say that there are now in the world machines that think, that learn and that create. Moreover their ability to do these things is going to increase rapidly until—in a visible future—the range of problems they can handle will be coextensive with the range to which the human mind has been applied".

Knowledge-based systems: The key to power? (1969-1979)

- DENDRAL by Feigenbaum 1969 at Stanford: program to solve the problem of inferring molecular structure from the information provided by a mass spectrometer

AI becomes an industry (1980—present)

- **RI expert system:** The program helped configure orders for new computer systems. And saved a company 40 million a year.

- The return of neural networks (1986—present)
  - back-propagation learning algorithm first found in 1969 by Bryson

AI becomes an industry (1980–present) cont.

- AI adopts the scientific method (1987–present)
- The emergence of intelligent agents (1995–present)
  - Allen Newell, John Laird. and Paul Rosenbloom on SOAR (Newell, 1990; Laird et al., 1987) is the best-known example of a complete agent architecture
- The availability of very large data sets (2001–present)

Modern AI

Quiz

- **AI Program is called?**
  - ❑ **Wetware**
  - ❑ **Formula**
  - ❑ **Intelligent Agent**

Intelligent Agent

Sensors

Agent ?

Actuators
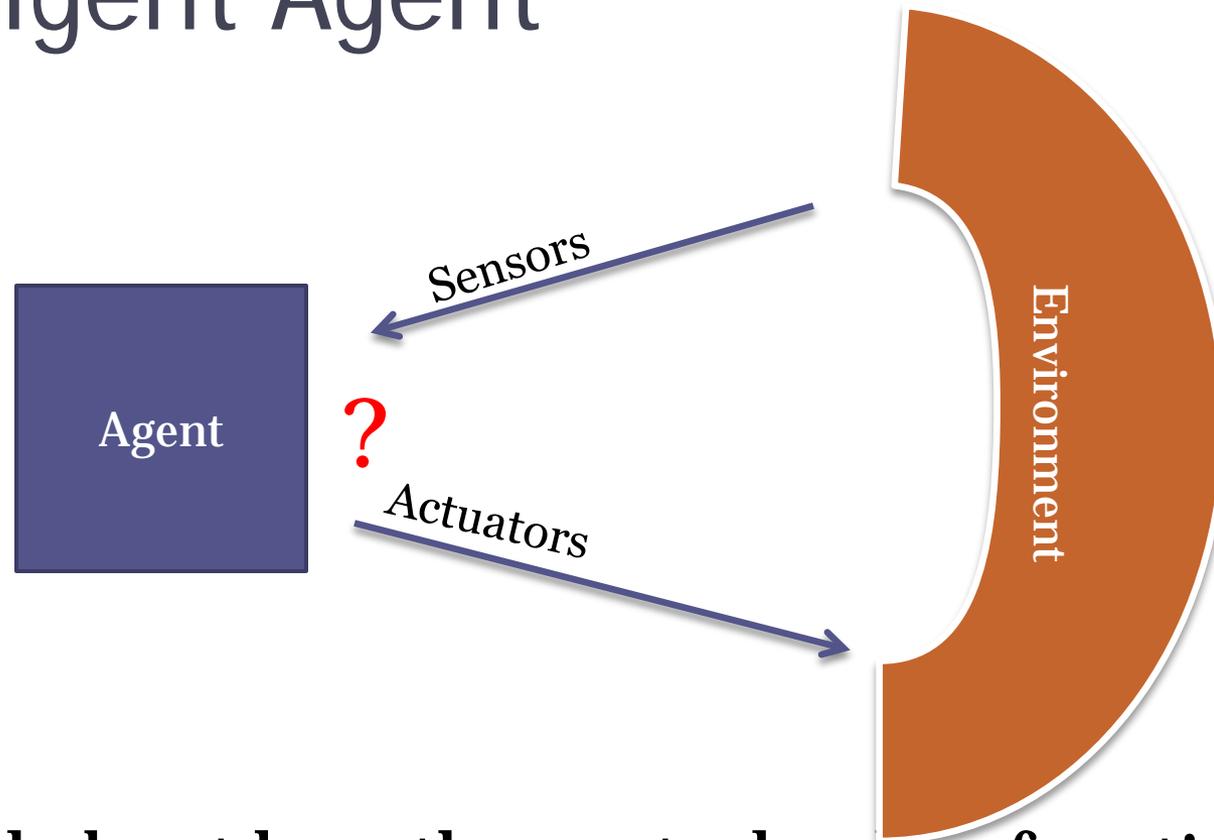
Environment

- It's all about how the control policy function of this agent takes the decision

Intelligent Agent

- An AI program is called an intelligent agent.
- Properties of an intelligent agent:
  - interacts with an environment in a state
  - uses **sensors** to perceive its state
  - uses **actuators** to affect its state
  - has a function called its **control policy** that maps sensors to actuators
- The process of this type of interaction is called perception action cycle

Application of AI

Quiz

- AI has successfully been used in ?
  - ❑ Finance
 - ❑ Robotics
  - ❑ Games
  - ❑ Medicine
  - ❑ The web

AI in Finance

Trading Agent

Rates News

Decision

Trades

Stock or Bond Market
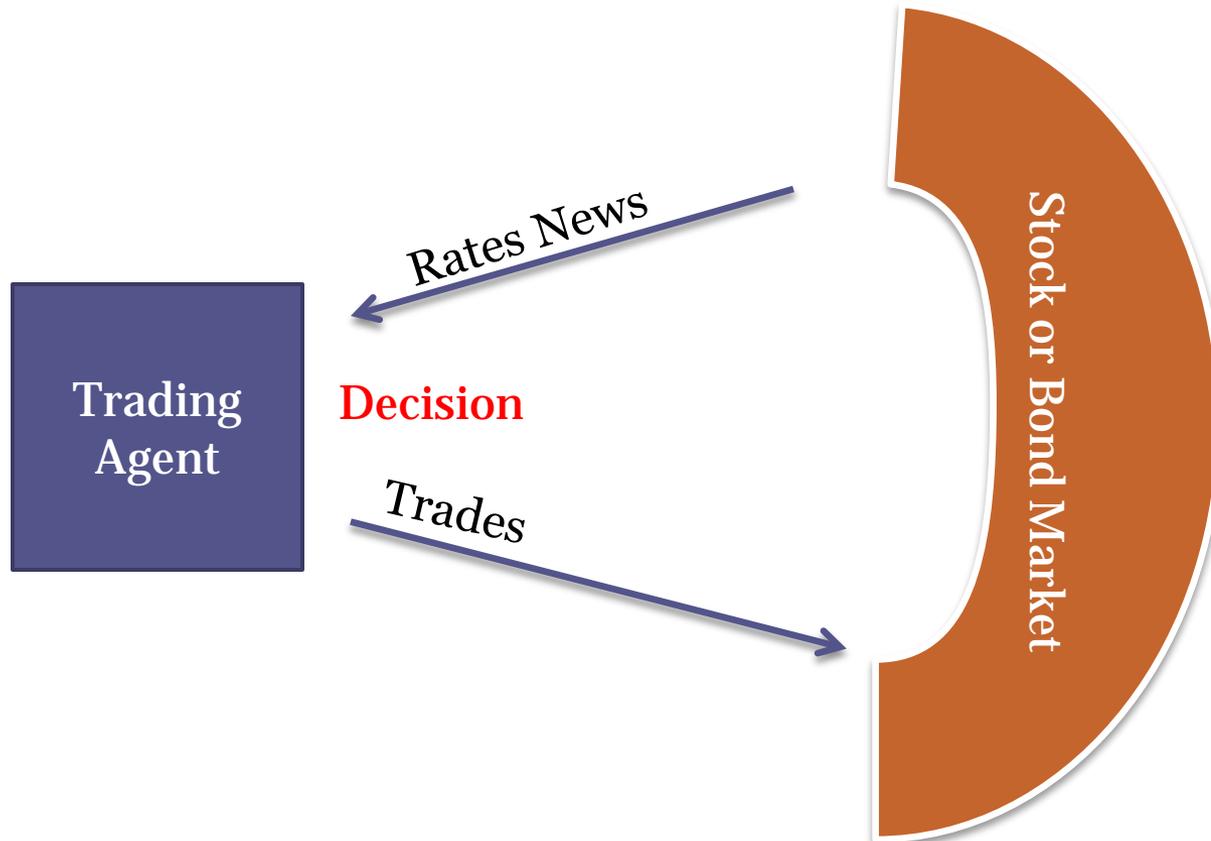
AI in Robotics

AI in Games

Game
Agent

Your movies

Decision

Agent movies

You
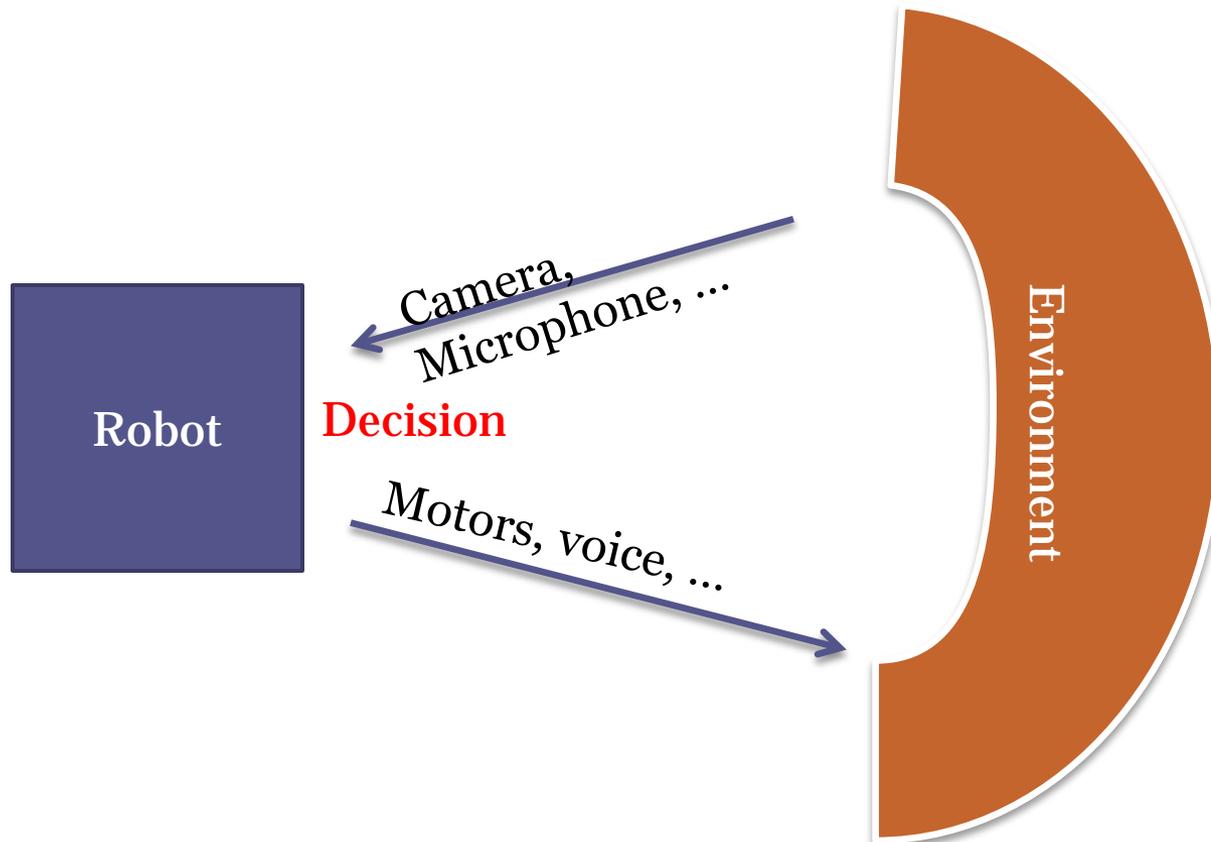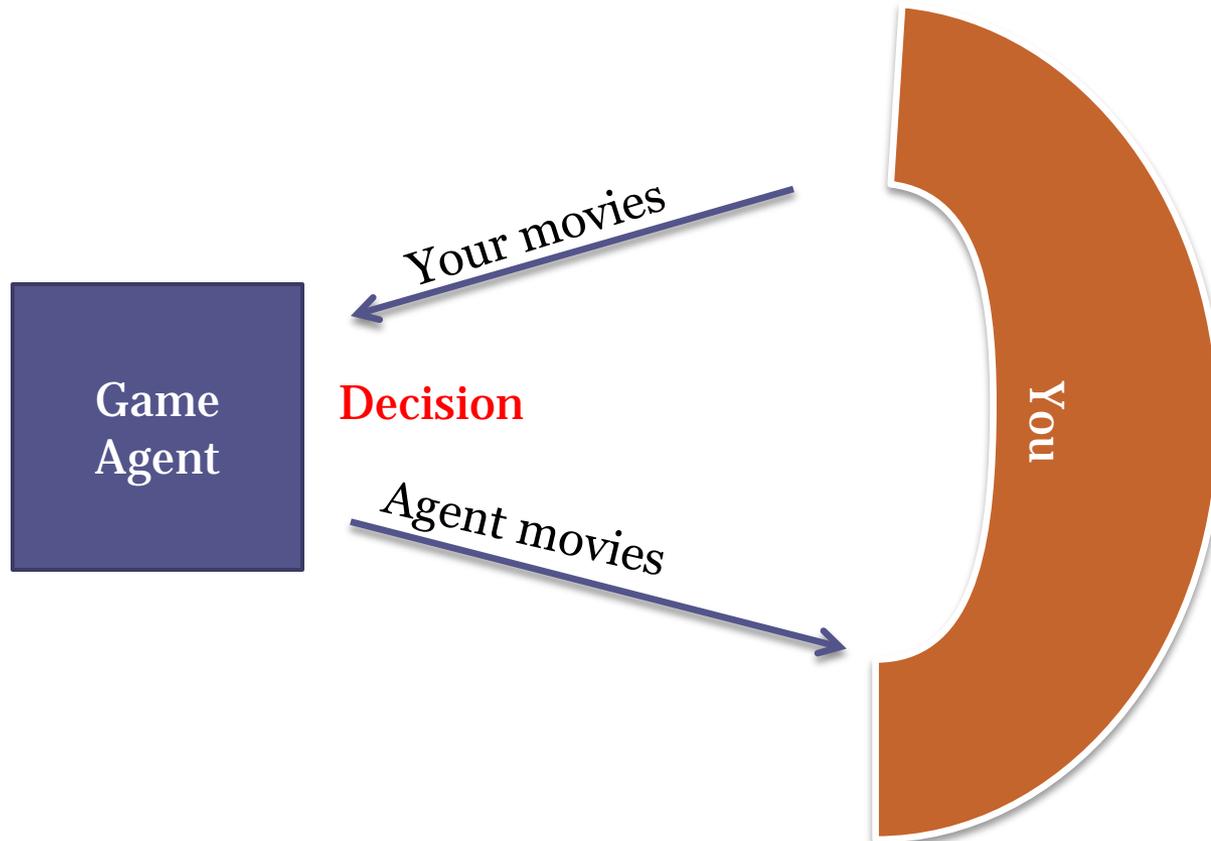
AI in Medicine
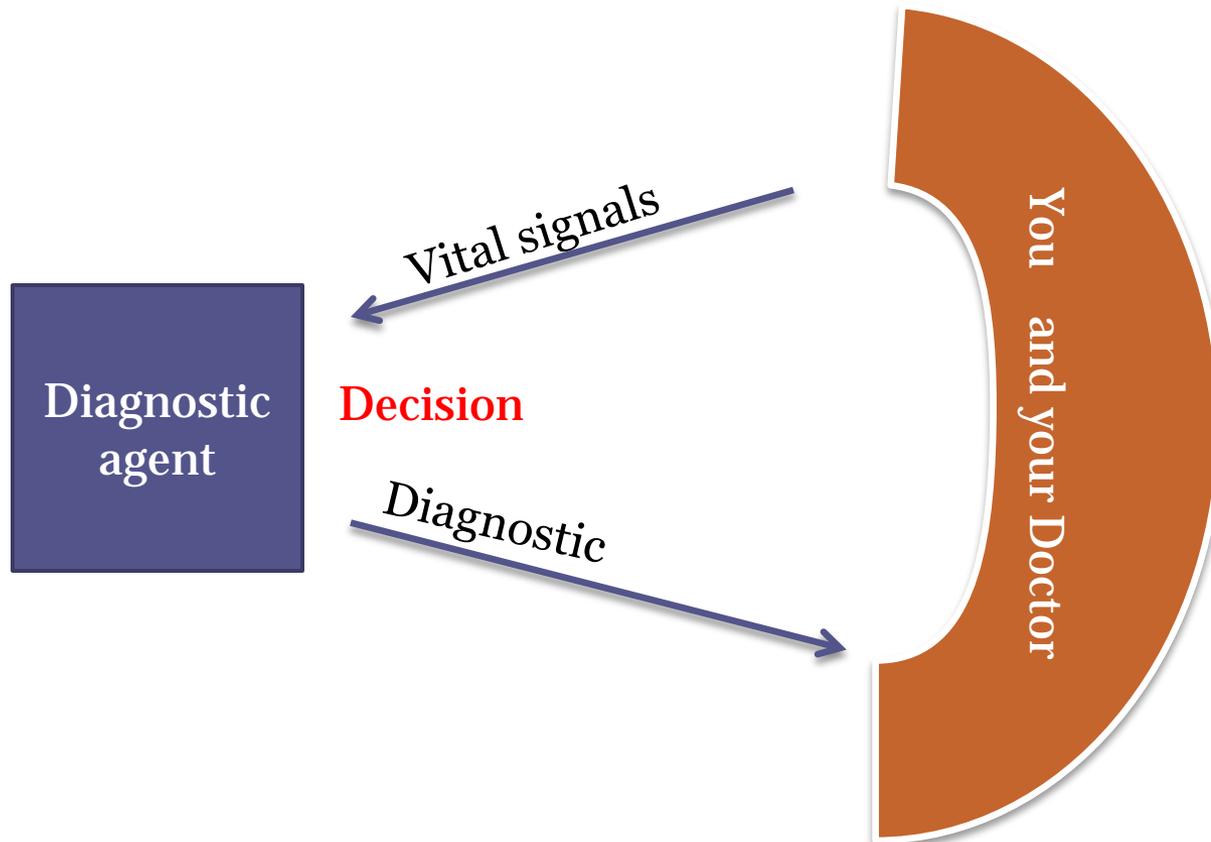
AI in the WEB

Search text

Search   Feeling lucky

Query

Crawler

DB

Decision

Answer

You and World Wide Web
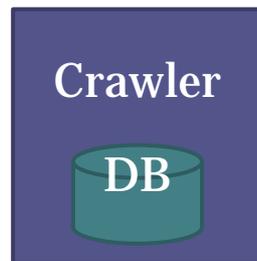
Terminology

# Terminology

- **fully observable:** An environment is called fully observable if what your agent can sense at any point in time is completely sufficient to make the optimal decision i.e. its sensors can see the entire state of the environment.
- **partially observable:** that is in contrast to some other environments where agents need memory to make the best decision.

fully versus observable
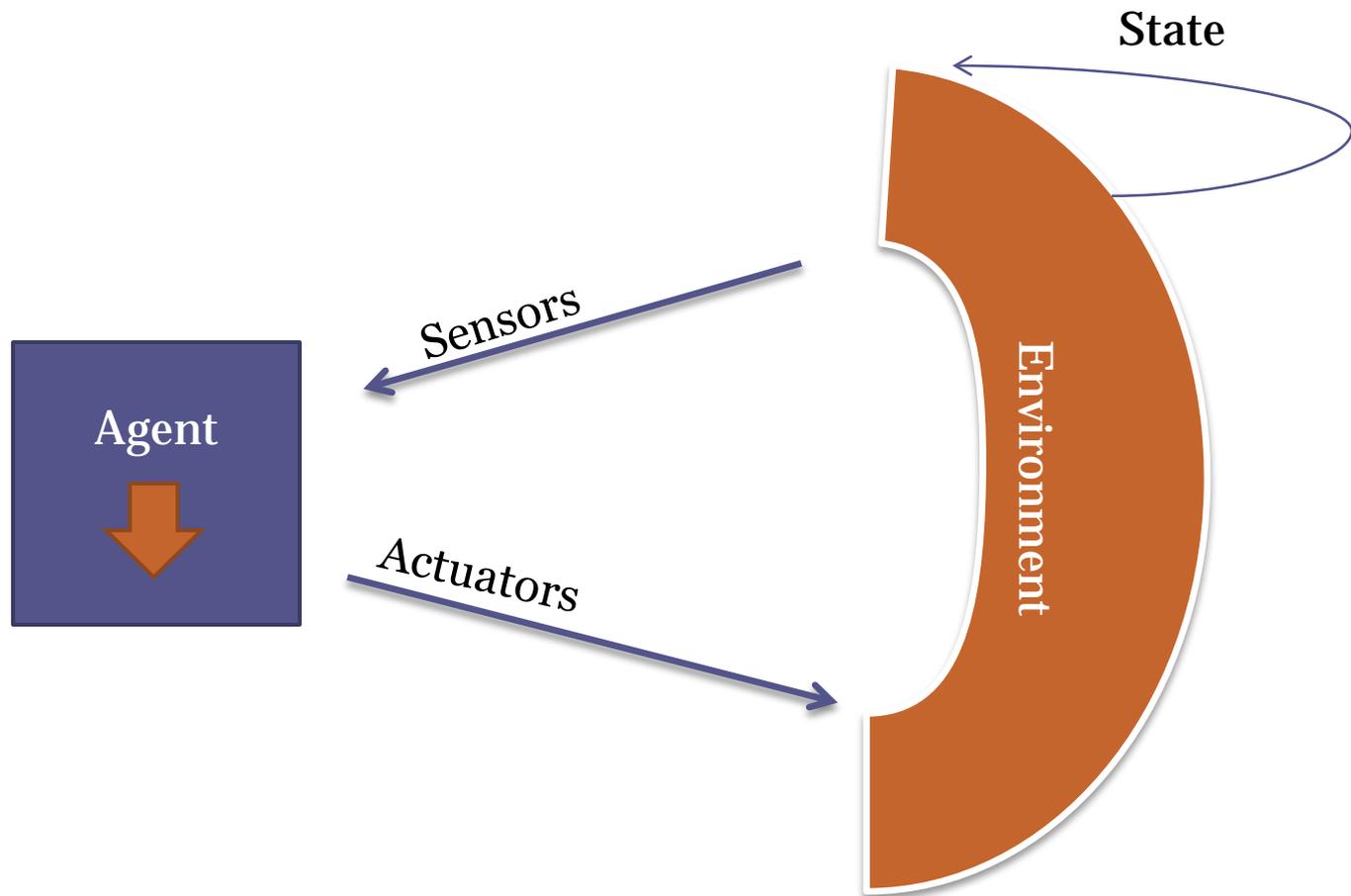
Terminology

- **Deterministic:** Deterministic environment is one where your agent's actions uniquely determine the outcome.

- **Stochastic:** In stochastic environment, there is certain amount of randomness.

Terminology

- **Discrete v.s. continues:** A discrete environment is one where you have finitely many action choices, and finitely many things you can sense. For example, in chess there's finitely many board positions, and finitely many things you can do.

Terminology

- **Benign:** In benign environments, the environment might be random. It might be stochastic, but it has no objective on its own that would contradict your own objective. For example, weather is benign.
- **Adversarial:** Contrast this with adversarial environments, such as many games, like chess, where your opponent is really out there to get you.

Quez

	Fully Observe.	Stochastic	Continues	Adversarial
Checkers	X			X
Cards (king)		X		X
Robot car		X	X	

AI and Uncertainty

AI And Uncertainty

- AI is the technique of uncertainty management in computer software.
- AI can tells: what to do when you don't know what to do.
- *Reasons for uncertainty*
  - sensor limit
  - stochastic environment
  - laziness
  - ignorance - **we don't know**

AI Example

Google machine translation

- For more than 50 different languages
- Realistic translation involved 2 tasks
  - Offline: collect a set of real examples of two different languages. Then build a model to detect line matches in both languages
  - Online: to find an answer for a query based on the results of the offline model.

CLASSIC SOUPS

齐	燉	雞	湯	57.	House Chicken Soup (Chicken, Celery, Potato, Onion, Carrot) 1
雞		飯	湯	58.	Chicken Rice Soup 1
雞		麵	湯	59.	Chicken Noodle Soup 1
廣	東 雲	吞		60.	Cantonese Wonton Soup 1
蕃	茄	蛋	湯	61.	Tomato Clear Egg Drop Soup 1
雲		吞	湯	62.	Regular Wonton Soup 1
酸		辣	湯	63.	Hot & Sour Soup 1
蛋		花	湯	64.	Egg Drop Soup 1
雲		蛋	湯	65.	Egg Drop Wonton Mix 1
豆	腐 菜		湯	66.	Tofu Vegetable Soup ....
雞	玉 米		湯	67.	Chicken Corn Cream Soup ....
蟹	肉玉米		湯	68.	Crab Meat Corn Cream Soup ....
海		鮮	湯	69.	Seafood Soup ....