Introduction to Artificial Intelligence (AI)

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Reference

- Chapter 1: **Introduction to AI**

- Prateek Joshi, **Artificial Intelligence with Python**, Packt, 2017
  - Material: https://github.com/PacktPublishing/Artificial-Intelligence-with-Python

Outline

- What is AI?
- Why do we need to study AI?
- Applications of AI
- Branches of AI
- Defining intelligence using Turing Test
- Making machines think like humans
- Building rational agents
- General problem solver
- Building an intelligent agent
- Summary

What is Artificial Intelligence?

- **Artificial Intelligence (AI)** is a way to make machines think and behave **intelligently**.

- Intelligent **programs**

- We want the machines to **sense**, **reason**, **think**, and **act**.

- We want our machines to **be rational** too.

- AI is closely related to the **study of human brain**.

- By **mimicking** the way the **human brain** learns, thinks, and acts, we can build a machine that can do the same.

Why do we need to study AI?

- **AI can impact every aspect of our lives**.

- AI is producing **spectacular products** such as self-driving cars and intelligent robots that can walk.

- **We need AI systems that can**:
  - Handle **large amounts of data** in an efficient way.
  - Ingest data simultaneously from **multiple sources** without any lag.
  - Index and organize data in a way that allows us to **derive insights**.
  - Learn from new data and **update constantly** using the right learning algorithms.
  - Think and respond to situations based on the **conditions in real time**.

Applications of AI

1. **Computer Vision**
2. **Natural Language Processing**
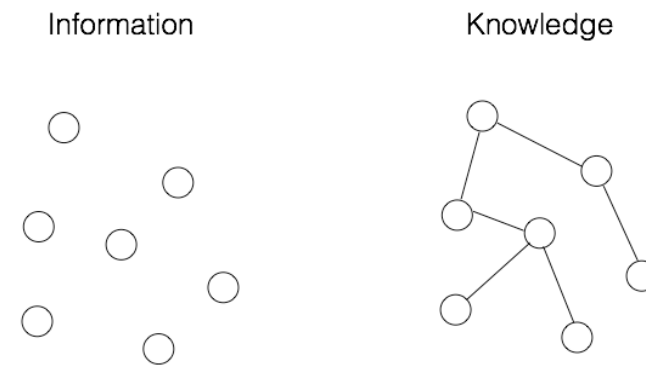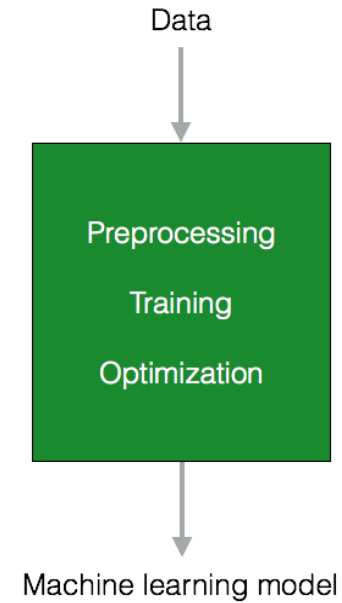3. **Speech Recognition**
4. **Expert Systems**
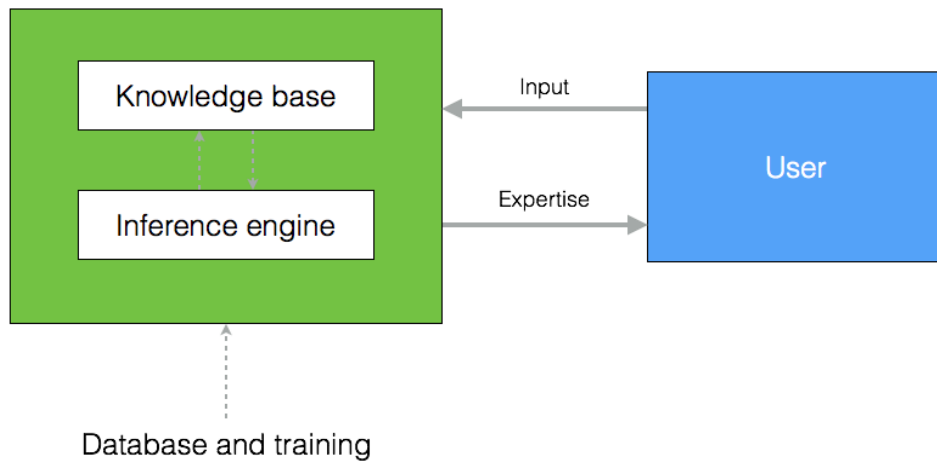
Applications of AI

5. Games

6. Robotics

Branches of AI

1. **Machine learning and pattern recognition**
2. **Logic-based AI**
3. **Search**
4. **Knowledge representation**
5. **Planning**
6. **Heuristics**
7. **Genetic programming**

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Defining intelligence using Turing Test

- **Alan Turing** defined intelligent behavior as the ability to achieve human-level intelligence during a **text conversation**.

- **Difficult test, need**:
  - Natural language processing
  - Knowledge representation
  - Reasoning
  - Machine learning

Respondents

A   B

Interrogator

C
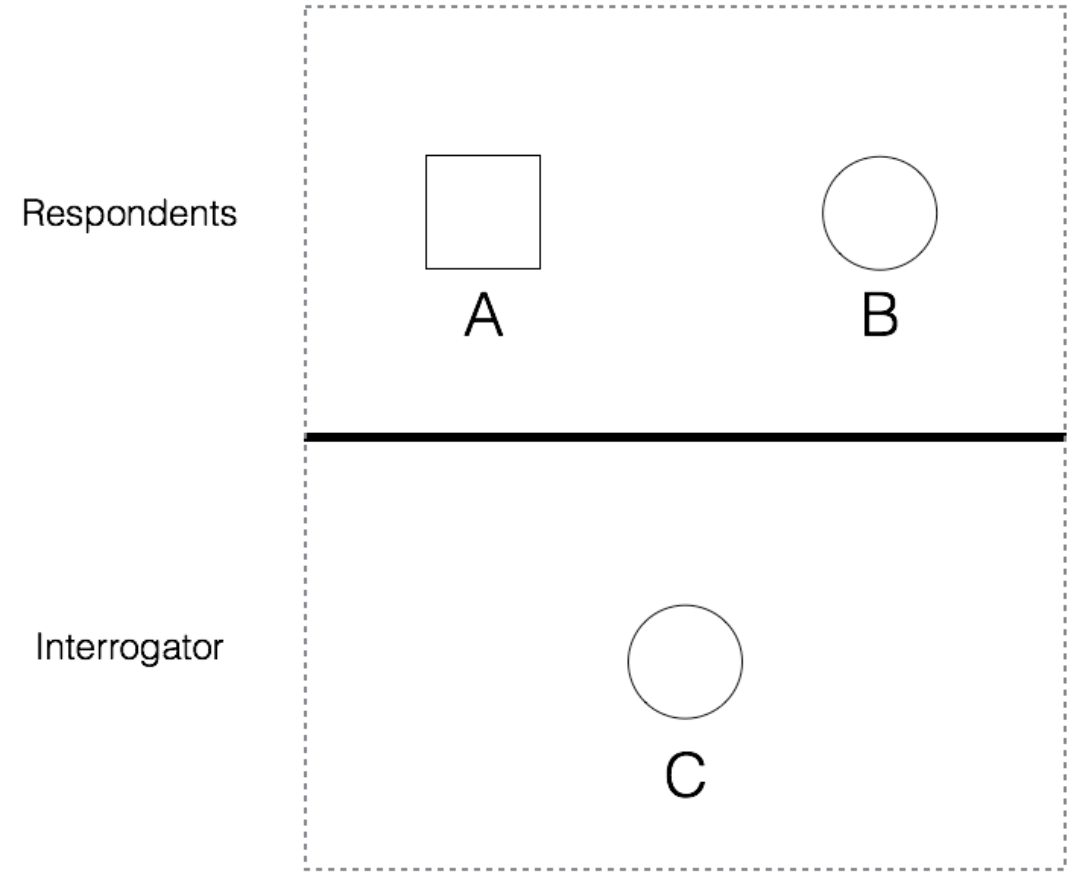
Making machines think like humans

- We need first to **understand how humans think**.

- **Cognitive Modeling** is a field of computer science that deals with simulating the **human thinking process**.

- Cognitive modeling is used in a variety of **AI applications** such as:
  - Deep learning
  - Expert systems
  - Natural language processing
  - Robotics

Building rational agents

- **Rationality** refers to doing the right thing in a given circumstance.

- An agent is said to **act rationally** if, given a set of rules, it takes actions to achieve its goals.

- **Example AI**: to design robots that can navigate unknown terrains.

- The performance depends on what **percentage of that task is complete**.

Input

Sensor

Preprocessor

Agent function

Actuator

Action
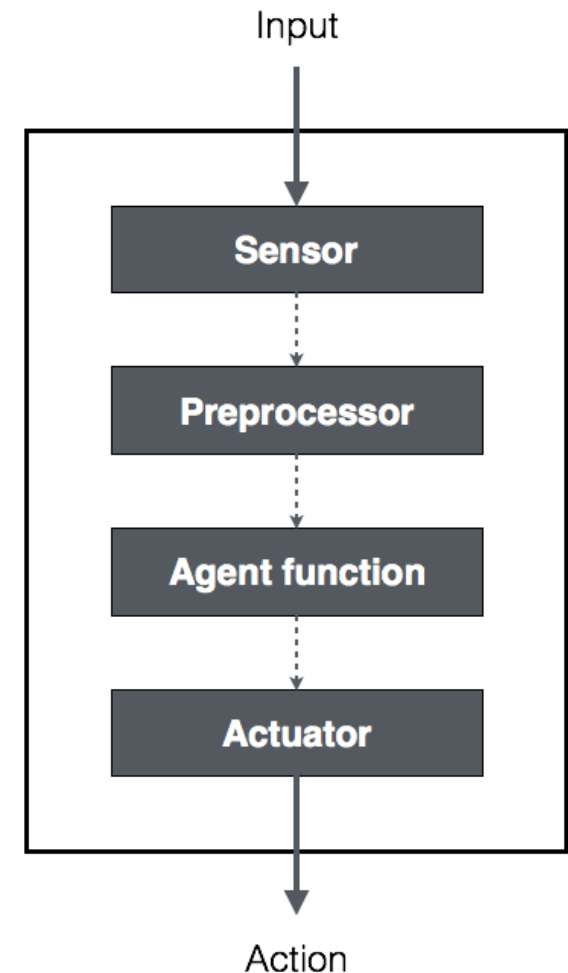
General Problem Solver

- The **General Problem Solver (GPS)** is an AI program intended to solve any general problem using the **same base algorithm**.

- Uses a language called **Information Processing Language (IPL)** to express any problem with a set of well-formed formulas.

- These formulas are part of a **directed graph** with multiple **sources** and **sinks**.
    - The **sources** refer to **axioms**
    - The **sinks** refer to the **conclusions**

- **Can solve well-defined problems**, such as proving mathematical theorems in geometry and logic.

- **Fails in the real world** because of the number of possible paths you can take.
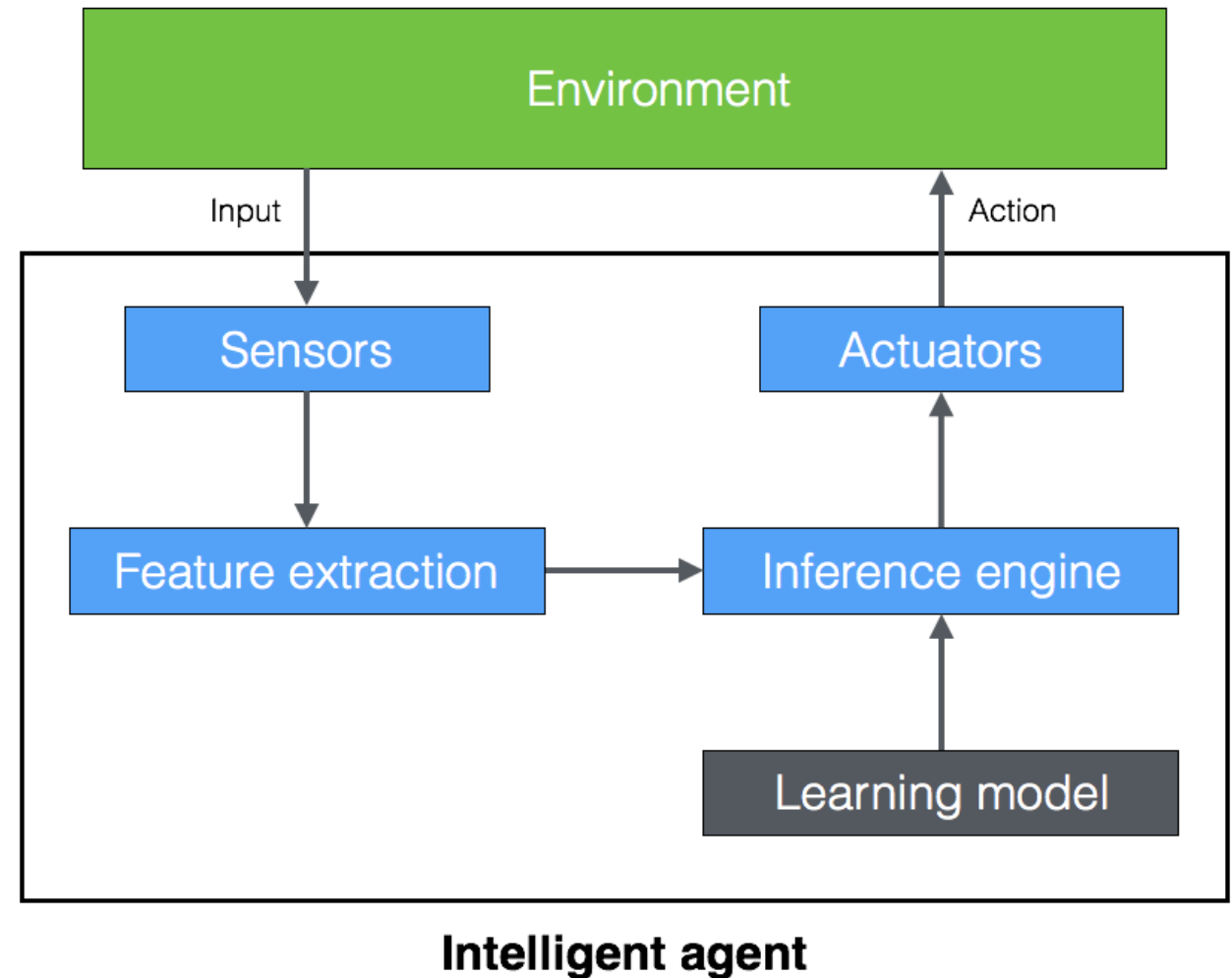
Building an intelligent agent

- **Ways** to impart intelligence to an agent:
  - Machine learning
  - Stored knowledge
  - Rules

- **Types of Models**
  - Learned models
  - Analytical models

Intelligent agent

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