Chapter 1: Introduction to Artificial Intelligence

CSE 3117 — Artificial Intelligence

What is AI?

- AI is a relatively new field, starting in the late 1940s.
- The term **"Artificial Intelligence"** was coined by **John McCarthy in 1956.**

Definitions of AI

- **Russell & Norvig (1995):** "AI is an attempt to understand intelligent entities and to build them."
- **Dean, Allen & Aloimonos (1995):** "AI is the design and study of computer programs that behave intelligently."
- **Wechsler (1958):** "The aggregate or global capacity to act purposefully, think rationally, and deal effectively with the environment."
- **Rich & Knight (1991):** "The study of how to make computers do things at which, at the moment, humans are better."

Two Goals of AI

- **Engineering Goal:** Solve real-world problems using AI techniques.
- **Scientific Goal:** Understand and explain various kinds of intelligence.

AI combines ideas and techniques for:
- Knowledge representation
- Using knowledge to solve problems

Views of AI

AI can be viewed under four main perspectives:
- Acting humanly – The Turing Test approach
- Thinking humanly – Cognitive modeling approach
- Thinking rationally – The "laws of thought" approach
- Acting rationally – The rational agent approach

Acting Humanly: The Turing Test

- Proposed by **Alan Turing (1950)** in *Computing Machinery and Intelligence.*
- Central question: "Can machines think?" → "Can machines behave intelligently?"
- **Imitation Game:** A human interacts (via terminal) with both a machine and a person. If the human cannot tell which is which, the machine passes the test.

To pass the Turing Test, a machine must:

1. Represent knowledge
2. Reason automatically
3. Learn

    4. Process natural language

Total Turing Test adds:
    5. Vision (computer vision)
    6. Movement (robotics)

Example: Eugene Goostman (2014) — claimed to pass the test, later dismissed by critics.

Thinking Humanly: Cognitive Modeling

- Seeks to model the human thought process scientifically.
- Based on understanding how humans think using:
  - Introspection – Observing one's own thoughts.
  - Psychological experiments – Predicting & testing human behavior.
  - Brain imaging / neurological data – Direct observation of brain activity.
- Cognitive Science combines AI and psychology.
- **Challenge:** Limited understanding of the human brain; experiments are costly and imprecise.

Thinking Rationally: Laws of Thought

- Originated from **Aristotle**, who studied "right reasoning."
- Example of logical reasoning (syllogism):
  Socrates is a man. All men are mortal. Therefore, Socrates is mortal.
- 19th-century logicians developed logical notation for statements about real-world objects.

Problems:
- Not all intelligent behavior follows logic.
- Difference between theoretical solutions ("in principle") and practical ones.

Acting Rationally: Rational Agent

- **Rational behavior:** Doing the right thing — i.e., what maximizes goal achievement given available information.
- May not always involve thinking (e.g., reflexes), but thinking should serve rational action.

Advantages:
- More general than logic-based approaches.
- More scientific and practical than human-based approaches.

This course focuses on building rational agents.

The Foundations of AI

Discipline	Contribution to AI
Philosophy	Reasoning, mind as a physical system, nature of knowledge
Mathematics	Logic, algorithms, proof, computation, probability
Economics	Rational decision-making models
Neuroscience	Biological basis for intelligence
Psychology	Experimental studies of human and animal behavior
Computer Engineering	Building fast, efficient computing systems
Linguistics	Language understanding and representation