جامعة المستقبل
كلية التقنيات الصحية والطبية
قسم تقنيات البصريات

Principles of computers

First stage

Lecture

Artificial Intelligence

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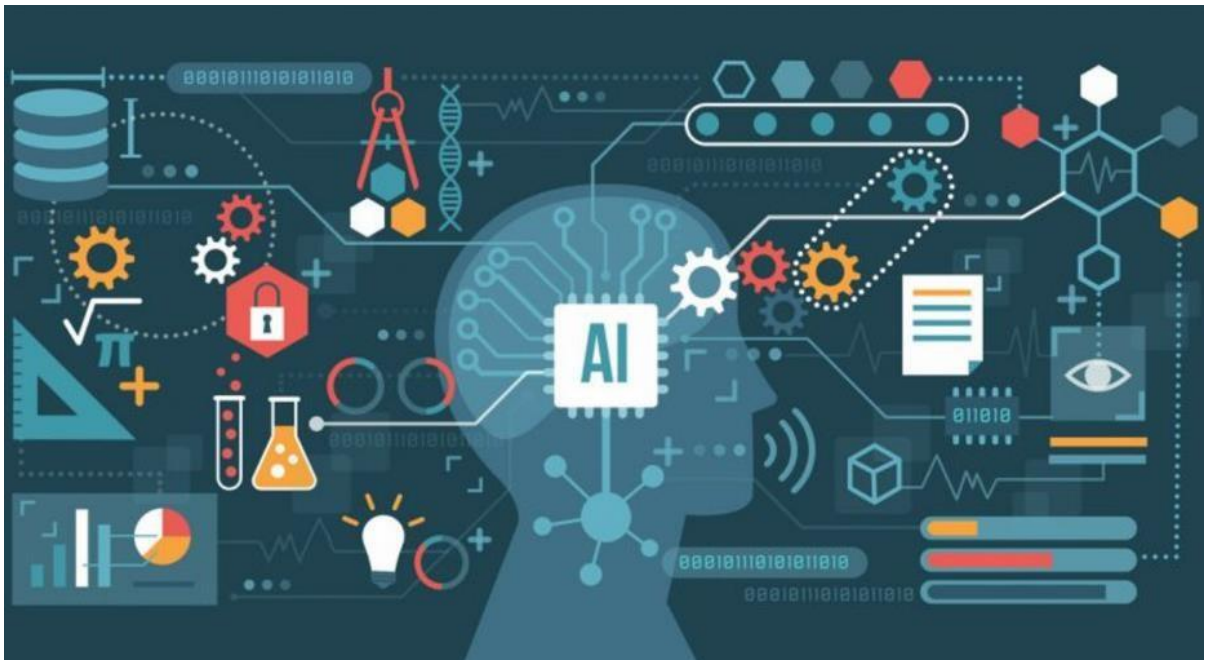
INTRODUCTION TO ARTIFICIAL INTELLIGENCE (AI)

■ Explore the definition, history, techniques, and ethical considerations of Artificial Intelligence (AI), a field reshaping industries, economies, and daily life.



DEFINITION OF AI

Artificial Intelligence refers to the development of computer systems capable of performing tasks requiring human intelligence.

Tasks include reasoning, problem-solving, learning, perception, and decision-making.

AI encompasses:

Machine Learning (ML): Systems learning from experience without explicit programming.

Natural Language Processing (NLP): Machines understanding and generating human language.

Computer Vision: Interpreting visual data like images or videos.

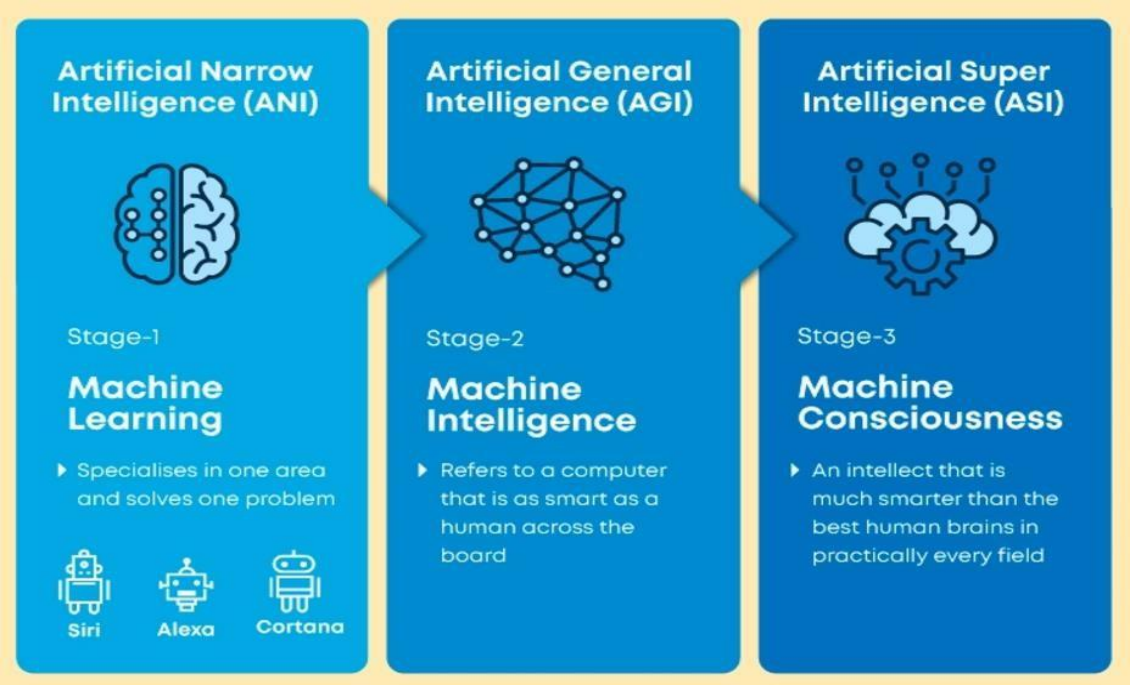
Robotics: Intelligent machines interacting with the physical world.

AI is categorized into three levels:

Narrow AI (Weak AI): Specialized in a single task (e.g., Siri, spam filters).

General AI (Strong AI): Hypothetical systems performing any intellectual task humans can do.

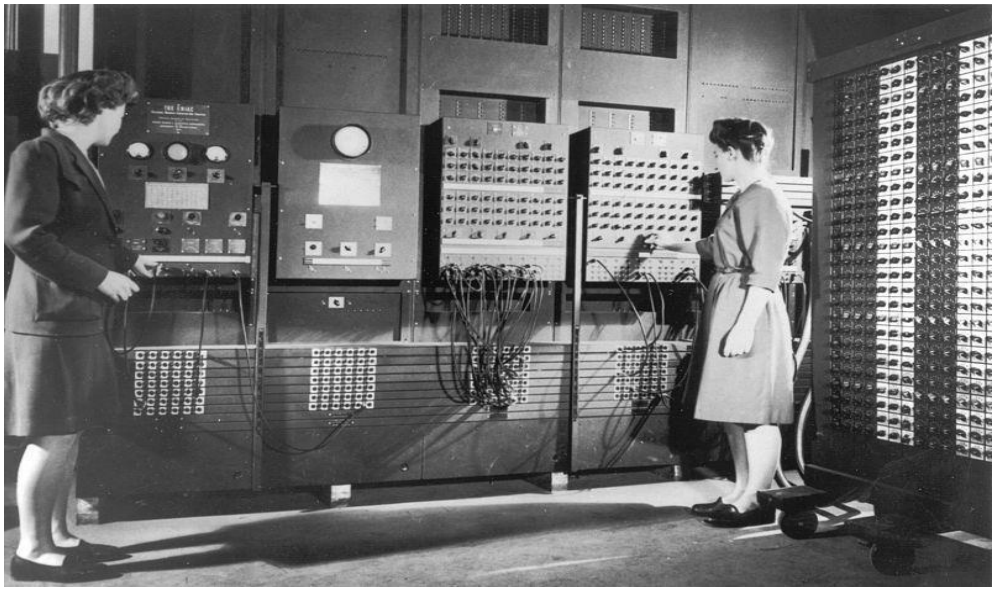
Superintelligent AI: Theoretical systems surpassing human intelligence in all areas, raising questions about control and ethics.



HISTORY OF AI

1936: Alan Turing introduced the "Turing Machine," the mathematical foundation for computation

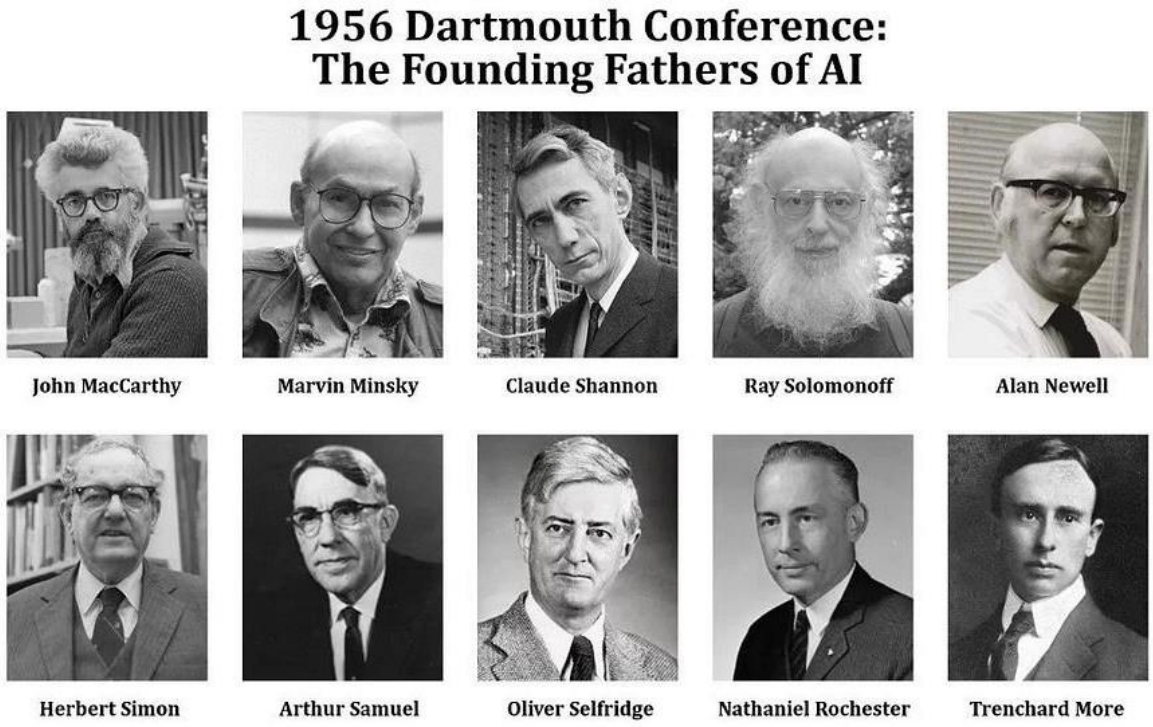
1940s–1950s: Development of programmable computers like the ENIAC allowed for early experimentation with automated reasoning**.**



The Dartmouth Conference marked the official birth of AI as a field.

Key contributors included John McCarthy and Marvin Minsky.

Early programs successfully solved algebra problems, played checkers, and proved logical theorems



1970s–1980s: AI suffered from unmet expectations, leading to funding cuts and reduced interest.

Limitations in computing power and the complexity of real-world problems led to "AI winters."

THE MODERNAI RESURGENCE

The 1990s brought advances in computational power, data availability, and improved algorithms.

Practical applications emerged, such as speech recognition and search engines.

1997: IBM's Deep Blue defeated world chess champion Garry Kasparov.

AI achieved breakthroughs in specialized domains, marking a significant revival of interest.

THE DEEP LEARNING REVOLUTION

Neural networks and access to large-scale data led to advancements in image recognition, language processing, and autonomous systems.

AI systems like Google Assistant and ChatGPT became part of everyday life.

AI TECHNIQUES OVERVIEW

AI methodologies include:

Symbolic AI: Rule-based systems using explicit logic.

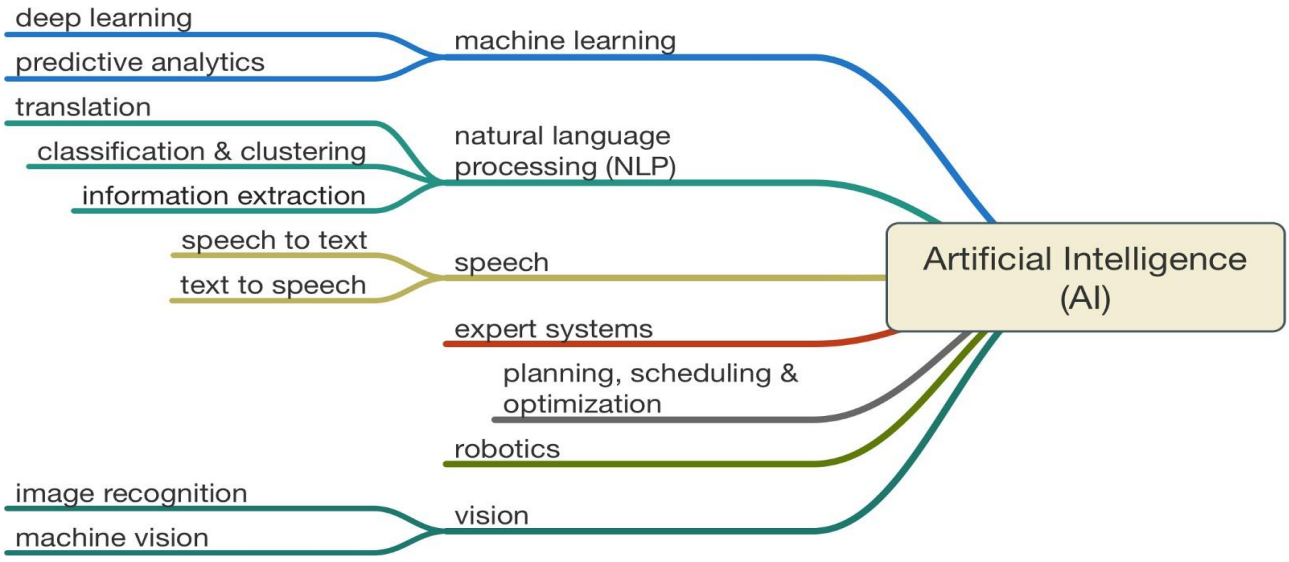
Machine Learning (ML): Data-driven approaches to identify patterns and make decisions.

Deep Learning: Neural networks with multiple layers for complex tasks.

NLP: Interacting through human language**.**

Computer Vision: Processing and analyzing visual data**.**

Robotics: Intelligent machines in real-world environments



SYMBOLIC AI

Relies on predefined rules and explicit logic to encode knowledge.

Strength: High interpretability and transparency.

Limitation: Ineffective at handling unstructured or complex real-world data.

MACHINE LEARNING

ML algorithms learn patterns from data to make predictions or decisions.

Types:

Supervised Learning: Uses labeled data (e.g., spam detection).

Unsupervised Learning: Identifies patterns in unlabeled data (e.g., customer segmentation).

Reinforcement Learning: Agents learn through trial and error to achieve goals.

Example: Game-playing AI like AlphaGo.

ML forms the backbone of many modern AI applications.

DEEP LEARNING

Subset of ML using neural networks with multiple layers to process complex data.

Applications:

Medical diagnostics (e.g., identifying diseases from X-rays).

Autonomous driving (e.g., recognizing road signs and obstacles).

NATURAL LANGUAGE PROCESSING (NLP)

Enables machines to understand, interpret, and generate human language.

Applications:

Chatbots and virtual assistants (e.g., ChatGPT, Alexa).

Sentiment analysis for social media and product reviews.

Machine translation (e.g., Google Translate).

COMPUTER VISION

Allows AI to interpret visual data like images or videos.

Applications:

Facial recognition for security and authentication.

Object detection in autonomous vehicles.

Augmented reality for gaming and training.

ROBOTICS

Combines AI with physical systems for interaction with the environment.

Applications:

Autonomous vehicles and drones.

Robotic manufacturing in industries.

Humanoid robots for caregiving and assistance**.**

CHALLENGES IN AI

Data Dependency: AI requires large volumes of high-quality data.

Generalization: Ensuring AI models work effectively in diverse real-world scenarios.

Energy Consumption: Training large AI models is resource-intensive and raises sustainability concerns.

ETHICAL CONCERNS: BIAS AND FAIRNESS

Bias in AI Systems: Algorithms can reflect societal biases present in training data.

Example: Discriminatory hiring algorithms or unfair loan approvals.

Addressing fairness is crucial for trust in AI.

ETHICAL CONCERNS: PRIVACY

AI systems often rely on personal data, raising concerns about misuse and

surveillance.

Example: Social media platforms using AI to analyze and influence user behavior.

ETHICAL CONCERNS: JOB DISPLACEMENT

Automation poses risks of job loss, especially in manufacturing, transportation, and

customer service.

Focus is needed on reskilling displaced workers and creating new job opportunities.

AUTONOMY AND ACCOUNTABILITY

Determining responsibility for AI decisions is challenging.

Example: Liability for accidents involving self-driving cars.

Transparency and accountability are essential for critical applications like healthcare and law enforcement.

GLOBAL RISKS OF AI

Weaponization of AI: Autonomous weapons could destabilize international

security.

Superintelligence Risks: AI surpassing human control poses existential threats.

REGULATION AND GOVERNANCE

Frameworks are being developed to ensure ethical AI use:

- Transparency in decision-making.
- Fairness and inclusivity in systems.
- Accountability for actions and impacts.