Computer Sciences III S1

Second Stage

LECTURE 6

Introduction To Artificial Intelligence

BY

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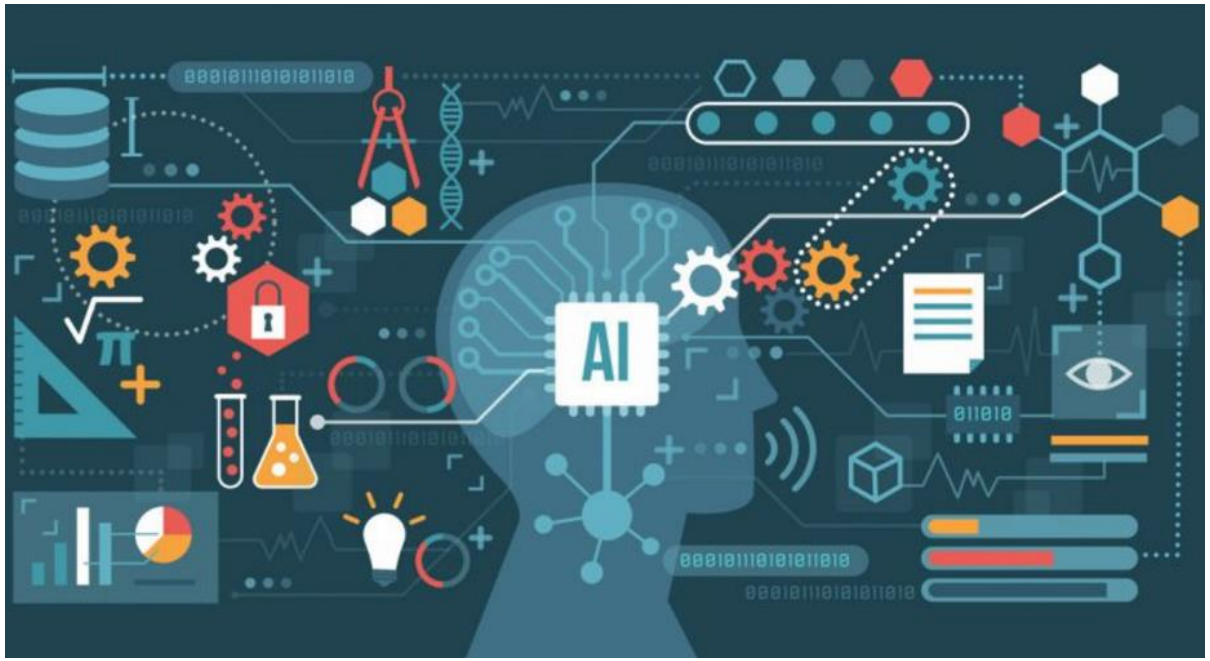
2024-2025

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.

DEFINITION OF AI

- 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.

Artificial Narrow Intelligence (ANI)

Stage-1

Machine Learning

- Specialises in one area and solves one problem


Siri


Alexa


Cortana

Artificial General Intelligence (AGI)

Stage-2

Machine Intelligence

- Refers to a computer that is as smart as a human across the board

Artificial Super Intelligence (ASI)

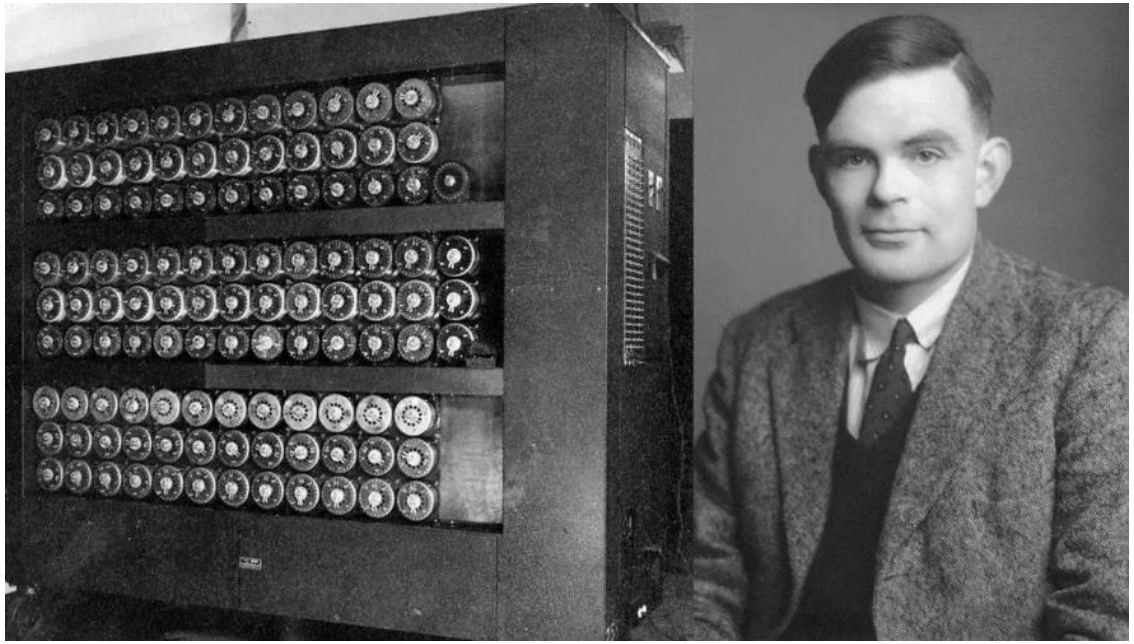
Stage-3

Machine Consciousness

- An intellect that is much smarter than the best human brains in practically every field

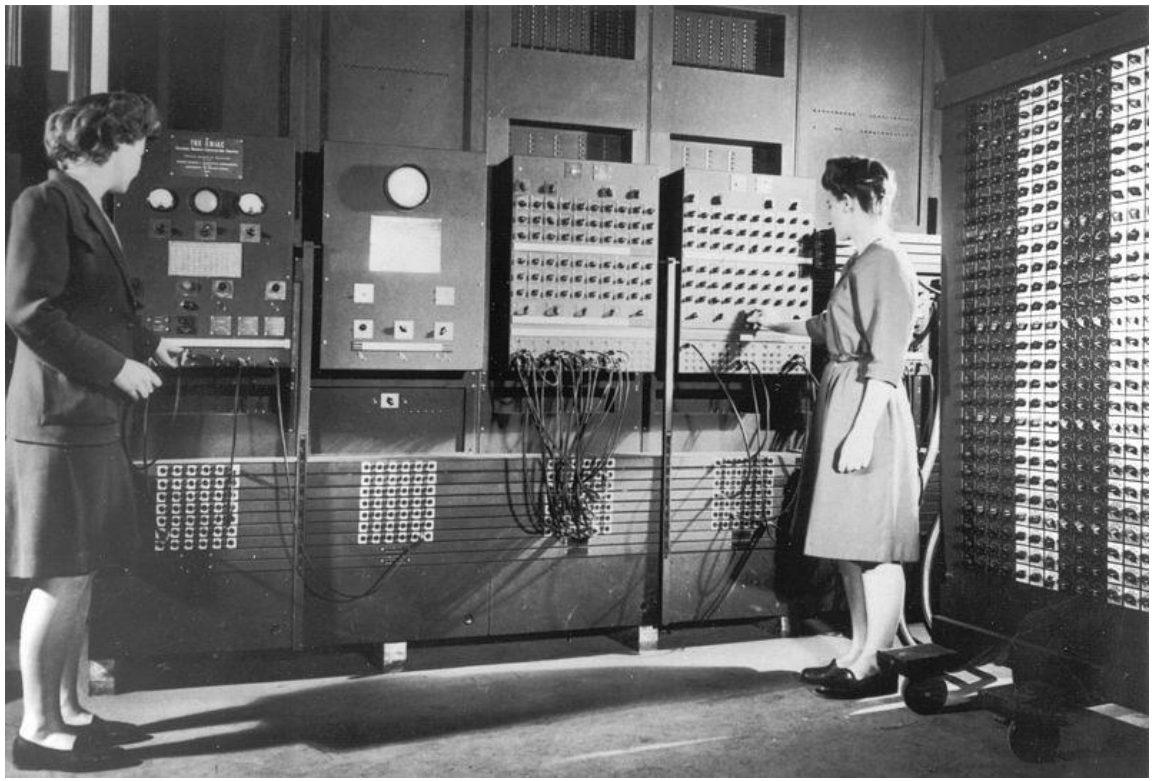
HISTORY OF AI
20TH CENTURY FOUNDATIONS

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



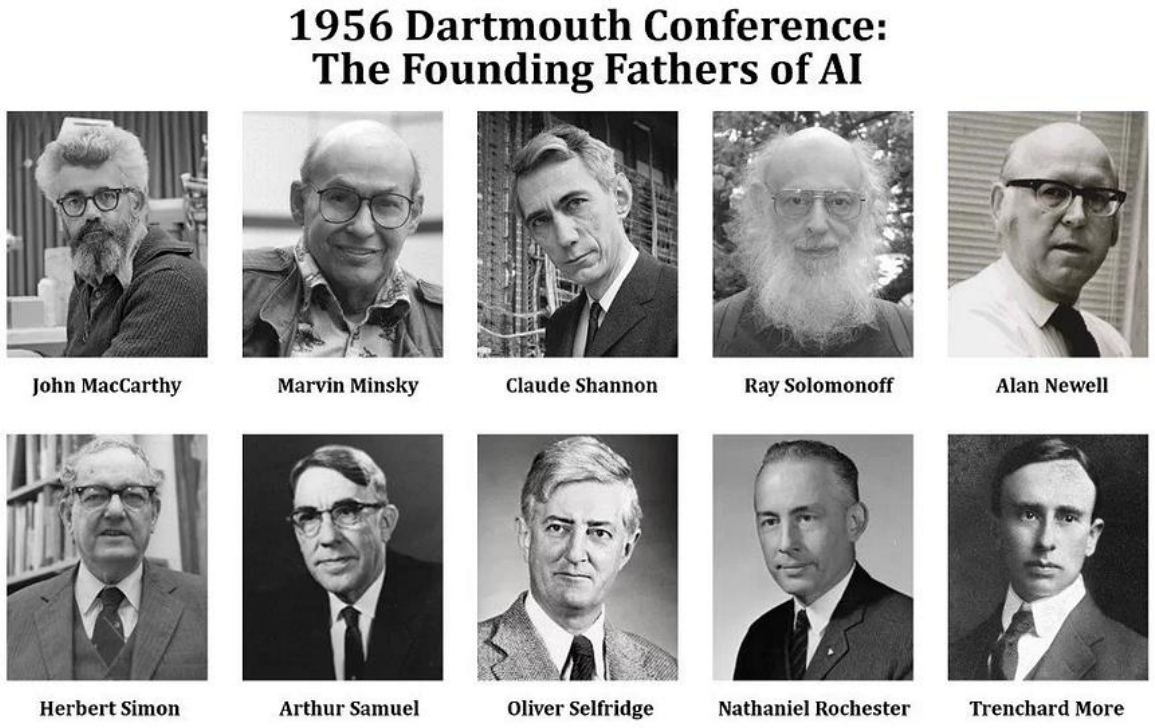
HISTORY OF AI
20TH CENTURY FOUNDATIONS

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



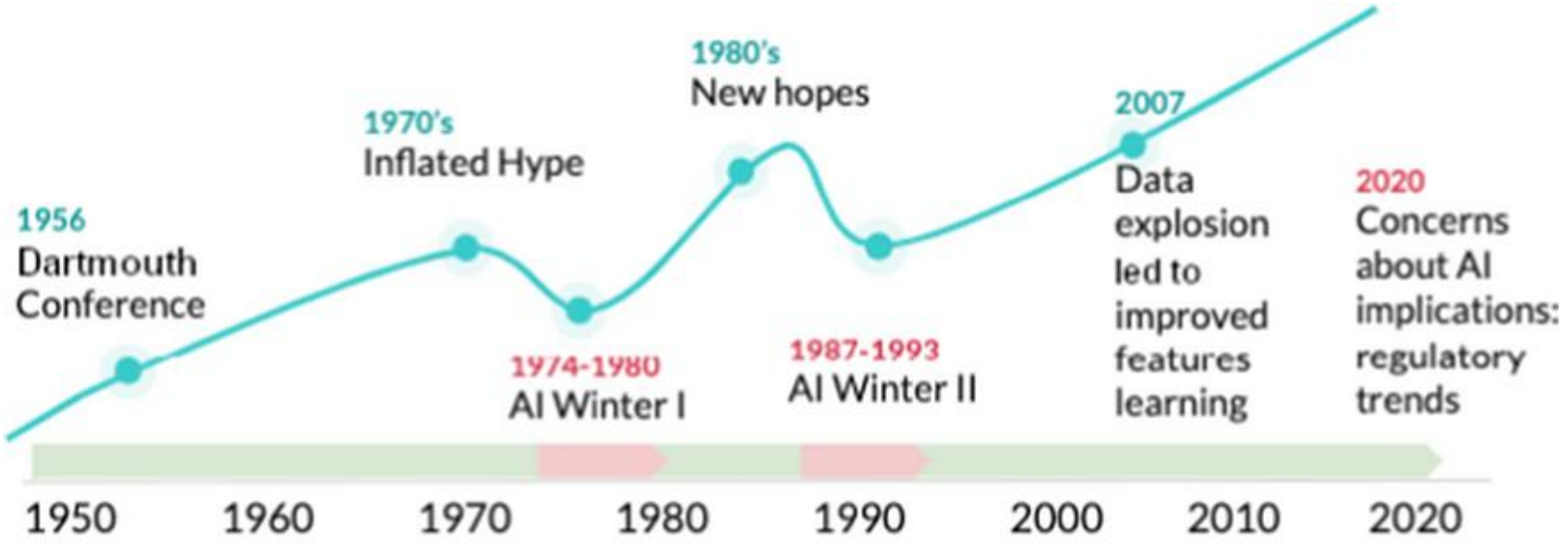
THE BIRTH OF AI (1956)

- 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.



CHALLENGES AND AI WINTERS

- **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 MODERN AI RESURGENCE

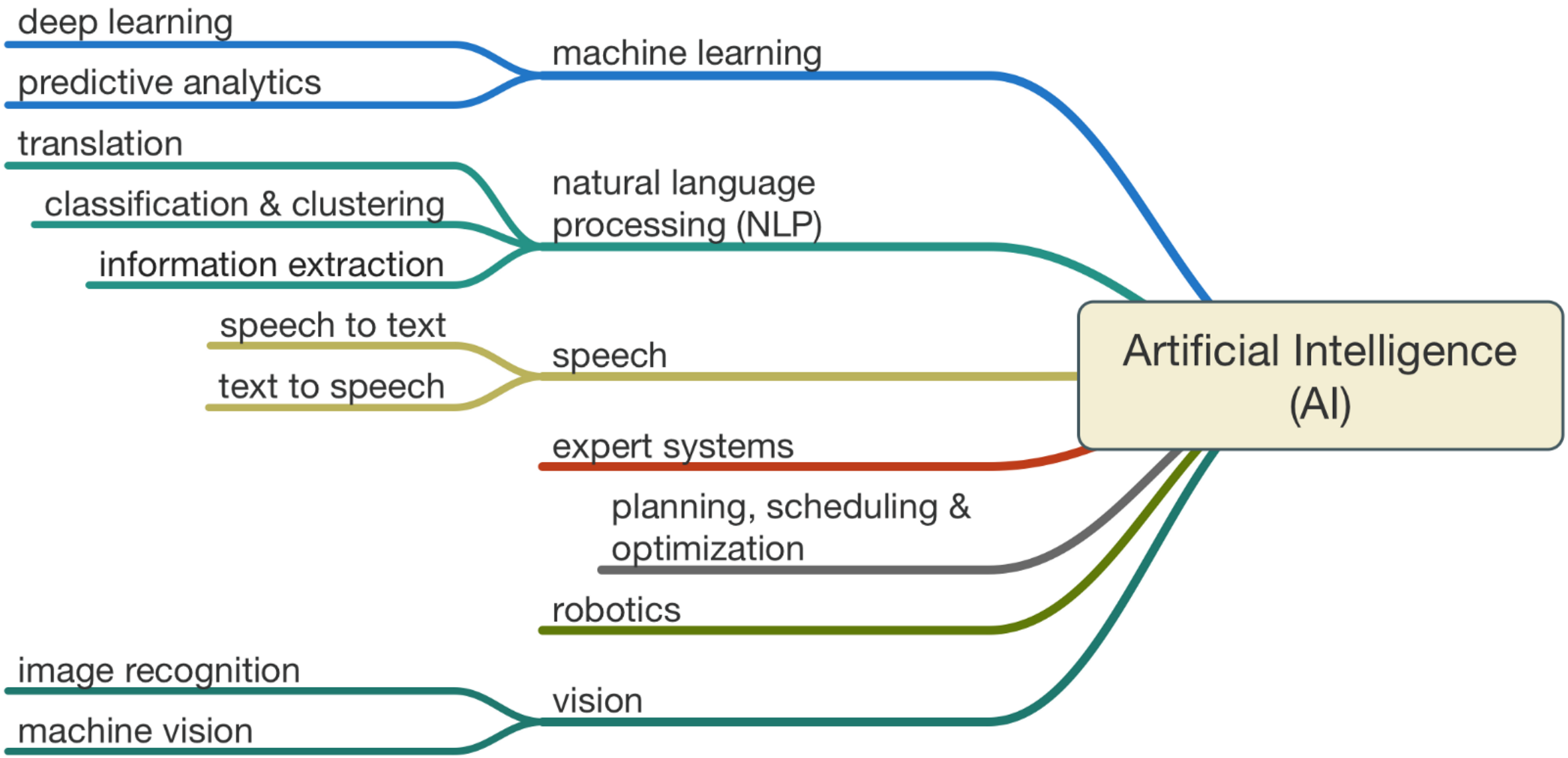
- The 1990s brought advances in computational power, data availability, and improved algorithms.
- Practical applications emerged, such as speech recognition and search engines.
- **1997:** IBM's Deep Blue defeated world chess champion Garry Kasparov.
- AI achieved breakthroughs in specialized domains, 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.


Artificial Intelligence (AI)
machine learning
deep learning
predictive analytics
natural language processing (NLP)
translation
classification & clustering
information extraction
speech
speech to text
text to speech
expert systems
planning, scheduling & optimization
robotics
vision
image recognition
machine vision

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.

CONCLUSION

- AI is a revolutionary technology shaping industries, economies, and society.
- By addressing ethical and technical challenges, AI can create a smarter, more equitable, and sustainable future.

- Thanks for lessening ..

Any questions?