

## 2.1 What is Artificial Intelligence?

Artificial intelligence is

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

### 2.1.1 Thinking humanly or The Cognitive Modelling Approach

**Definition 2.1** *Thinking humanly is referred to as The Cognitive Modelling Approach*

**Definition 2.2** *Cognitive science is a field which combines computer science and psychology to develop a tested model of the human brain*

### 2.1.2 Acting Humanly or The Turing Test Approach

**Definition 2.3** *The Turing test is a test that determines if a system is able to act humanly*

The Turing Test and the Total Turing Test has given rise to 6 area of AI

- Understand natural language
- Store knowledge
- Able to reason
- Able to learn and adapt

### 2.1.3 Thinking Rationally or The Laws of Thought Approach

**Definition 2.4** *Rationality is an abstract "idea" of intelligence, rather than "whatever humans do"*

The law of thought approach :

- Convert everything to logic and derive conclusions from logic
- Difficult to take day to day ideas and translate into logic
- There will be way to many logical statements which would overcomplicate the system and reduce efficiency

### 2.1.4 Acting Rationally or The Rational Agent Approach

- System acts to achieve the best expected outcome
- A rational agent acts to achieve the best (expected) outcome - learn from experience

### 2.1.5 Definition for 486

- System is intelligent if and only if it acts rationally
- Rationality is well defined, thus easier to scientifically study

## 2.2 Sensors, Actuators, and Rational Agents

### 2.2.1 Agents

- Agents are entitles that :
  - Interact with the environment.
  - Perceive the environment using sensors.
  - Act on the environment using actuators.

**Definition 2.5 Rational Agent :** *For each possible percept sequence, a rational agent should select an action that is expected to maximize its performance measure, given the evidence provided by the percept sequence and whatever prior knowledge the agent has.*

### 2.2.2 Properties of Task Environments \*

- Problems are Task Environments
- Solutions are Rational Agents
- Properties of the task environment
  - Fully observable vs. partially observable
  - Deterministic vs. stochastic
  - Static vs. dynamic
  - Episodic vs. sequential
  - Known vs. unknown
  - Single agent vs. multi-agent

**2.2.2.1 Uncertainty**

- Fully Observable- The agent knows the state of the world
- Partial Observable - Many states are possible given an observation

**2.2.2.2 Uncertain dynamics**

- Deterministic: the next state is completely determined given the current state and the action
- Stochastic: the current state and an action can lead to multiple possible next states

**2.2.2.3 Changing environment**

- Static: the environment does not change
- Dynamic: the environment changes while the agent interacts with it Ex. autonomous cars, medical diagnosis

**2.2.2.4 Long-term consequences of actions**

- Episodic: current action does not affect future actions
- Sequential: current action could affect all future actions

**2.2.2.5 Learning the rules of the environment**

- Known: the agent knows all the rules of the environment
- Unknown: the agent does not know all the rules of the environment
- Known/Unknown are different from Fully/Partially observables

**2.2.2.6 Number of agents**

- Single agent: the agent assumes that any other agents are part of the environment
- Multi-agent: the agent explicitly models other agents and reasons strategically about the other agents