

Artificial Intelligence

Introduction

Introduction

- Meaning of the Course Title “Artificial” – Man made
- “Intelligence” – Clever Thinking, having some thinking power.
- Hence AI enables machines to work like humans do as it provides a machine – A man made thinking power.

Introduction

If a machine

- Can learn
- Can reason
- Can solve problems

Then we can say Machine exhibits AI traits.

Introduction

Why this course on Artificial Intelligence ?

Introduction

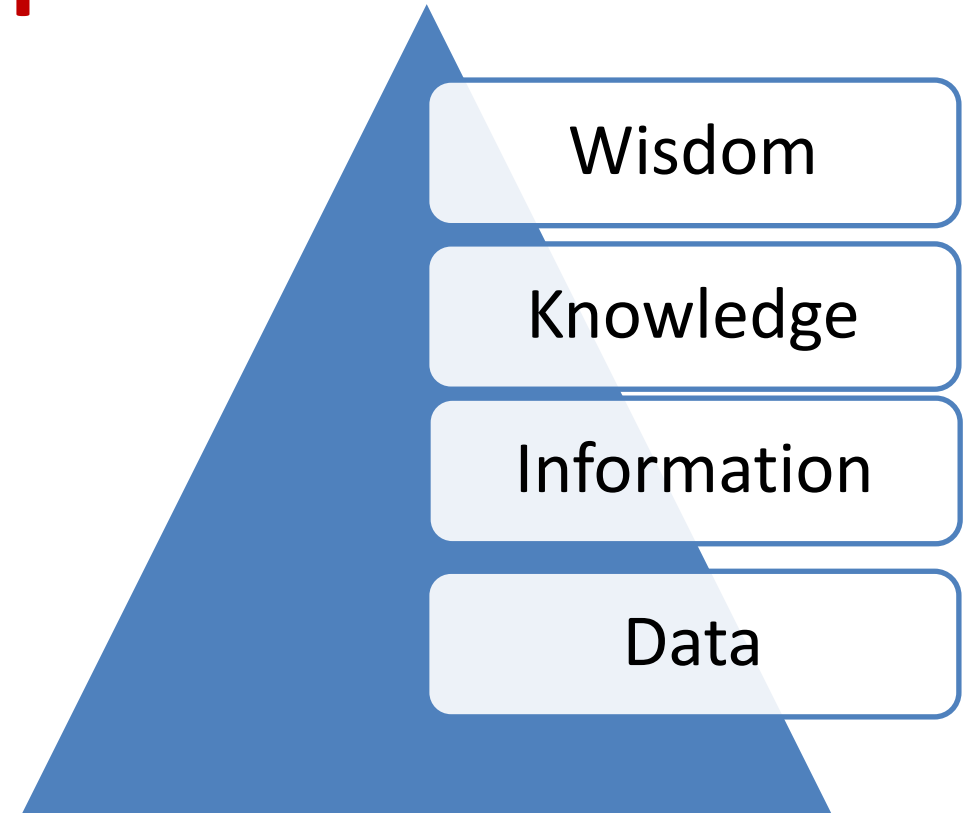
Which fields intersects to build an AI.

1. Philosophy
2. Mathematics / Statistics
3. Neuroscience
4. Psychology
5. Computer Science and Engineering
6. Control Theory (Adaptive Behavior or Self Controlling)
7. Linguistics

Introduction

What humans can do ? How human achieves intelligence

1. Looking at actions (images, videos)
2. Looking at Data, Knowledge
3. Can learn looking at steps
4. Can reason looking at data, actions etc.
5. Understands language
6. Can solve problem as he has past data, actions in his mind/memory.



Introduction

How Artificial Intelligence will be helpful, What is objective of AI ?

Introduction

Merits of AI

1. Faster work
2. May be having high accuracy
3. Efficiency

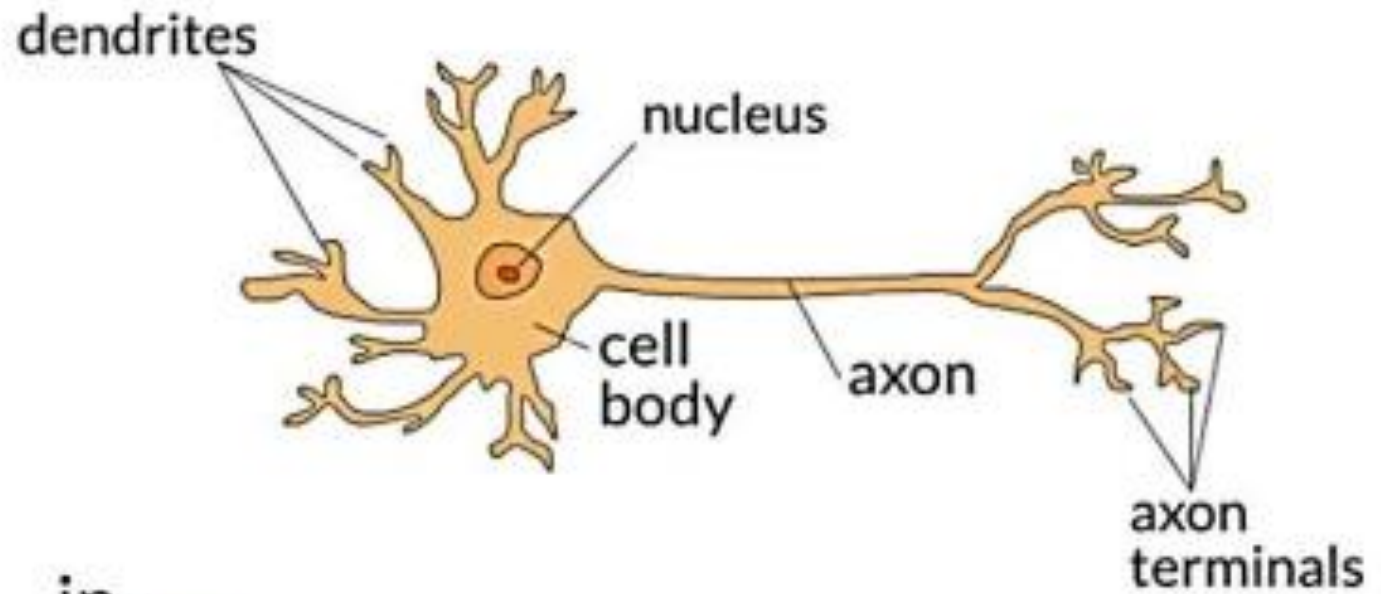
Introduction

Applications of AI

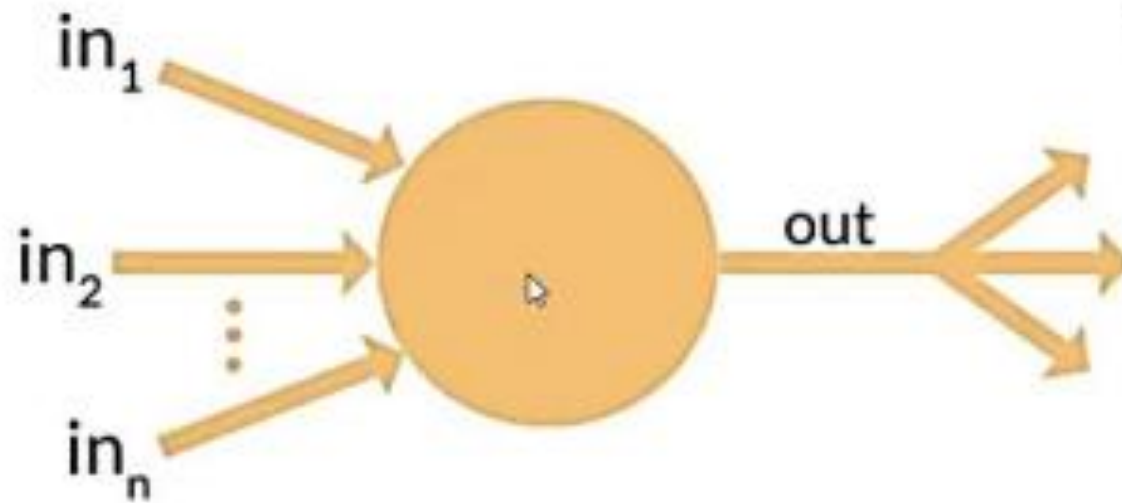
1. Speech and Language Processing
2. Image processing
3. Data Security
4. Numerical Data Processing
5. Etc.

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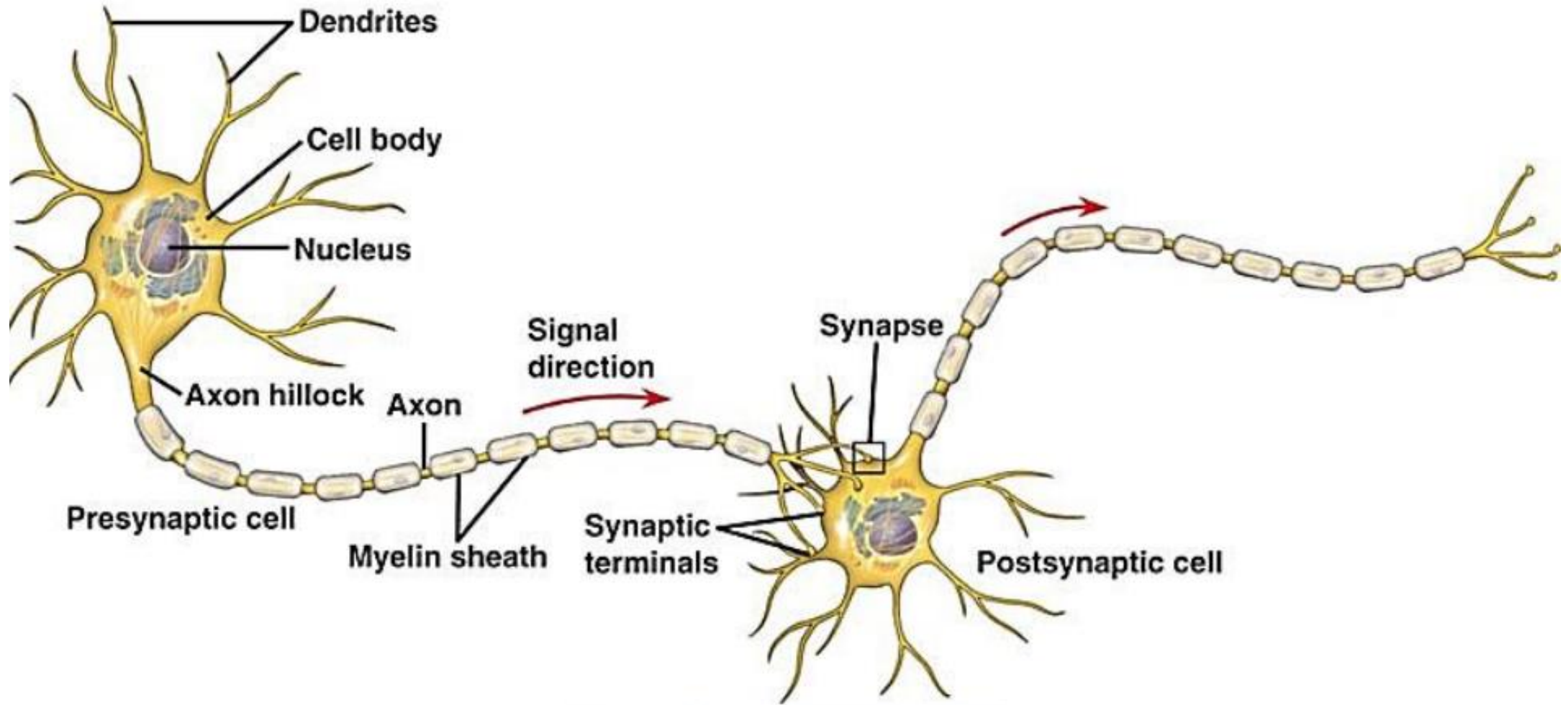
Biological Neuron



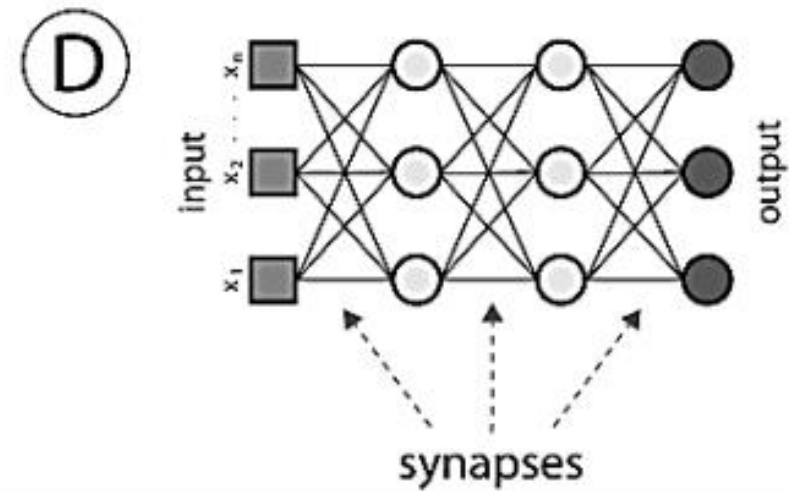
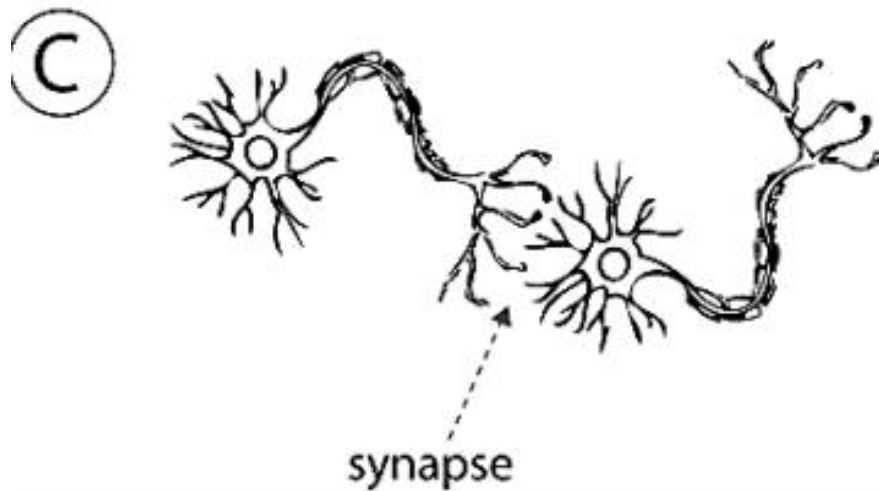
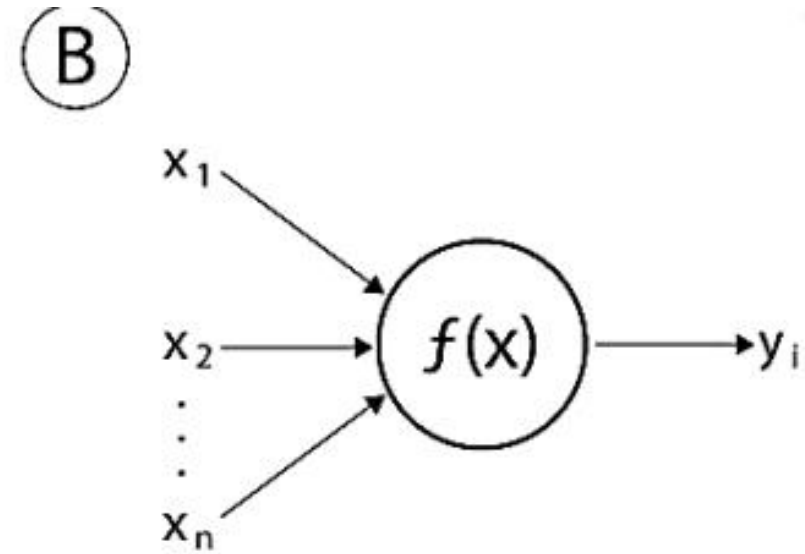
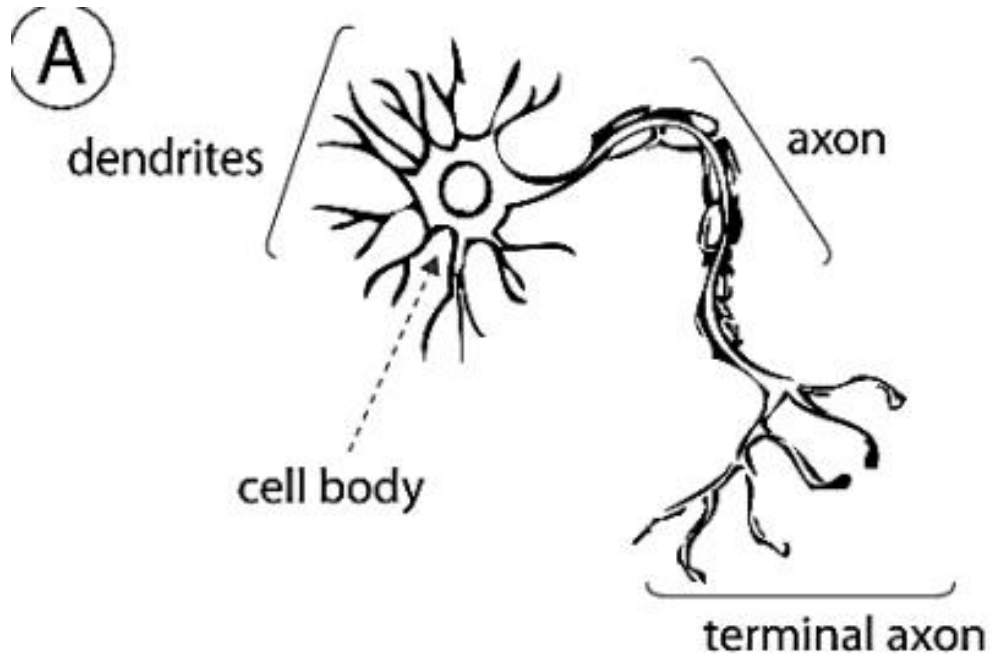
Artificial Neuron



Introduction



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AI History Timeline

1943 : Proposed model of Artificial Neurons by McCulloch and Pits.

1949 : Connection updates between two neurons by Hebb.

1950 : Alan Turing proposed a test to check machines ability to exhibit intelligence. Also known as **Turing Test**.

1955 : First AI program

1956 : Coined the word Artificial Intelligence by John McCarthy.

1966 : First Chatbot developed named as ELIZA by J Weizenbaum at MIT.

1970 to 1995 – Severe drop in AI based activities as it was an costly affair with low at results.

1997 : IBM built an AI system which played chess and won against G Kasparov.

2006 : Slowly AI came into business and social domains.

Introduction

Turing Test :

A computer passes the test if a human interrogator, after posing some written questions, cannot tell whether the written responses come from a person or from a computer.

Hence for this the computer would need to possess the following capabilities:

- **Natural language processing** to enable it to communicate
- **Knowledge representation** to store data
- **Automated reasoning** to use the stored information to answer questions
- **Machine learning** to adapt, detect and extrapolate patterns.
- **Computer Vision** to perceive objects
- **Robotics** to manipulate objects

Introduction

Types of AI

1. Weak/Narrow
2. General
3. Strong

1. Weak/ Narrow AI : Can do specific task as it is trained for that task only.
Eg. Recommendation Engine, self-driving car, speech and image recognition etc. The modern day AI applications are all weak AI.
2. General AI : Can performs task like human. No such system still exist.
3. Strong AI : Can perform task that can surpass humans. No such system still exist.

Agents

- **Agent :-** An agent can be a **software** or a **firmware** which can perceive its environment through **sensors** and react back to environment through **actuators**.
- **Eg. Human Agent :** A human has eyes, ears, skin, nose, tongue as sensory organs and legs, hands etc as actuators.
- **Robotic/firmware agent** may have camera, microphone, infrared, ultrasonic sensors as inputs/percepts and robotic hands, legs, arms, speakers, output screen as actuators.
- **Software agent** has mouse input, keyboard input, file input, network packets as sensors/inputs/percepts and file writes, outputting packets on network, display on screen, audio output as actuators.

Agents

Performance
Measure

Agent

Sensors

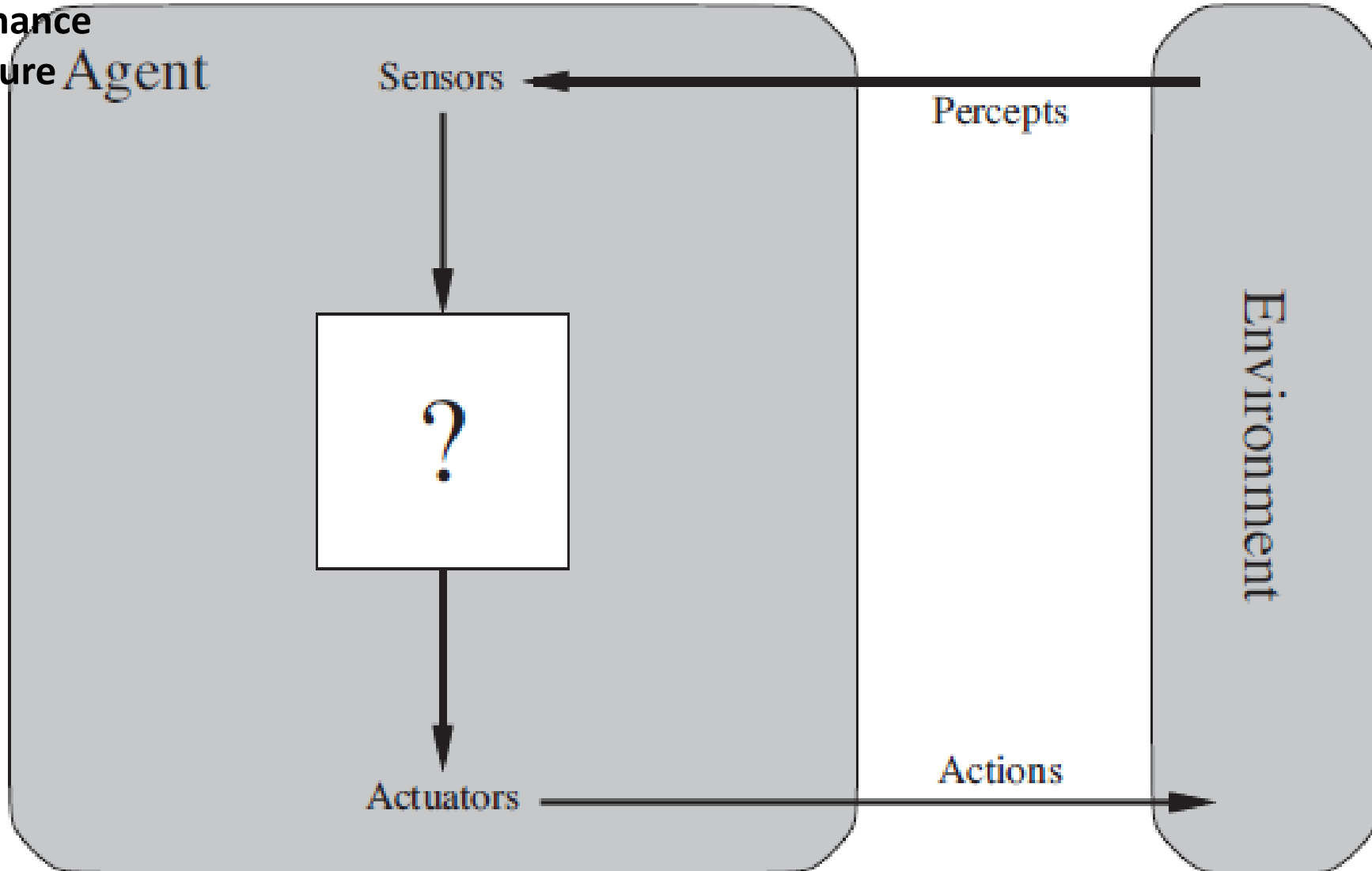
Percepts

?

Actuators

Actions

Environment



Agents

- **Rational Agent** :- For each possible percept/input 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 built-in knowledge the agent has.
- To specify agents characteristics, **Performance measure**, the **Environment**, and the **agent's Actuators** and **Sensors**, in short call PEAS (**P**erformance, **E**nvironment, **A**ctuators, **S**ensors) description. In designing an agent, the first step must always be to specify the task environment as fully as possible.
- Next is the PEAS for automated taxi driver.

Agents

Agent Type	Performance Measure	Environment	Actuators / Can take Actions / Output	Sensors / Percepts / Input
Automated Taxi Driver	Safe, Fast, Comfortable Trip, Maximize profit	Roads, Traffic, Customers	Steering, accelerator, brake, signal, horn, gears	Camera, Sonar, speedometer, GPS, odometer, engine sensors etc.
Automated Dry and Wet Garbage separator bin.				
AI based Books website recommender				

Agents

Types of Environments

- 1. **Fully Observable vs Partially Observable** : No Sensors means Unobservable, Fully means it **takes care of all kinds of input**, while partial means only **some inputs** are considered from environment.
- 2. **Single vs multiagent** : A agent solving crossword puzzle is an single agent system, while agent playing chess is multiagent system.
- 3. **Deterministic vs Stochastic (with context to agent)** : The next step taken by the agent is dependent on current step then the environment is deterministic otherwise stochastic/non-deterministic.
- 4. **Episodic Vs Sequential (with context to env)** : The previous event output has nothing to do with next event then it is episodic. If previous output is dependent in current state then it is sequential
- 5. **Static vs Dynamic** : If the environment continuously change then it is dynamic.
- 6. **Discrete Vs Continuous** : Environment having finite states eg cross-word puzzle, chess gamer. While driverless car is continuous as environment changes continuously.

Agents

Types of Agent:

- **1. Simple Reflex Agent** : Takes decision on basis of current percepts only ignoring the historic percept sequence. Have limited intelligence. Hence Non-adaptive to changes in environment. Must work under fully observable environment otherwise fails.
- **2. Model Reflex Agent** : Can work in partial observable env. Model means knowledge. So based on knowledge it can take decisions, including the current percepts.
- **3. Goal Based Agent** : Apart from having knowledge, it also remembers the goal to choose an action. Hence it is more proactive.
- **4. Utility Based Agent** : Same like goal based agent. But also includes how best it carries out each step with optimization.
- **5. Learning Agent** : It has learning capacity. From that it extracts the knowledge, does analysis and take decision.

References

1. Stuart Russel and Peter Norvig, “Artificial Intelligence – A Modern Approach”, 3rd edition, Pearson Education.