

Artificial Intelligence

(Introduction to AI and its Applications in Engineering and Computer Science)

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Lecture #0



What is AI?

Definition of AI: Artificial Intelligence refers to the simulation of human intelligence in machines that are programmed to think, learn, and make decisions like humans.

History and Evolution:

- 1950s: Alan Turing's seminal paper, "Computing Machinery and Intelligence [2]."
- 1956: The Dartmouth Conference, where AI was formally born as a field.

- 1970s-1990s: Early challenges (AI winters), limited computational power.
- 2000s to Present: Breakthroughs in machine learning, deep learning, and availability of big data.

Significance of AI:

- Revolutionizing industries by automating tasks, optimizing processes, and enabling innovation.



Civil Engineering: • Smart construction, structural health monitoring, urban planning.

- Example: AI-driven predictive maintenance for bridges, bldgs.

Electrical Engineering: • Power grid management, signal processing, renewable energy systems.

- Example: Power grid optimization: balancing energy supply and demand.

Mechanical Engineering: • Robotics, automation, and autonomous vehicles.

- Autonomous robots in manufacturing.

Computer Science Engineering: Software design, cybersecurity, and intelligent systems.

AI vs. Machine Learning (ML) vs. Deep Learning: (DL)

AI: The broader field is focused on creating systems capable of intelligent behavior.

ML: Subset of AI, learn patterns from data and improve performance over time.

DL: Subset of ML, uses NN to process complex data.



AI contributes to wide range of applications that enhance and automate various tasks:

ML:

- AI enables computers to learn from data without being explicitly programmed.
- ML algorithms help in identifying patterns, making predictions, and improving over time with more data.
- These are used in applications like: recommendation systems,

fraud detection, and predictive analytics.

Natural Language Processing (NLP):

- AI powers language-based applications, such as speech recognition, sentiment analysis, and chatbots.
- NLP helps computers understand, interpret, and generate human language, facilitating communication between humans and machines.



Computer Vision:

- AI is used to enable machines to interpret and understand visual information from the world, such as recognizing objects, faces, or analyzing medical images.
- Computer vision is applied in areas like autonomous vehicles, facial recognition, and image classification.

Robotics:

Robotics AI drives the intelligence behind robots,

allowing them to perform complex tasks autonomously or semi-autonomously. Robotics Robots can be used in manufacturing, healthcare (e.g., surgery), and service industries (e.g., customer support).

Automation and Optimization:

- AI can automate repetitive tasks and optimize processes.
- This can be seen in areas such as supply chain management, energy management, and software testing, reducing costs and increasing efficiency.



Autonomous Systems:

- AI is the backbone of autonomous systems, such as self-driving cars, drones, and unmanned aerial vehicles (UAVs).
- These systems rely on AI to process sensor data, make decisions, and navigate their environment safely.

Data Mining and Big Data Analytics:

- AI techniques are applied to

large datasets to discover hidden patterns, relationships, and trends.

- This is crucial in fields like marketing, healthcare, finance, and social media.

Game Development:

- AI enhances the gaming experience by creating intelligent non-playable characters (NPCs), simulating realistic behaviors, and enabling procedural content generation.



Cybersecurity:

- AI is used in detecting and responding to security threats, such as identifying anomalies in network traffic, malware detection, and automated threat response.

Healthcare:

- AI is applied in diagnostic systems, drug discovery, and personalized treatment

recommendations. Machine learning models can analyze medical data like images and patient records to assist in diagnosis and treatment planning.

- Overall, AI drives innovation and efficiency in computer science and has a transformative impact on industries such as healthcare, finance, entertainment, and beyond.



- [1] Chowdhary K.R. (2020) Introducing Artificial Intelligence. In: Fundamentals of Artificial Intelligence. Springer, New Delhi.
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- [2] A. M. TURING, I.—COMPUTING MACHINERY AND INTELLIGENCE, Mind, Volume LIX, Issue 236, October 1950, Pages 433–460,
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