

UNIT-I

AI and Its Subfields

Introduction to Artificial Intelligence:

1. Historical Evolution of Artificial Intelligence

Artificial Intelligence (AI) did not emerge overnight; it evolved over decades through contributions from mathematics, computer science, neuroscience, psychology, and engineering. The history of AI can be divided into the following phases:

1.1 Early Conceptual Foundations (Before 1950)

Philosophical Roots: Philosophers like Aristotle and Descartes discussed human reasoning and logical thought, laying the foundation for mechanized thinking.

Mathematical Foundation:

George Boole (1854): Developed Boolean algebra to represent logical statements mathematically.

Alan Turing (1936): Introduced the concept of a universal computing machine, now known as the **Turing Machine**.

Turing Test (1950):

Proposed by **Alan Turing**, it evaluates a machine's ability to exhibit intelligent behavior indistinguishable from a human.

1.2 Birth of AI (1956–1960)

- The term “**Artificial Intelligence**” was first coined by **John McCarthy** in **1956** at the historic **Dartmouth Conference**, considered the official birth of AI as a discipline.
- Early programs demonstrated machine reasoning:
 - **Logic Theorist (1955):** Developed by Allen Newell and Herbert Simon.
 - **General Problem Solver (1957):** An early problem-solving program using heuristics.

1.3 Early Growth – The Golden Age (1960–1974)

- AI research expanded in universities and research labs.
- **LISP language** was developed by John McCarthy for AI programming.
- **SHRDLU (1970)** demonstrated natural language understanding in a virtual world.
- Optimism grew, and researchers predicted human-level AI soon.

1.4 First AI Winter (1974–1980)

- Due to **overpromising and underdelivering**, funding from DARPA and other agencies decreased.
- AI research slowed due to computational limitations and lack of large datasets.

1.5 Revival through Expert Systems (1980–1987)

- AI regained popularity through **Expert Systems** such as:
 - **MYCIN (1976):** Diagnosed blood infections.
 - **DENDRAL (1965–1980):** Chemical structure analysis.
- AI entered industry for the first time to solve domain-specific problems.
- Commercial success encouraged new funding.

1.6 Second AI Winter (1987–1993)

- Expert systems became too costly and brittle.

- Hardware limitations caused decline in AI popularity and research funding again.

1.7 Rise of Machine Learning (1993–2010)

- Shift from rule-based programming to **machine learning**.
- AI evolved from logic systems to **data-driven learning**.
- Notable milestones:
 - **1997:** IBM's **Deep Blue** defeated chess champion **Garry Kasparov**.
 - **2002:** AI used in household robots like **Roomba**.

1.8 Modern AI Era – Deep Learning (2010–Present)

- Breakthroughs in **neural networks**, **big data**, and **GPU computing**.
- Significant achievements:
 - **2011:** IBM **Watson** won *Jeopardy!*
 - **2012:** Deep Learning revolutionized image recognition (AlexNet).
 - **2016:** Google DeepMind's **AlphaGo** beat world Go champion Lee Sedol.
 - **2020–2025:** AI advances in **autonomous vehicles**, **ChatGPT**, **healthcare AI**, **robotics**, and **scientific discovery**.