Artificial Intelligence

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Lecture # 1

Contents

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What is AI?

What is AI?

- **Definition:** Artificial Intelligence is a branch of computer science that aims to build machines capable of mimicking human intelligence.
- **Key Idea:** It's about creating systems that can reason, learn, solve problems, and perceive their environment.

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History of AI

- **Philosophical Roots (Pre-1940s):**
  - Long before computers, thinkers like Aristotle and René Descartes speculated about mechanical "thinking."
- **Early Beginnings (1940s–1950s):**
  - **Alan Turing (1950):** Proposed the Turing Test to measure machine intelligence.
  - **John McCarthy (1956):** Coined the term "Artificial Intelligence" at the Dartmouth Workshop, marking the field's formal birth.
- *Example:* Early text-based games where you "conversed" with a machine were the first step.

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The Golden Age & The AI Winters

- **The Golden Age (1950s–1970s):**
    - **Logic Theorist (1956):** A program that could prove mathematical theorems.
    - **ELIZA (1966):** A simple chatbot that mimicked a psychotherapist.
- **AI Winters (1970s–1980s):**
    - Progress stalled due to limited computing power and unrealistic expectations.
    - Funding dried up.
- *Analogy:* Like a hyped-up movie sequel that didn't deliver—people lost interest.

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Revival & Modern AI

- **Revival (1990s–2000s):**
  - With better hardware and more data, AI made a comeback.
  - **IBM's Deep Blue (1997):** Defeated world chess champion Garry Kasparov.
- **Modern AI (2010s–Present):**
  - Driven by **machine learning** and **deep learning**.
  - **Google's AlphaGo (2016):** Beat a world champion in the complex game of Go.
  - **ChatGPT (2020s):** AI models that can generate human-like language.

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Applications of AI (Part 1)
Applications of AI (Part 2)

Applications of AI (Part 1)

- **Natural Language Processing (NLP):**
  - Enables machines to understand and generate human language.
  - *Examples:* Siri, Google Translate, chatbots.
- **Computer Vision:**
  - Allows computers to "see" and interpret images and videos.
  - *Examples:* Facial recognition, medical scans.
- **Robotics:**
  - AI-powered robots perform complex physical tasks.
  - *Examples:* Surgical robots, warehouse automation.

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Applications of AI (Part 1)
Applications of AI (Part 2)

Applications of AI (Part 2)

- **Expert Systems:**
  - Mimic human expert decision-making.
  - *Examples:* Fraud detection in banking, early medical diagnosis systems.

- **Recommendation Engines:**
  - Suggest what you might like based on data.
  - *Examples:* Netflix movies, Spotify playlists.

- **Predictive Analytics:**
  - Forecasting based on past data.
  - *Examples:* Weather forecasting, stock market prediction.

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The Future of AI

The Future of AI

- **Artificial General Intelligence (AGI):**
  - The goal of creating machines with human-like intelligence across all domains.
- **Ethical Considerations:**
  - **Bias** in algorithms.
  - **Job displacement** from automation.
  - **Privacy** concerns.
- **Human-AI Collaboration:**
  - The future is about machines and humans working together to enhance our abilities.
  - *Example:* A doctor using AI to analyze scans faster.

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What is an Intelligent Agent?
Rationality
Types of Agents (Part 1)
Types of Agents (Part 2)
Summary for Students

What is an Intelligent Agent?

- **Definition:** An agent is an entity that perceives its environment and takes actions to achieve goals.
- **Key Components:**
    - **Agent:** The decision-maker (e.g., a robot).
    - **Sensors:** How the agent perceives the world (e.g., cameras).
    - **Actuators:** How the agent acts (e.g., motors).
    - **Environment:** The world the agent operates in.
- *Example:* In a self-driving car, the AI is the **agent**, cameras are **sensors**, and the steering wheel is an **actuator**.

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Rationality

- **Rational Agent:** An agent that acts to achieve the best possible outcome.
- **Performance Measure:** A way to judge the agent's success.
- *Example:* The performance of a vacuum-cleaning robot is measured by how clean the floor is and how little energy it uses.

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Types of Agents (Part 1)

- **Simple Reflex Agents:**
  - Act only on the current perception.
  - Based on simple "if-then" rules.
  - *Example:* A thermostat turns the heater on if the temperature is too low.

- **Model-Based Reflex Agents:**
  - Maintain an internal model of the environment.
  - Use past perceptions to make more informed decisions.
  - *Example:* A self-driving car knows its location on a map, not just what it sees right now.

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Types of Agents (Part 2)

- **Goal-Based Agents:**
  - Have explicit goals and choose actions to achieve them.
  - *Example:* A GPS finds the shortest route to your destination.

- **Utility-Based Agents:**
  - Aim for the best outcome (maximize utility), considering factors like efficiency and safety.
  - *Example:* A delivery drone chooses a route that is not only short but also uses minimal battery.

- **Learning Agents:**
  - Improve their performance over time by learning from experience.
  - *Example:* An AI that learns to play a video game by observing its own actions.

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Summary for Students

- **AI's Journey:** From philosophical roots to powerful real-world applications.
- **Intelligent Agents:** The core building blocks of AI systems that perceive, act, and adapt to environments.
- **The Future:** AI development requires ethical responsibility, and the best path forward is through human-AI collaboration.