Computer Sciences III S1

Second Stage

LECTURE 6
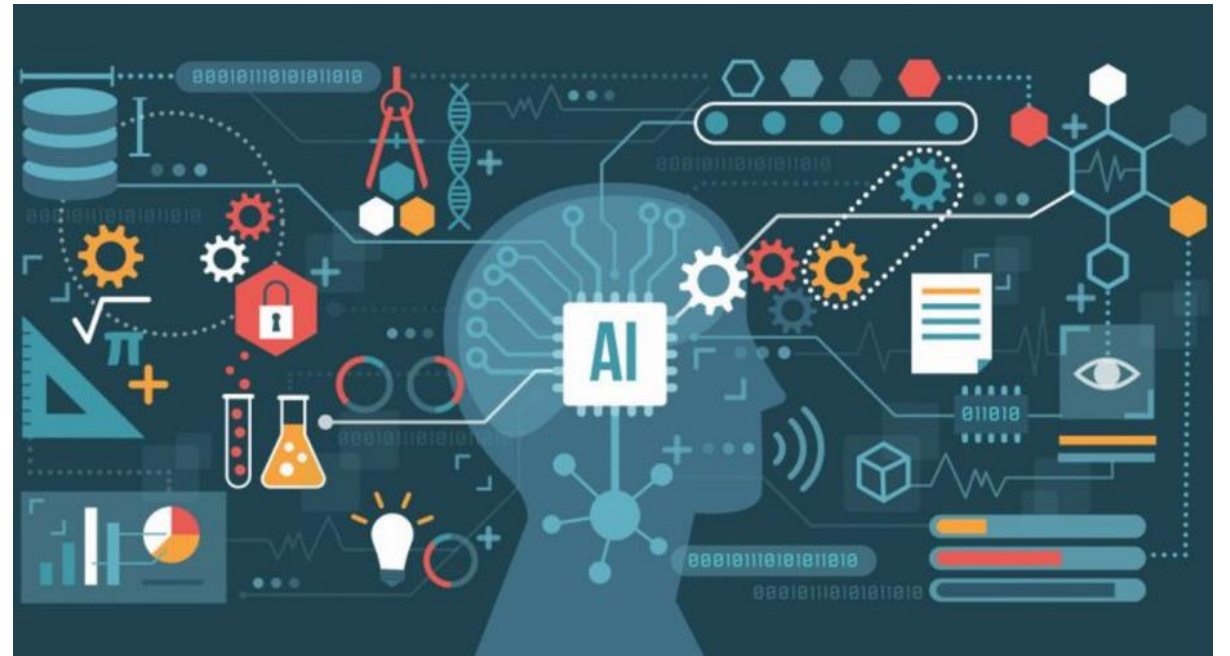## Introduction To Artificial Intelligence

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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.

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

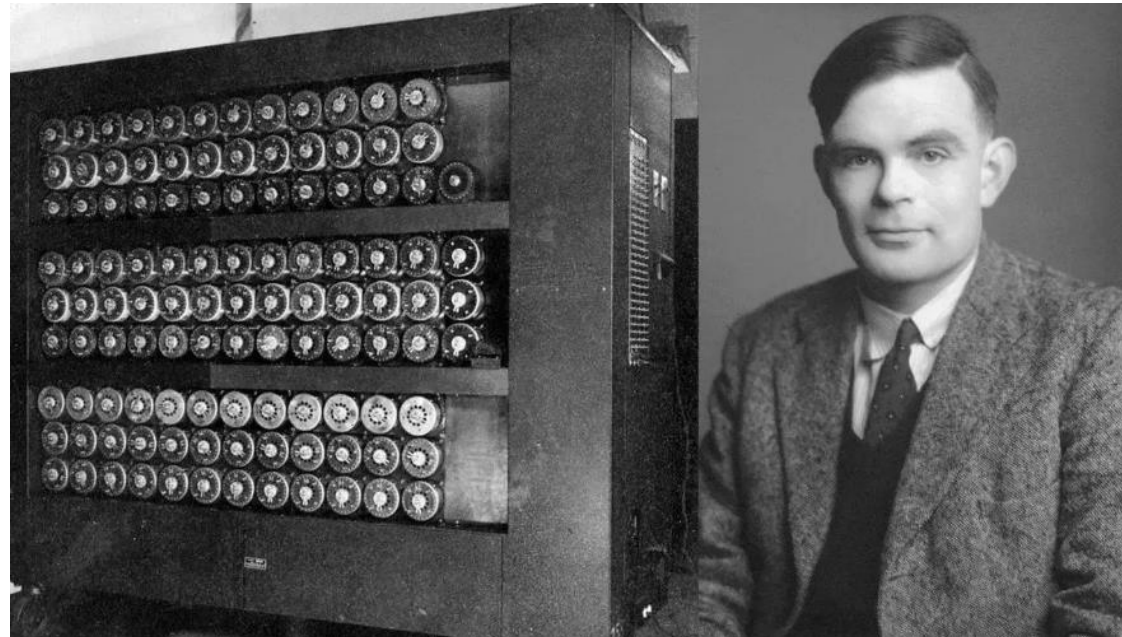# Artificial Super Intelligence (ASI)

Stage-3

Machine Consciousness

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

HISTORY OF AI
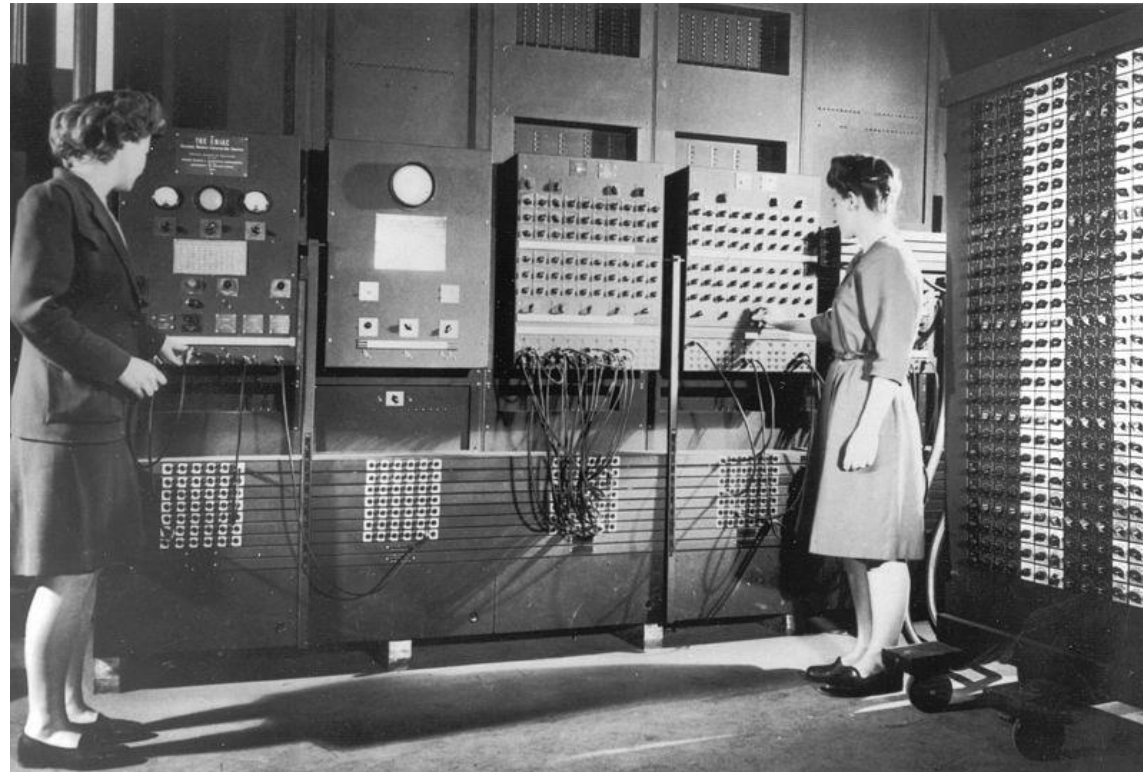# 20TH CENTURY FOUNDATIONS

- **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.

1956 Dartmouth Conference: The Founding Fathers of AI

John MacCarthy   Marvin Minsky   Claude Shannon   Ray Solomonoff   Alan Newell

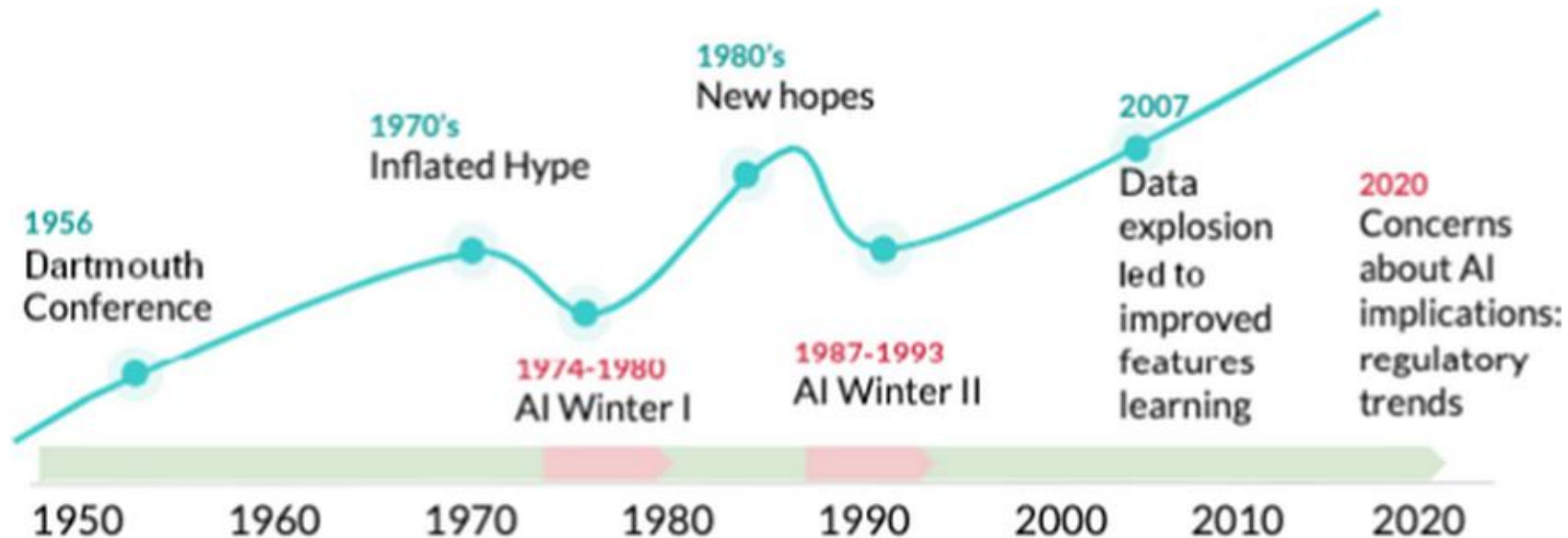Herbert Simon   Arthur Samuel   Oliver Selfridge   Nathaniel Rochester   Trenchard More

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."

1956 Dartmouth Conference · 1970's Inflated Hype · 1974-1980 AI Winter I · 1980's New hopes · 1987-1993 AI Winter II · 2007 Data explosion led to improved features learning · 2020 Concerns about AI implications: regulatory trends

1950 · 1960 · 1970 · 1980 · 1990 · 2000 · 2010 · 2020

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.
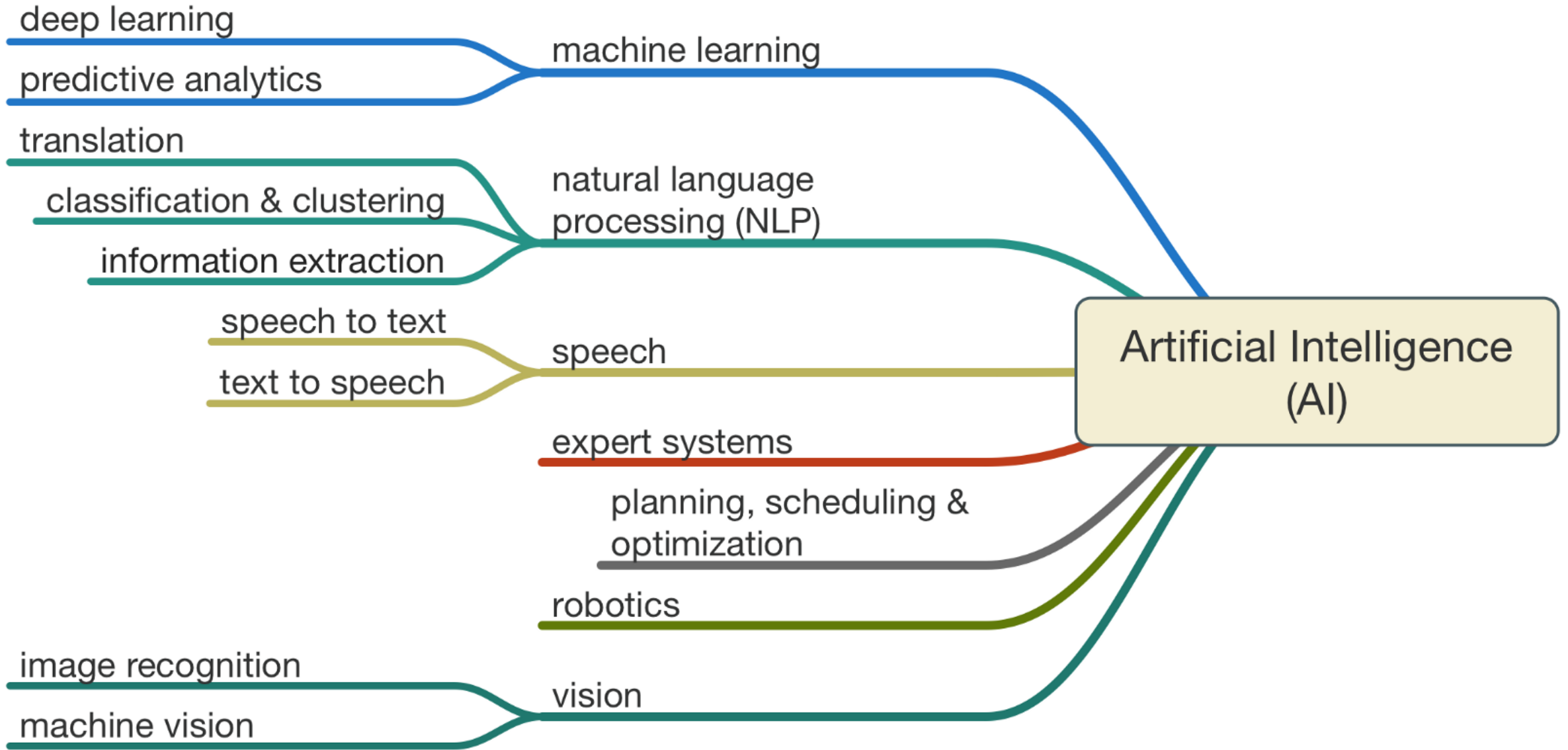
THE DEEP LEARNING REVOLUTION

- 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.

deep learning
predictive analytics
→ machine learning

translation
classification & clustering
information extraction
→ natural language processing (NLP)

speech to text
text to speech
→ speech

expert systems

planning, scheduling & optimization

robotics

image recognition
machine vision
→ vision

Artificial Intelligence (AI)

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?