جامعة الجلالة
GALALA UNIVERSITY

Artificial Intelligence Science Program

Dr. Mohamed Abd Elaziz

Mohamed Abd Elaziz

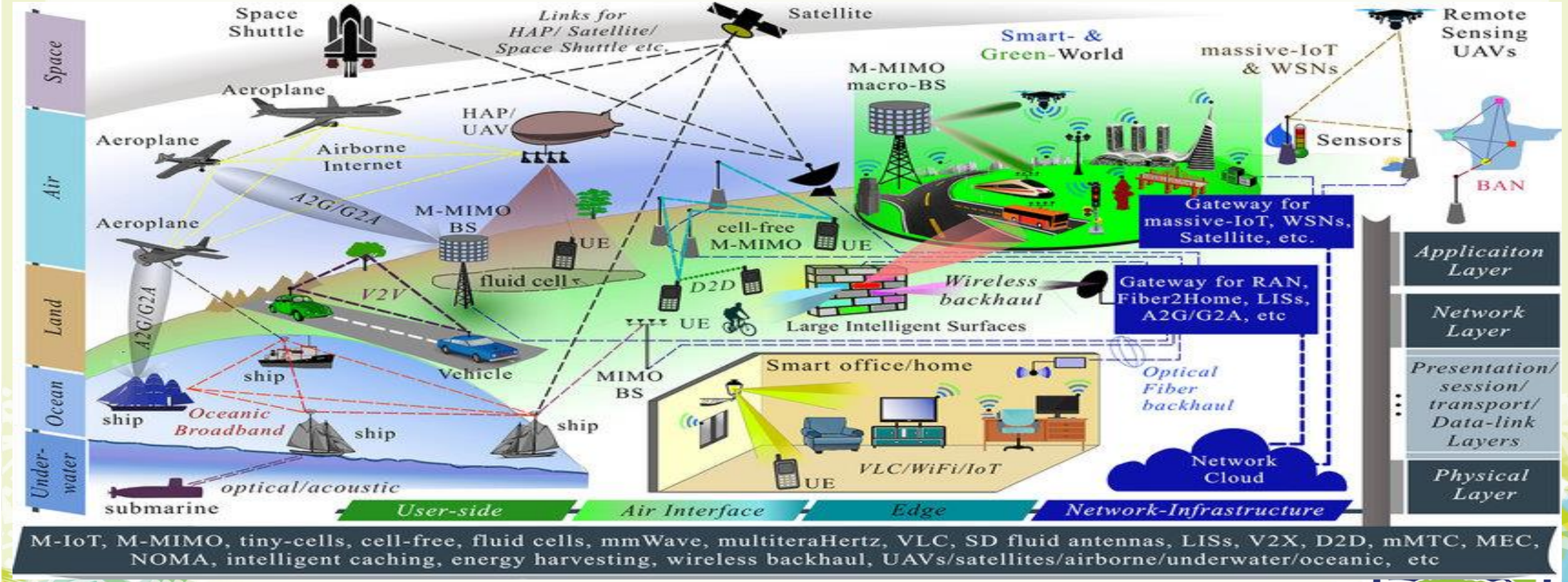
- Contacts
  - Position: Associate Professor of Artificial intelligence and computer science
  - Address: Galala University, Egypt
  - E-mail: abd_el_aziz_m@yahoo.com
  - Research gate:
    https://www.researchgate.net/profile/Mohamed_Elsayed_Abd_El_Aziz2
  - Google Scholar:
    https://scholar.google.com/citations?user=70I7KMIAAAAJ&hl=ar

Chapter 1: Introduction to AI

Why Study AI?

- AI makes computers more useful.
- Intelligent computer would have huge impact on civilization.
- AI cited as “field I would most like to be in” by scientists in all fields
- Computer is a good metaphor for talking and thinking about intelligence.

Applications of AI



Applications of AI

What is the definition of AI?

What do you think?

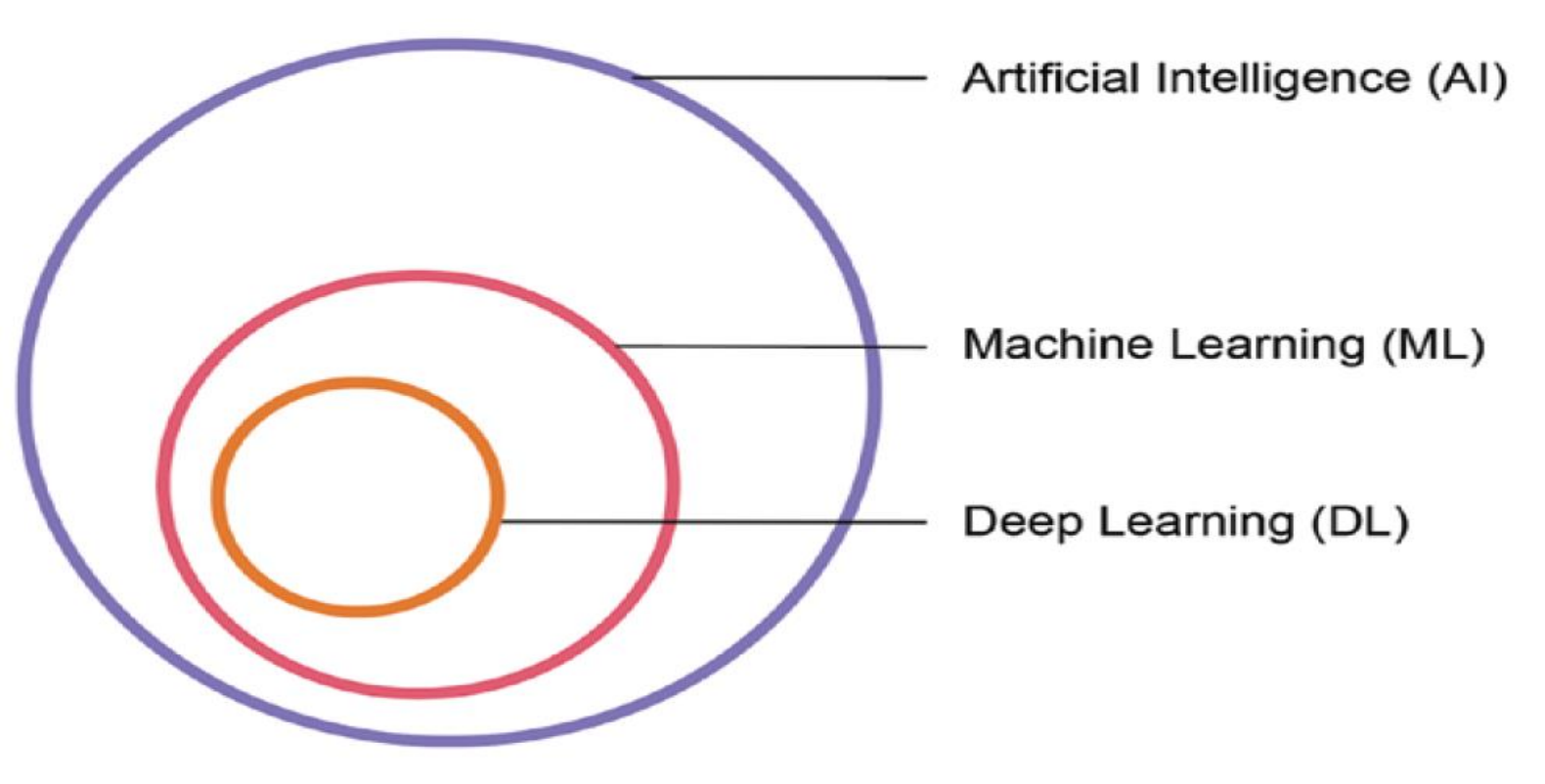
What is the definition of AI?

- Intelligence can be defined in many ways, from the ability to learn to deal with new situations to the ability to make the right decisions according to some criterion.
  - Many tasks that come naturally to humans —such as perception and control tasks—are extremely difficult to write formal rules or programs for a machine to execute.
- Often it is hard to codify all the knowledge and thought processes behind information processing and decision making into a formal program on which a machine can then act.

What is the definition of AI?

- Humans, on the other hand, over their lifetime can gather a large amounts of data through observation and experience that enables this human level of intelligence, abstract thinking, and decision making.
- Artificial intelligence (AI) is a broad field of study the complex problem and the human-like ability to sense, act, and reason.
  - One goal of AI can be to create smart machines that think and act like humans, with the ability to simulate intelligence and produce.
- Artificial intelligence (AI) is a field of computer science that looks at the logic behind human intelligence. The field seeks ways to understand how we think and to re-create this intelligence in machines. Because of its nature, AI extends across human activities, making it relevant in different ways to every industry.

Relationship between AI, machine learning, and deep learning

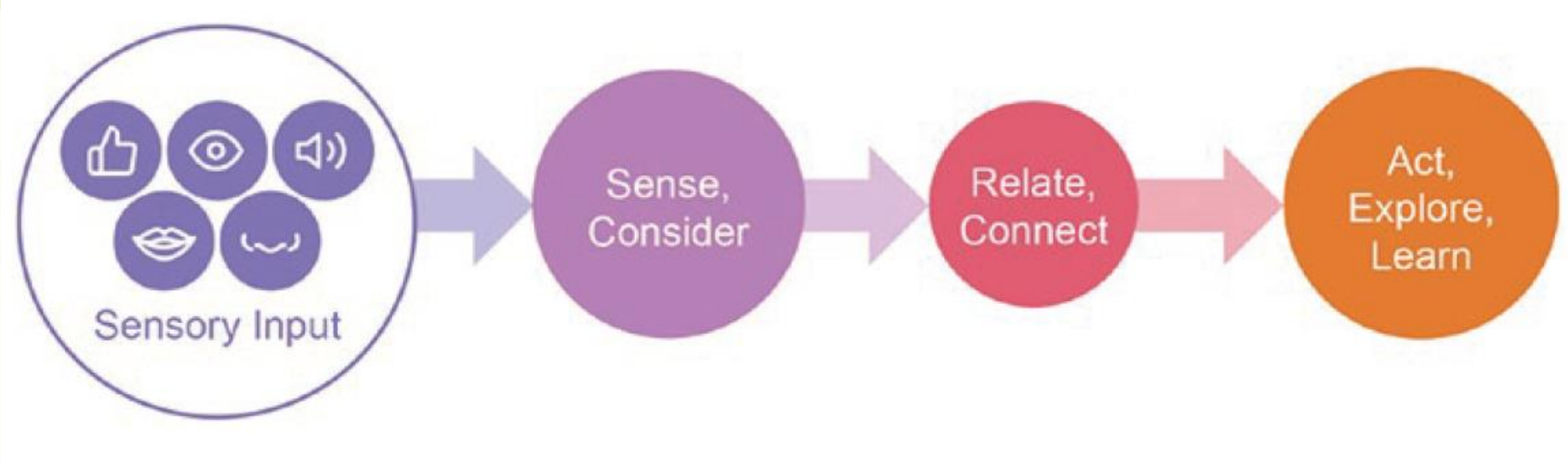


Machine Learning

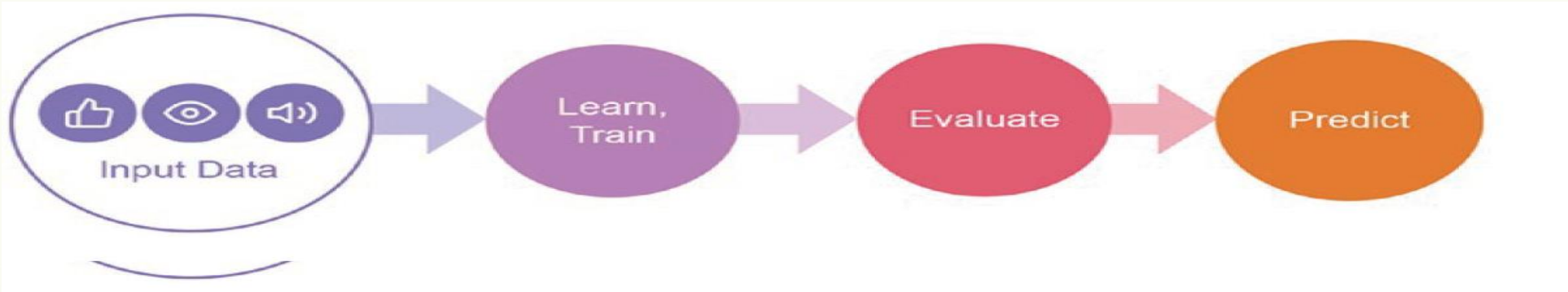
- Machine learning makes up a large portion of artificial intelligence being applied in businesses today.
- The goals of machine learning are to automate processes in order to decrease human effort, and to discover complex patterns that humans cannot interpret on their own.

What Is Learning?

- If we could simplify human learning, we might say that humans take information from their environment, relate it to something, and then learn or act.
- These inputs could be something they see, taste, hear, feel, or even their interpretation of a mood or tone.
  - That information is related to prior knowledge a person has about the world, making a connection.
  - From there, a human might act on their new knowledge, explore, or innovate.



How humans learn



How machines learn

What is the definition of AI?

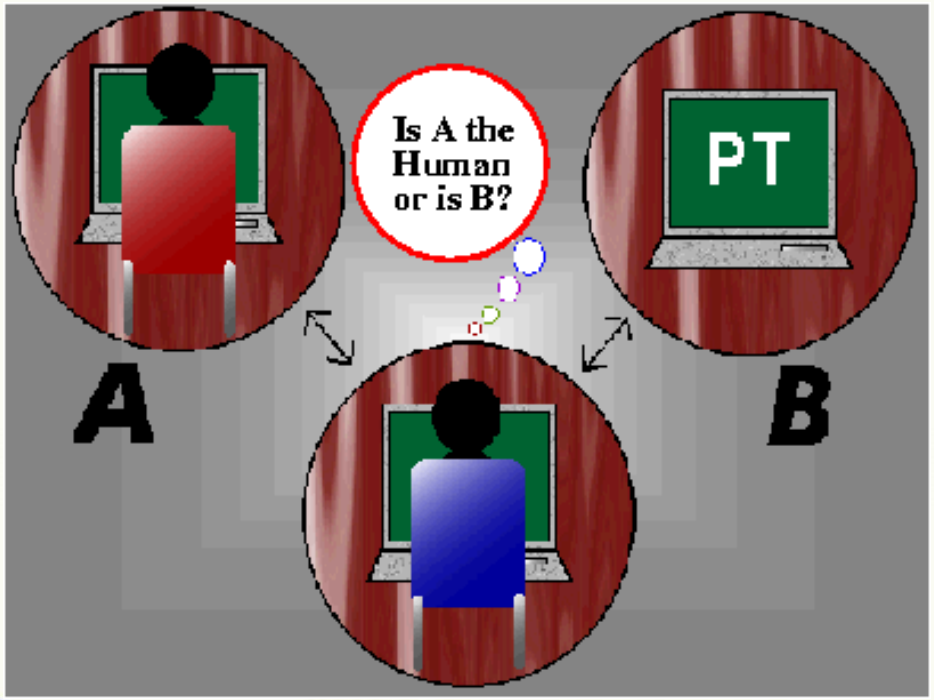
From these two dimensions:-

- **human vs. rational and**
- **thought vs. behavior**

Systems that think like humans	Systems that think rationally
Systems that act like humans	Systems that act rationally

Approach 1: Acting Humanly

- Turing test:
  - Computer and human both interrogated by judge
  - Computer passes test if judge can't tell the difference

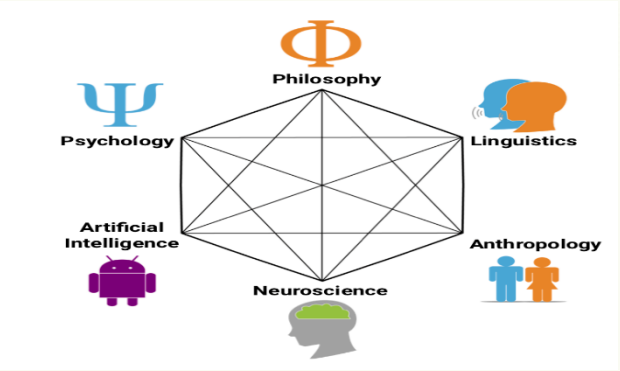


How effective is this test?

- Agent must:
  - Have command of language
  - Have wide range of knowledge
  - Demonstrate human traits (humor, emotion)
  - Be able to reason
  - Be able to learn

- The computer would need the following capabilities:
  - **natural language processing** to communicate successfully in a human language;
  - **knowledge representation** to store what it knows or hears;
  - **automated reasoning** to answer questions and to draw new conclusions;
  - **machine learning** to adapt to new circumstances and to detect and extrapolate patterns.
  - **computer vision** and speech recognition to perceive the world;
  - **robotics** to manipulate objects and move about.

Approach 2: Thinking Humanly: The cognitive modeling approach



- Requires knowledge of brain function
- How can we validate this
- This is the focus of Cognitive Science
  - Cognitive science, the interdisciplinary scientific investigation of the mind and intelligence. It encompasses the ideas and methods of psychology, linguistics, philosophy, computer science, artificial intelligence (AI), neuroscience (see neurology), and anthropology.

Approach 3: Thinking Rationally

- What are correct arguments or thought processes?
- Provided foundation of much of AI.
- Not all intelligent behavior controlled by logic
- What is our goal? What is the purpose of thinking?

Approach 3: Thinking Rationally

- These laws of thought were supposed to govern the operation of the mind; their study initiated the field called **logic**.
- The **logic** within artificial intelligence hopes to build on programs to create intelligent systems.
- Logic as conventionally understood requires knowledge of the world that is *certain.*
- The theory of **probability** fills this gap (*certain)*, allowing accurate reasoning with uncertain information

Approach 4: Acting Rationally

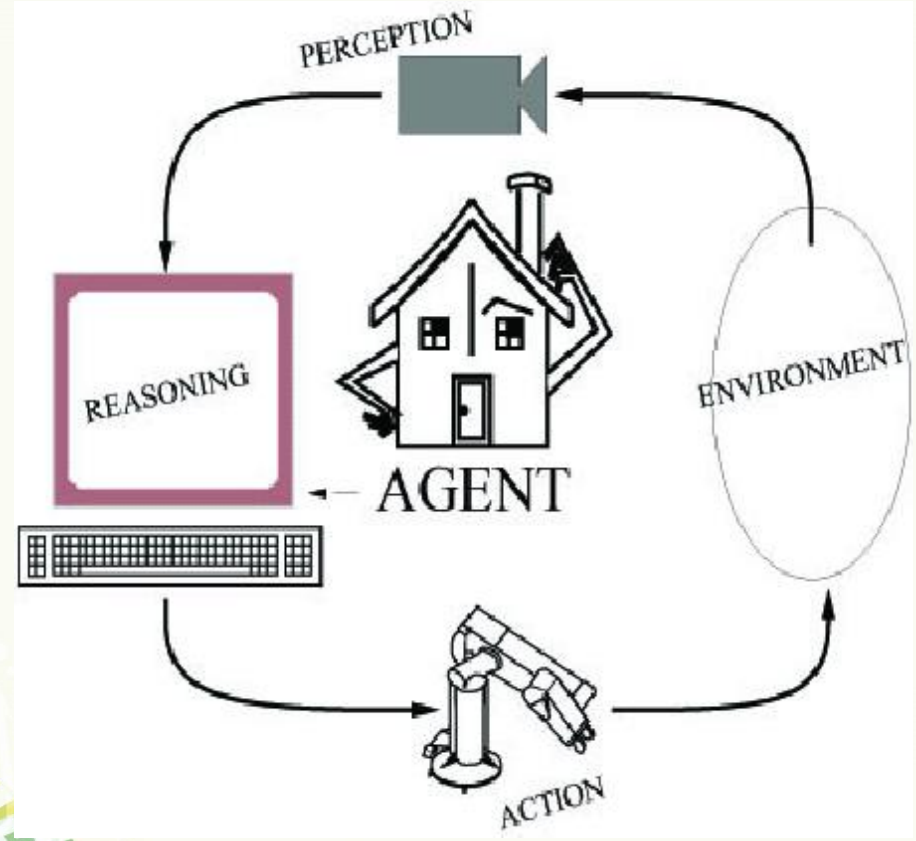
- An agent is just something that acts
  - Computer programs do something, but computer agents are expected to do more: operate autonomously, perceive their environment, adapt to change, and create and acheive goals.
- A rational agent is one that acts so as to achieve the best outcome or, when there is uncertainty, the best expected outcome.
- Making correct inferences is sometimes part of being a rational agent,
  - Because one way to act rationally is to deduce that a given action is best and then to act on that conclusion.

Chapter 2: Intelligent Agents

Components of an AI System

- Systems that can **reasonably** be called **intelligent**.
- We begin by examining **agents, environments**, and the **coupling** between them.
- The **observation** that some agents behave better than others leads naturally to the idea of a rational agent.
- An **agent** is anything that can be viewed as perceiving its **environment** through **sensors** and acting upon that environment through **actuators (effectors)**.

Components of an AI System



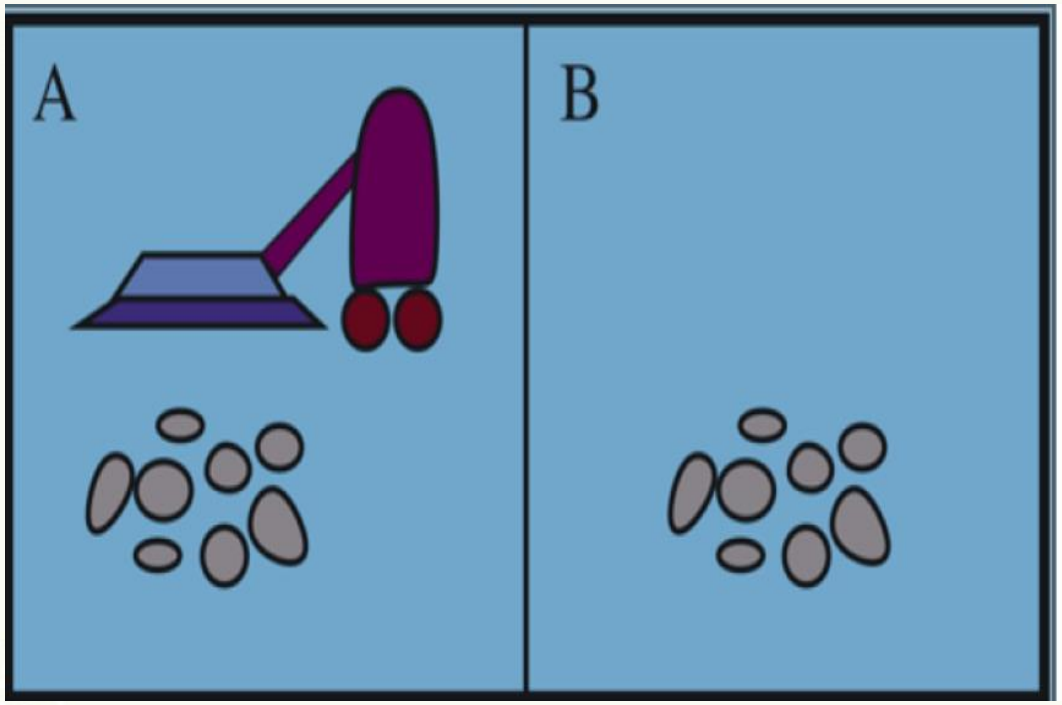
An agent perceives its environment through sensors and acts on the environment through effectors.

Human: sensors are eyes, ears, actuators (effectors) are hands, legs, mouth.

Robot: sensors are cameras, sonar, lasers, bump, effectors are motors

The agent's **behavior** is described by its function that maps percept to action.

A vacuum-cleaner



Percept sequence	Action
[A, Clean]	Right
[A, Dirty]	Suck
[B, Clean]	Left
[B, Dirty]	Suck
[A, Clean], [A, Clean]	Right
[A, Clean], [A, Dirty]	Suck
⋮	⋮
[A, Clean], [A, Clean], [A, Clean]	Right
[A, Clean], [A, Clean], [A, Dirty]	Suck
⋮	⋮

A vacuum-cleaner

Rationality

- A rational agent does the **right thing**
- A fixed performance measure evaluates the sequence of observed action effects on the environment.

PEAS

- Use PEAS to describe task
  - Performance measure
  - Environment
  - Actuators
  - Sensors
- The agent's prior knowledge of the environment.
- The actions that the agent can perform.
- The agent's percept sequence to date.
- **A rational agent** should select an **action** that is expected to maximize its performance measure

PEAS

- Use PEAS to describe task environment
  - Performance measure
  - Environment
  - Actuators
  - Sensors
- Example: Taxi driver
  - Performance measure: safe, fast, comfortable (maximize profits)
  - Environment: roads, other traffic, customers
  - Actuators: Steering, accelerator, brake, signal, horn
  - Sensors: cameras, sonar, speedometer, GPS, odometer, accelerometer, engine sensors.

Agent Type	Performance Measure	Environment	Actuators	Sensors
Medical diagnosis system	Healthy patient, reduced costs	Patient, hospital, staff	Display of questions, tests, diagnoses, treatments	Touchscreen/voice entry of symptoms and findings
Satellite image analysis system	Correct categorization of objects, terrain	Orbiting satellite, downlink, weather	Display of scene categorization	High-resolution digital camera
Part-picking robot	Percentage of parts in correct bins	Conveyor belt with parts; bins	Jointed arm and hand	Camera, tactile and joint angle sensors
Refinery controller	Purity, yield, safety	Refinery, raw materials, operators	Valves, pumps, heaters, stirrers, displays	Temperature, pressure, flow, chemical sensors
Interactive English tutor	Student's score on test	Set of students, testing agency	Display of exercises, feedback, speech	Keyboard entry, voice

Examples of agent types and their PEAS descriptions.