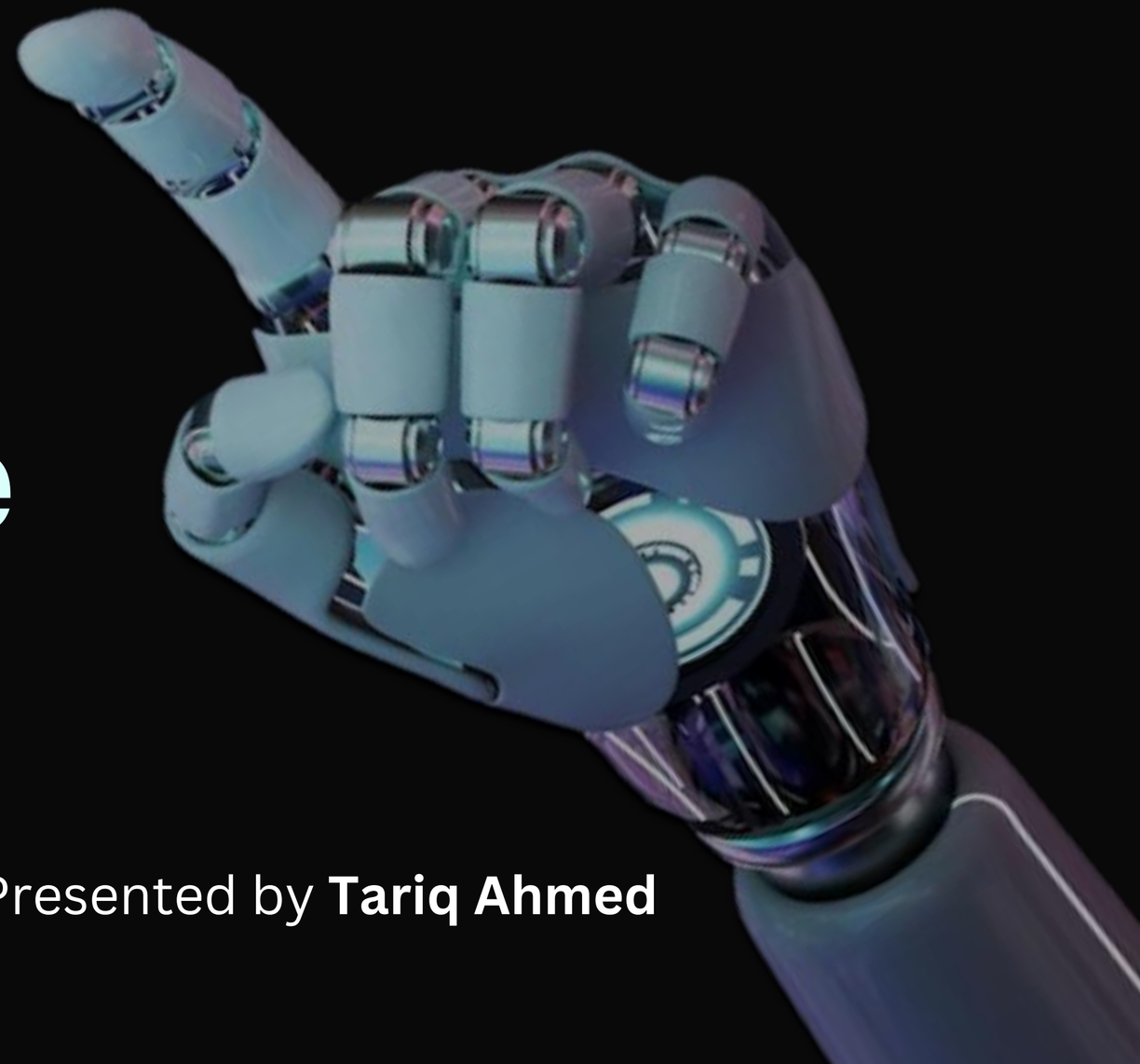
The Era of

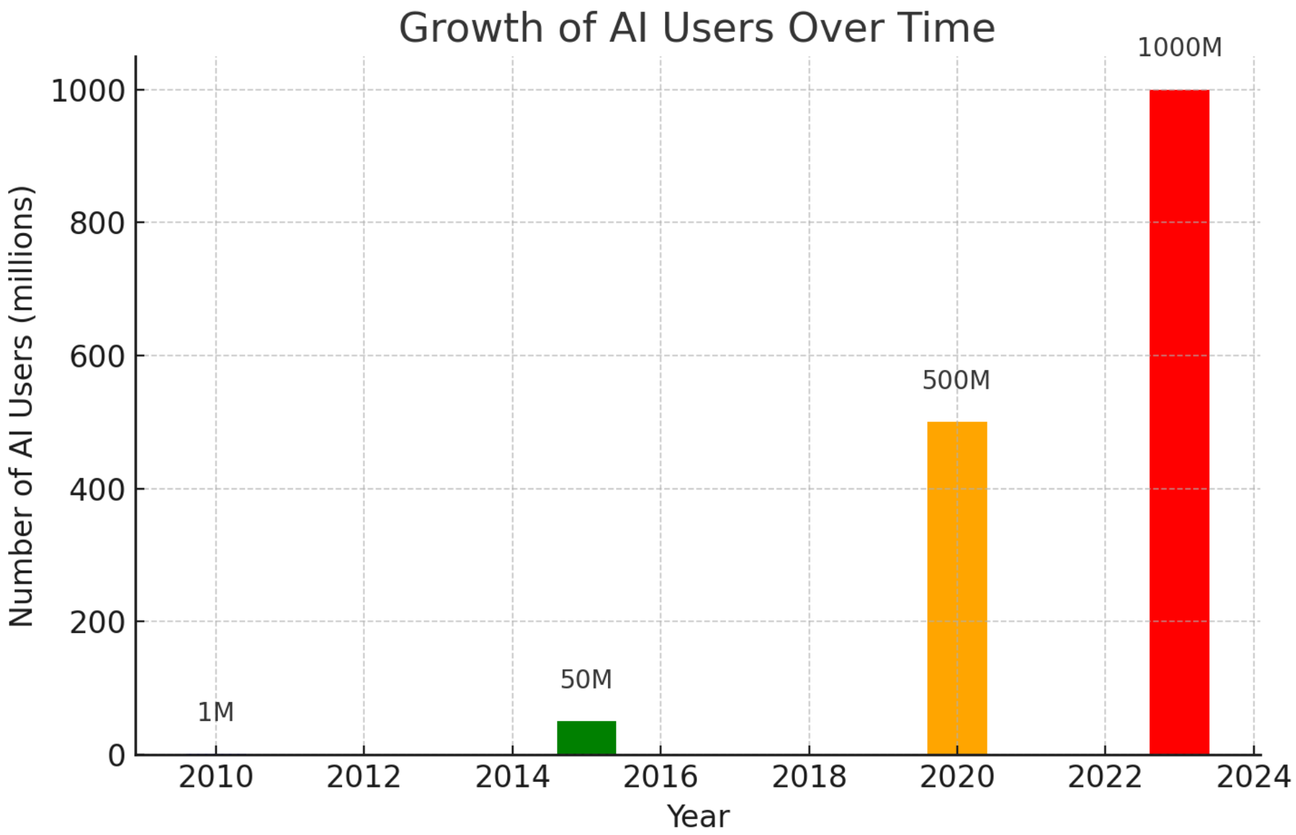
# Artificial Intelligence



Presented by **Tariq Ahmed**

# Growth of AI usage

- With the advancement in science and technology , the innovations or breakthroughs in the field of big data, machine learning, and artificial intelligence, many unskilled jobs may be taken over by machines.
- At present in India above 90% internet user in some or the other way are using AI on daily basis.



# What is Intelligence?

Ability to learn and perform suitable techniques to solve problems and achieve goals (Stanford Univ.)

## Problem-Solving

The ability to analyze a problem, formulate a plan, and execute a solution to overcome challenges.

## Learning

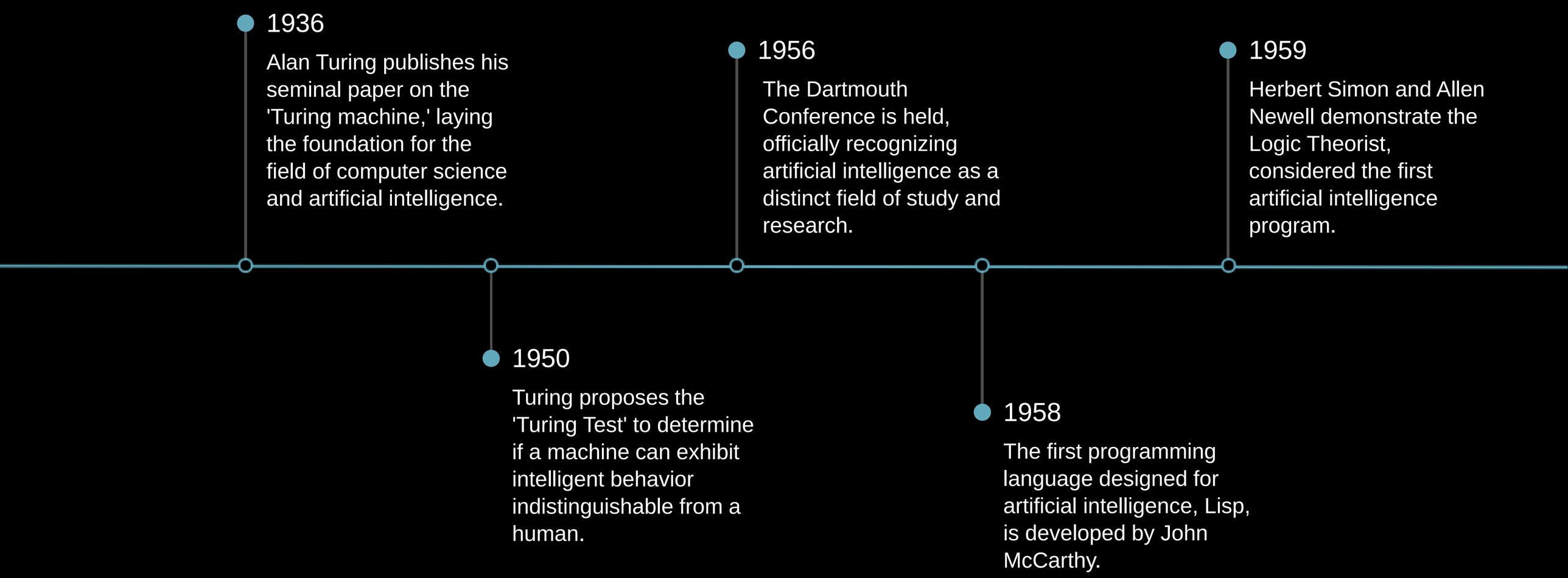
The process of acquiring new knowledge, skills, and understanding through experience, instruction, or study.

## Decision-Making

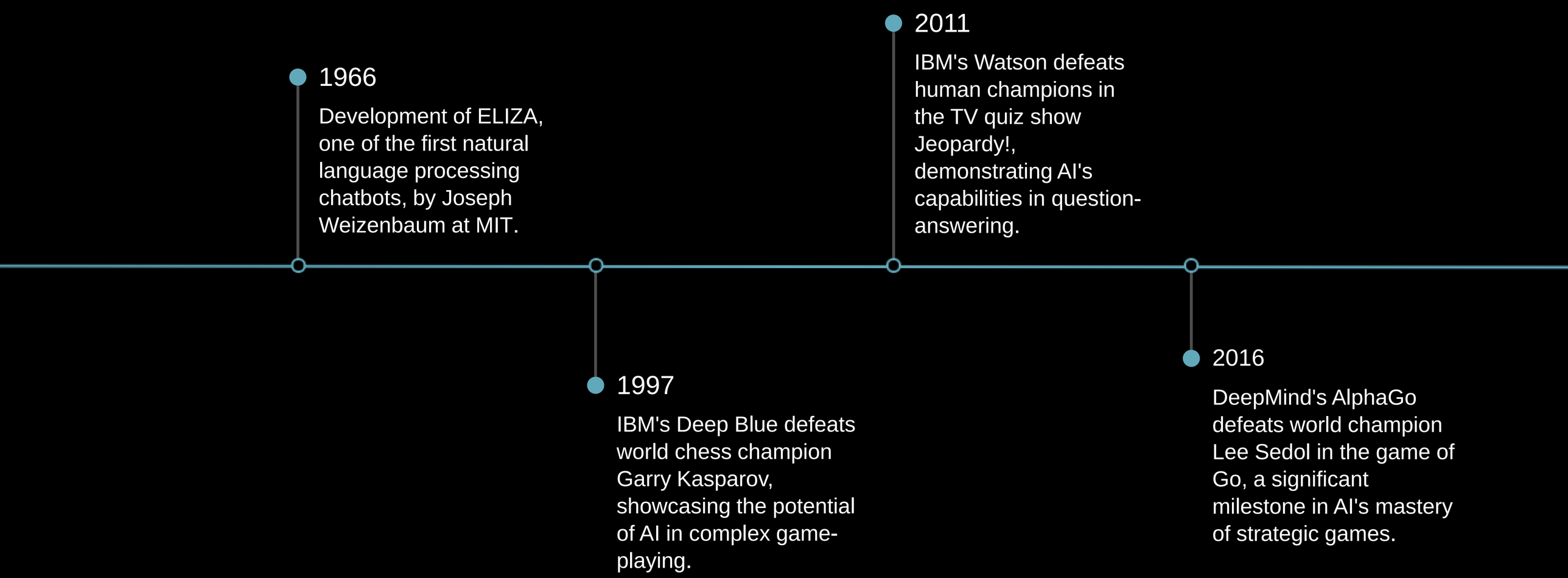
The cognitive process of evaluating options, weighing alternatives, and selecting the most appropriate course of action.

Earlier robot were flexible, accurate, and consistent but not intelligent.

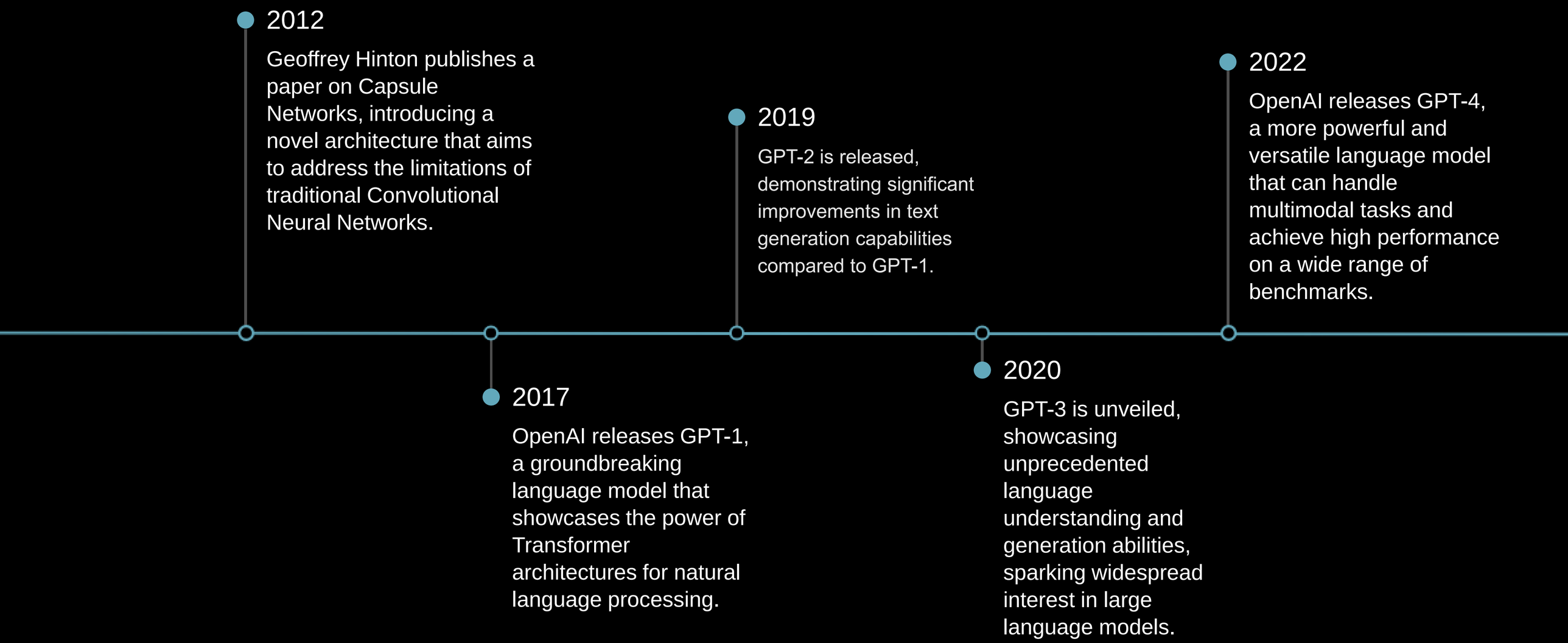
# The Pioneering Era of AI



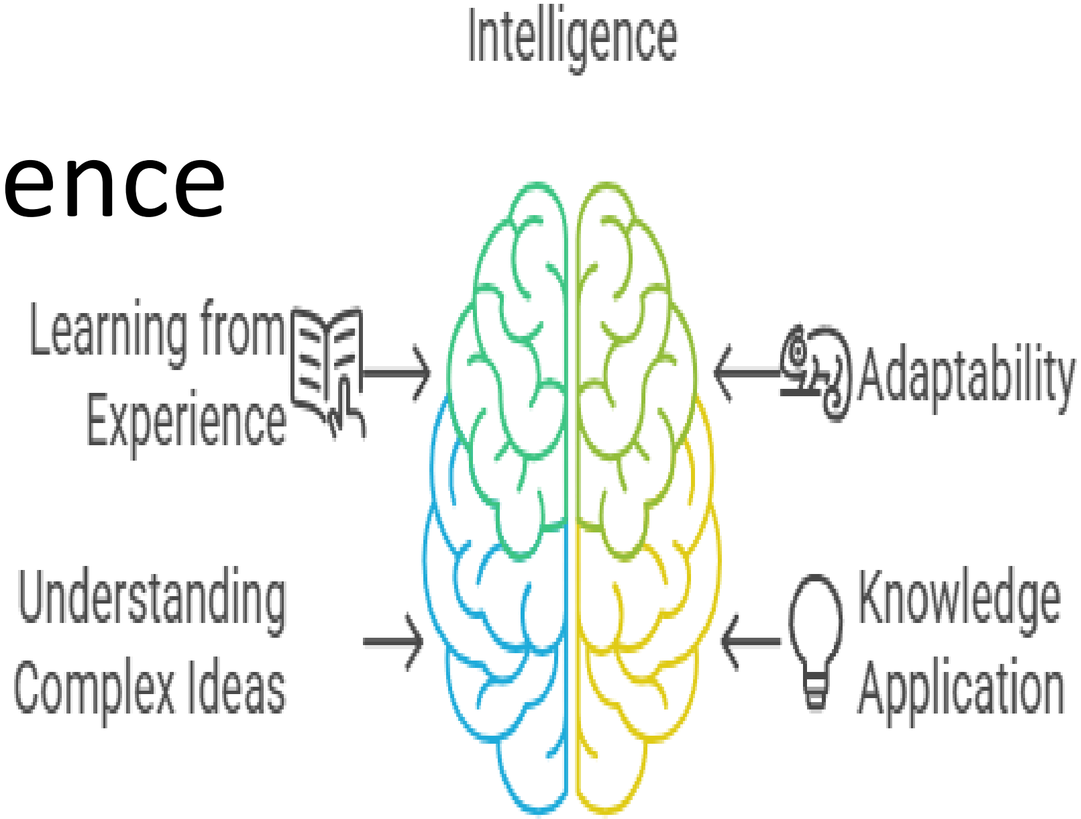
# Early AI Milestones



# Advancements in Deep Learning



# Artificial Intelligence

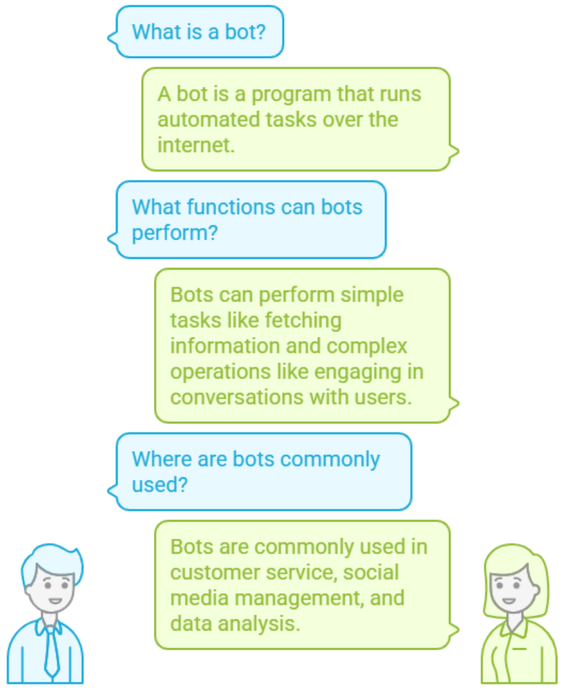


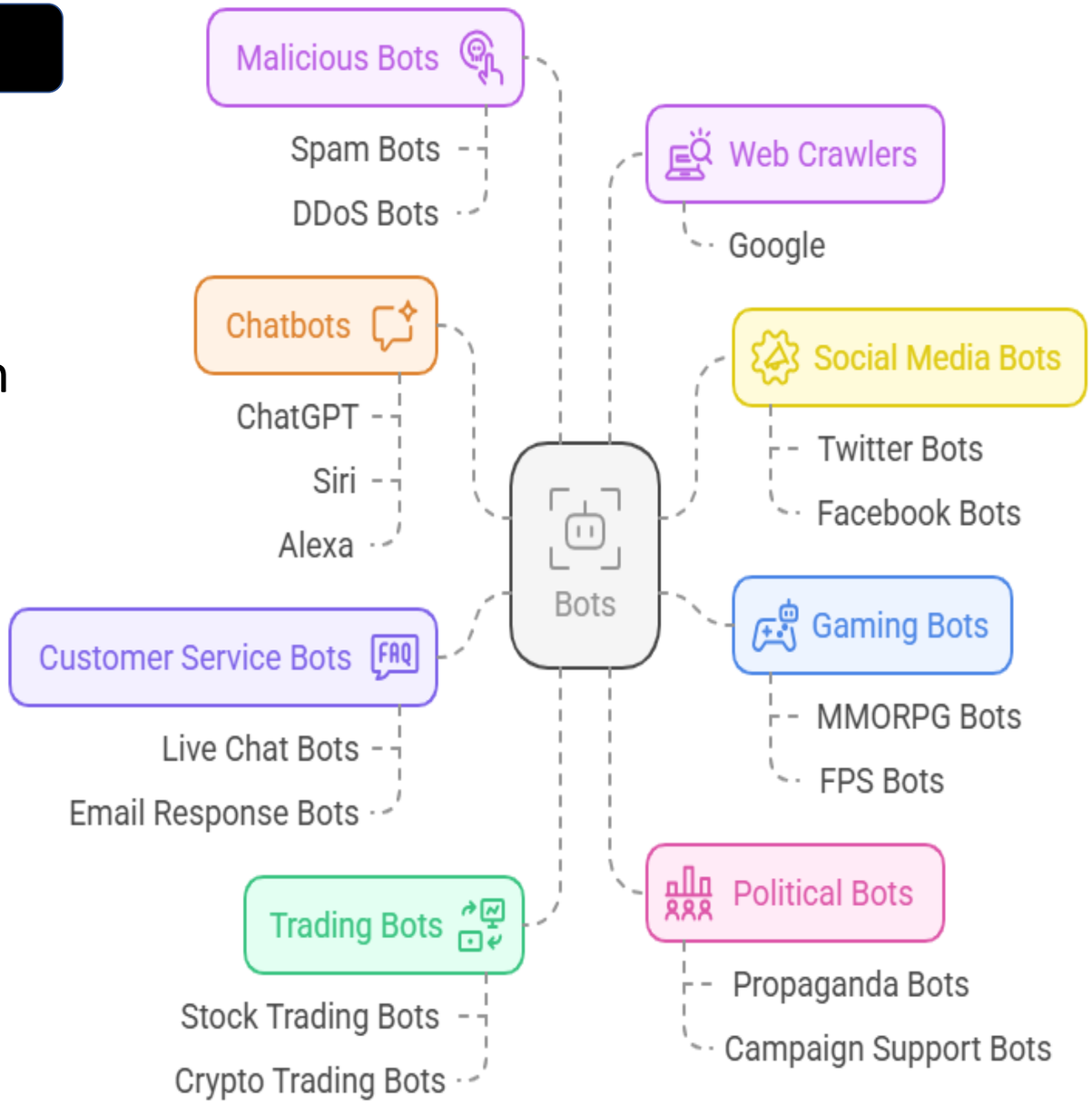

- Characteristics of human behavior:
  - Understanding
  - Reasoning
  - Learning
  - Solving Problems
  - Effective communication
- Simulation of human intelligence processes by computer systems.
- The Science and Engineering of making intelligent machines, especially intelligent computer programs - McCarthy .
- Artificial Intelligence (AI) refers to the development of computer systems capable of performing tasks that typically require human intelligence.
  - SIRI and Alexa are powered by AI

# BOTS

A bot (short for "robot") is a software program that performs automated tasks over the internet or within a system.
Bots can be simple scripts or complex AI-driven programs that interact with users, execute commands, and perform repetitive tasks.

Automate tasks, improve efficiency, and enhance user experiences.



# Components of AI

**Machine Learning**

Subset of AI that enables systems to learn from data and improve over time without explicit programming.

**Neural Networks**

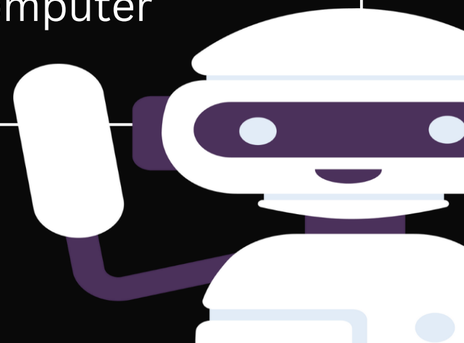
Introduction to artificial neural networks, inspired by the structure and functioning of the human brain.

**Deep Learning**

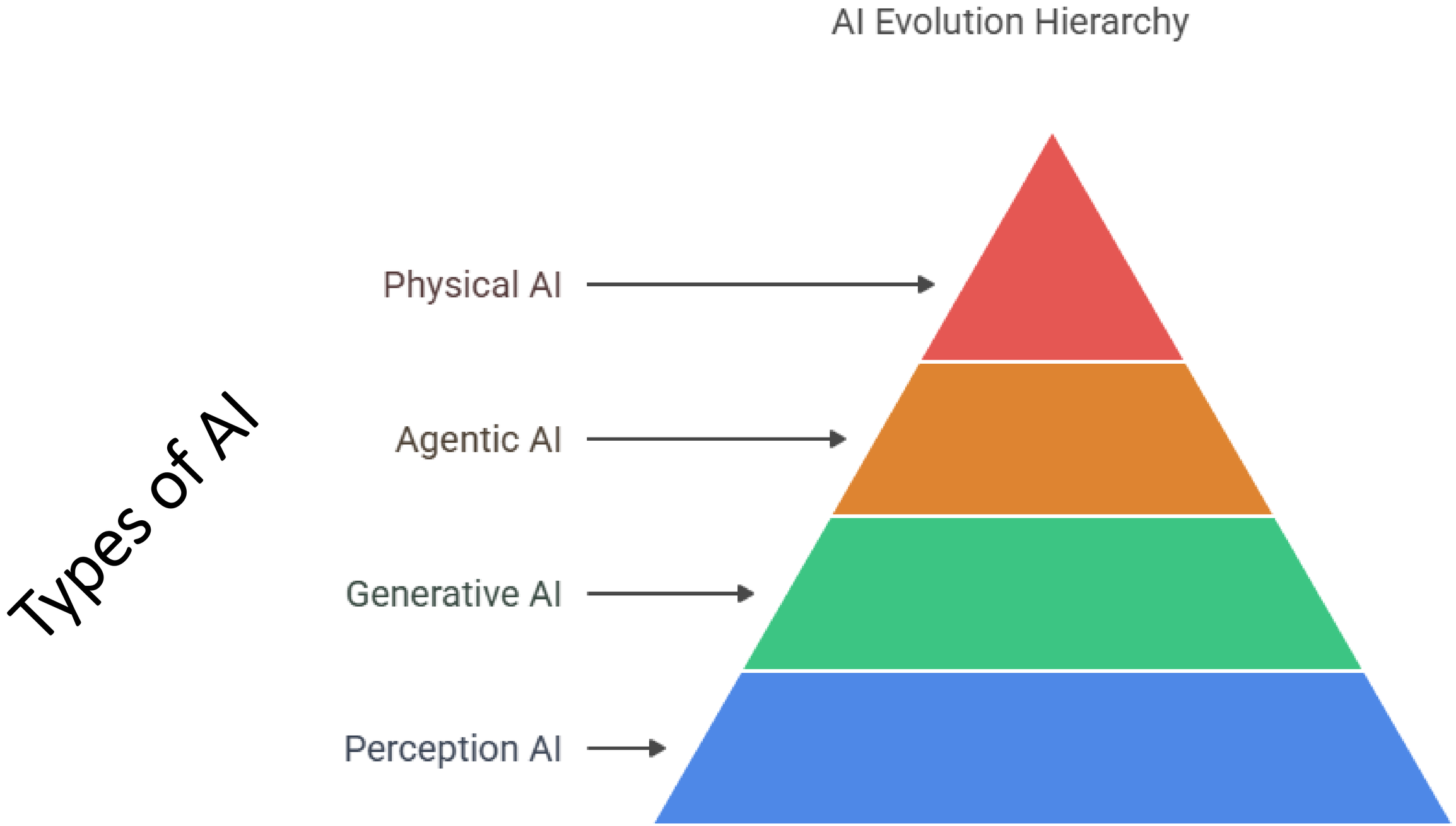
Subset of machine learning using neural networks with many layers, capable of learning representations of data.

**NLP, Computer Vision, Robotics**

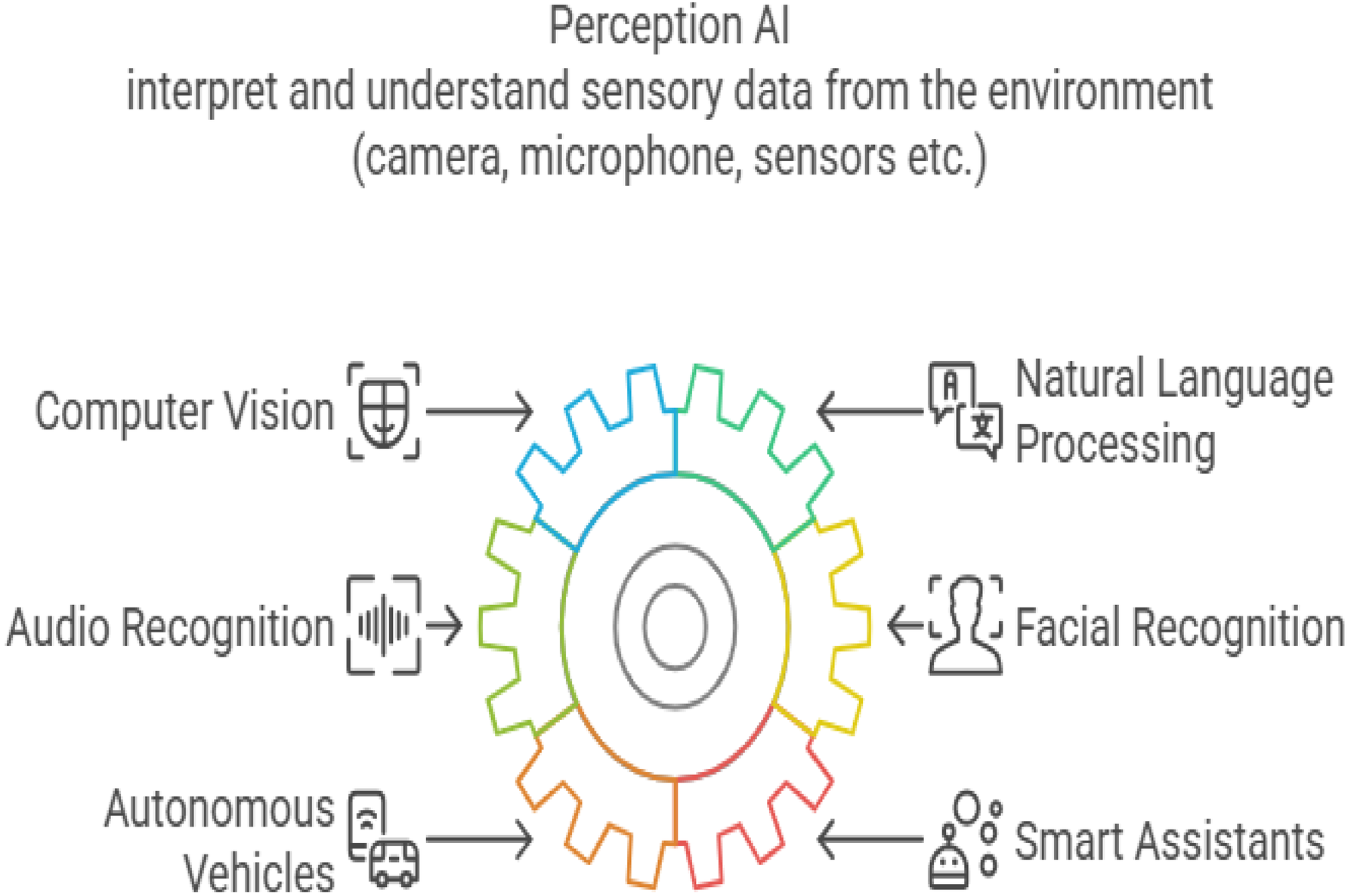
Brief descriptions of other key components contributing to AI's capabilities, including NLP, computer vision, and robotics.



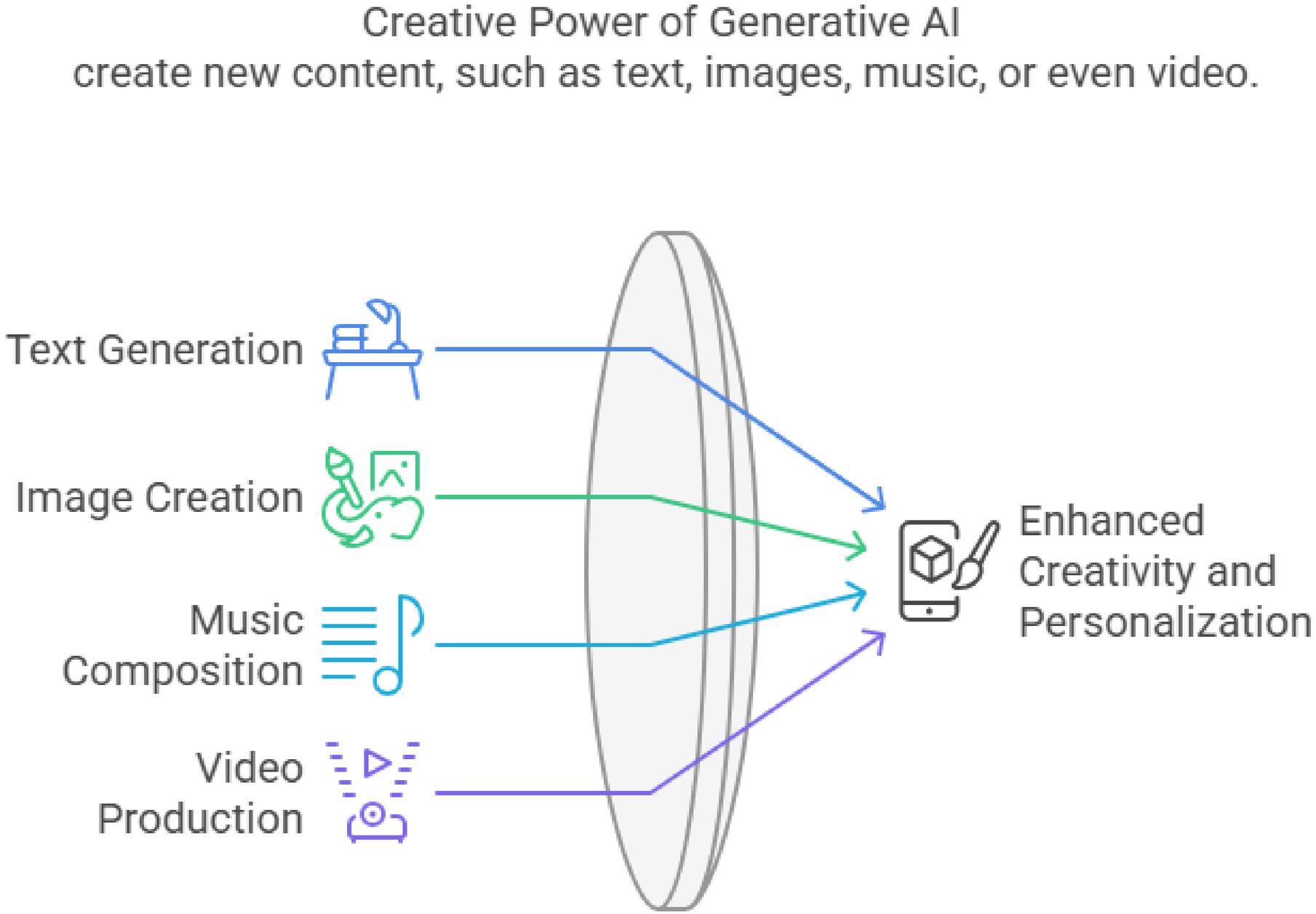
Types of AI


AI Evolution Hierarchy
Physical AI
Agentic AI
Generative AI
Perception AI

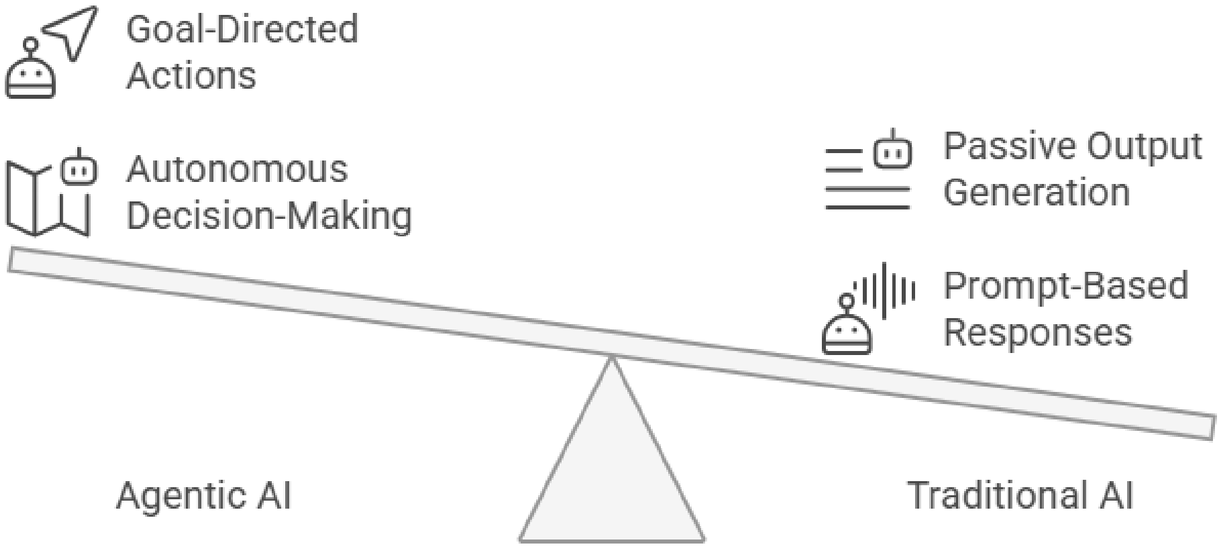
# Perception AI

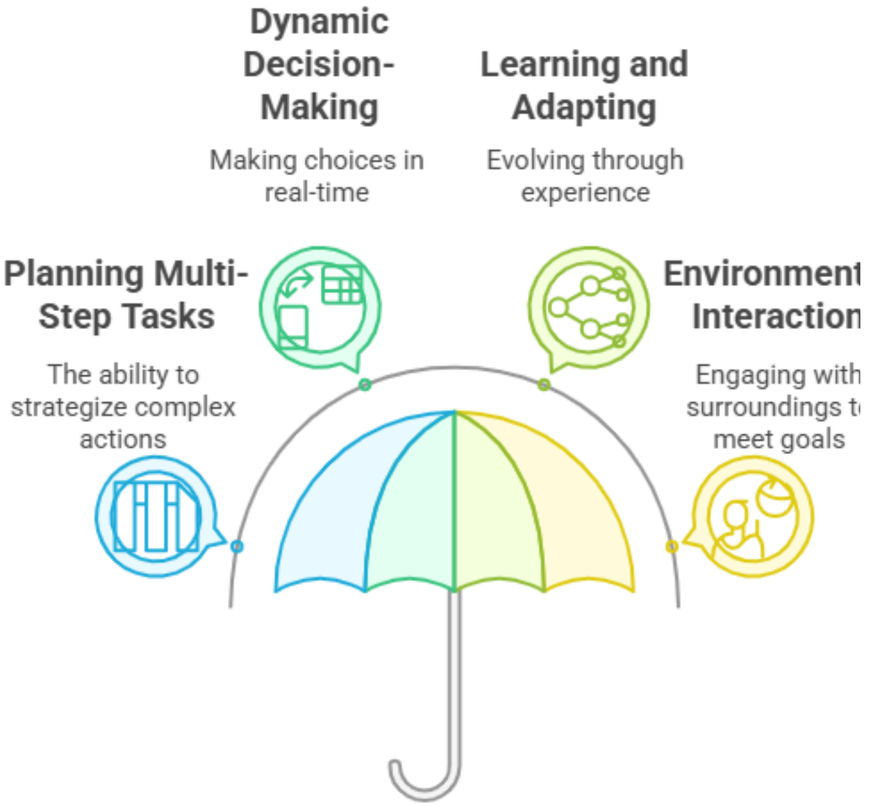


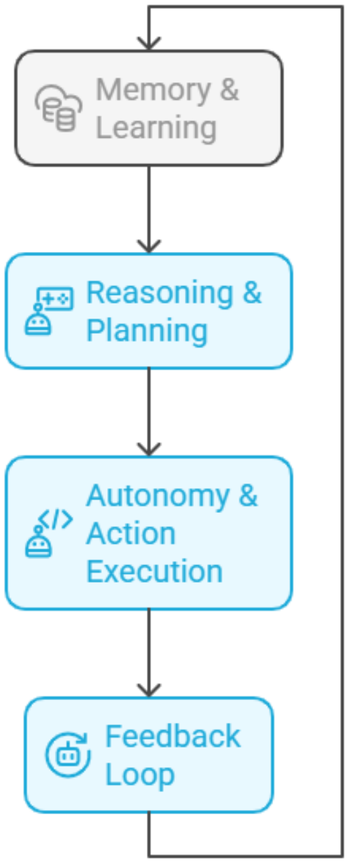
# Generative AI



# Agentic AI


Goal-Directed Actions
Autonomous Decision-Making
Passive Output Generation
Prompt-Based Responses
Agentic AI
Traditional AI


Dynamic Decision-Making
Making choices in real-time
Learning and Adapting
Evolving through experience
Planning Multi-Step Tasks
The ability to strategize complex actions
Environment Interaction
Engaging with surroundings t meet goals


Components of Agentic AI
Memory & Learning
Reasoning & Planning
Autonomy & Action Execution
Feedback Loop

# Physical AI

- ✓ Physical AI combines intelligence with a physical form to **perceive, process, and act** in the real world similar to a human being or could able behave as superhuman
- ✓ **Waymo’s autonomous taxis** use AI to drive passengers safely without human intervention.
- ✓ **Amazon’s warehouse robots** sort, package, and move products efficiently.

## Physical AI Process Funnel

### Data Collection

Sensors gather data from the environment

### Data Analysis

AI models analyze and interpret data

### Action Planning

Decisions and plans are formulated

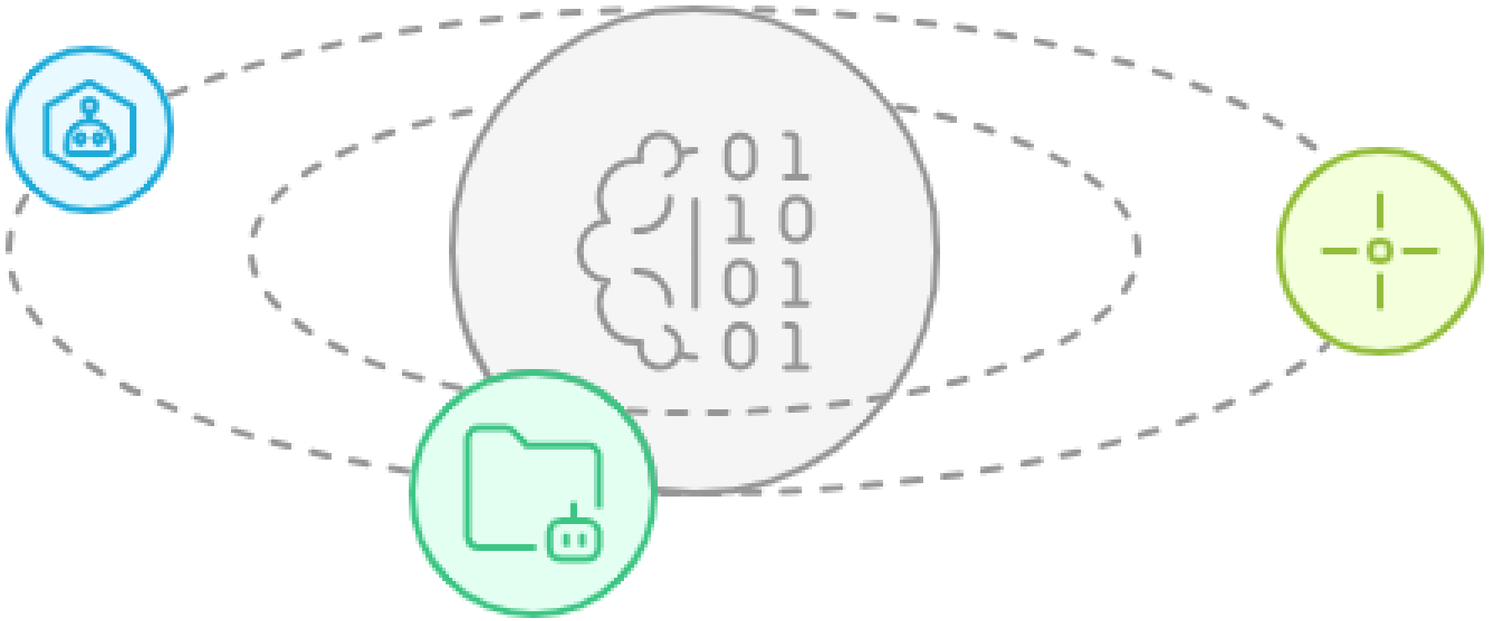
### Action Execution

Motors and limbs execute plans

### Performance Feedback

Continuous feedback adjusts actions

# Agentic AI vs Physical AI




## Interaction

Physical AI involves real-world machines, while Agentic AI operates primarily as software.

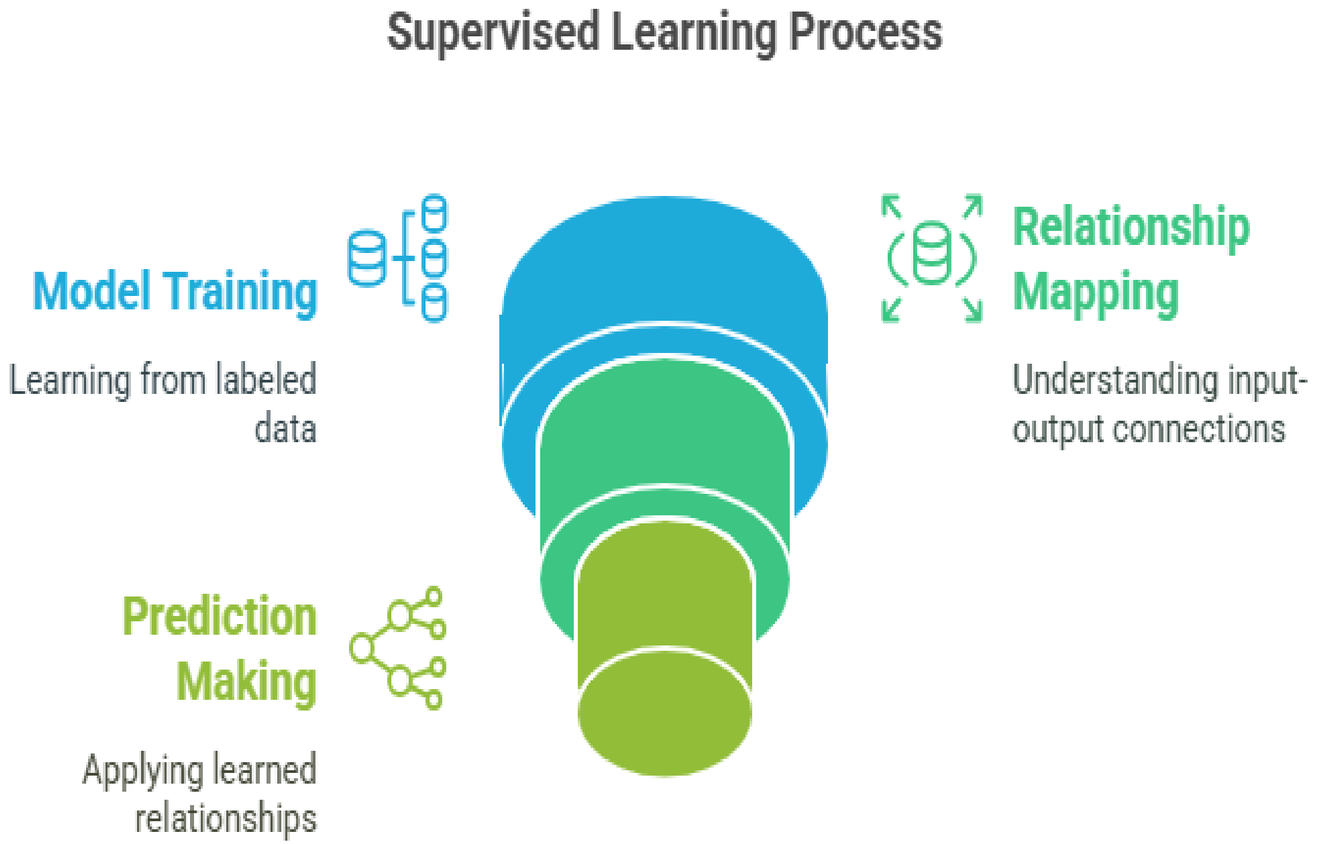
## Examples

Tesla Optimus and Boston Dynamics robots represent Physical AI; Auto-GPT and AI personal assistants represent Agentic AI.

## Key Focus

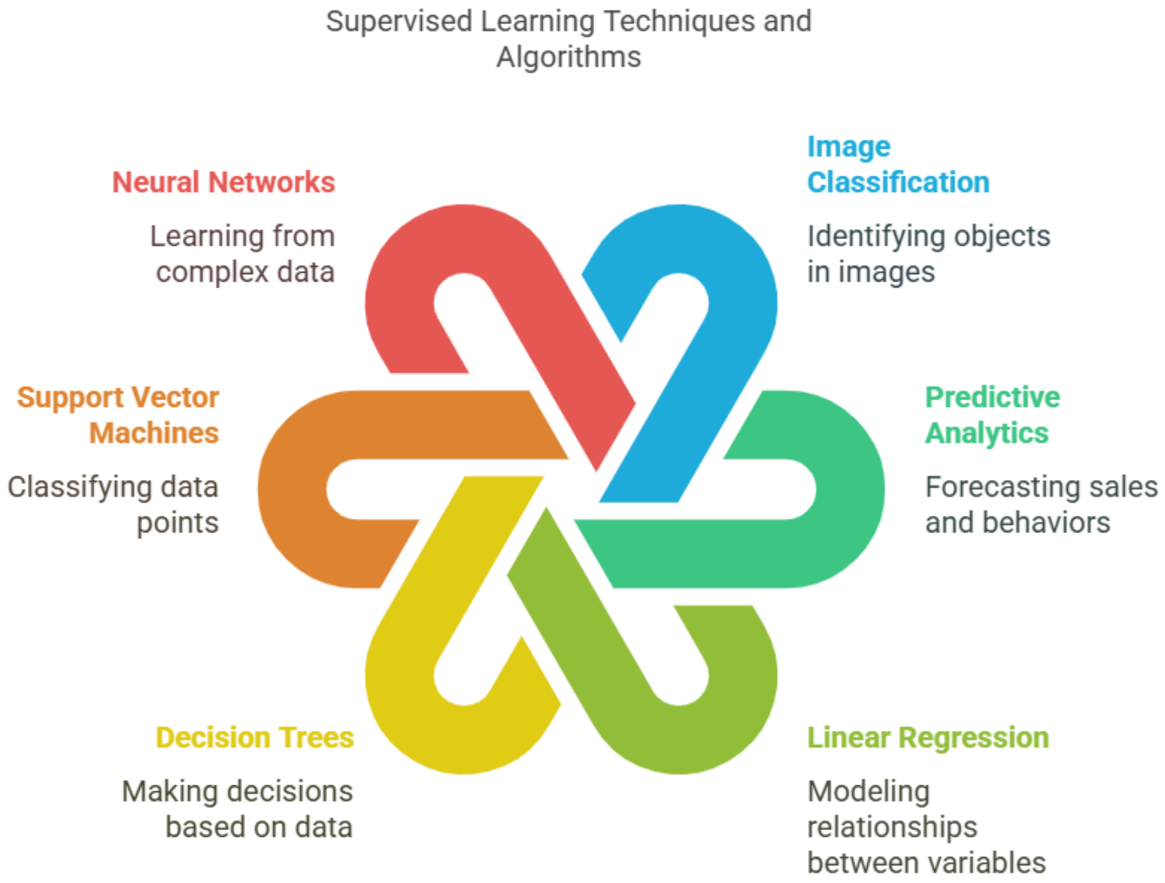
Physical AI emphasizes sensing and acting, whereas Agentic AI focuses on reasoning and decision-making.

# Machine Learning Algorithms

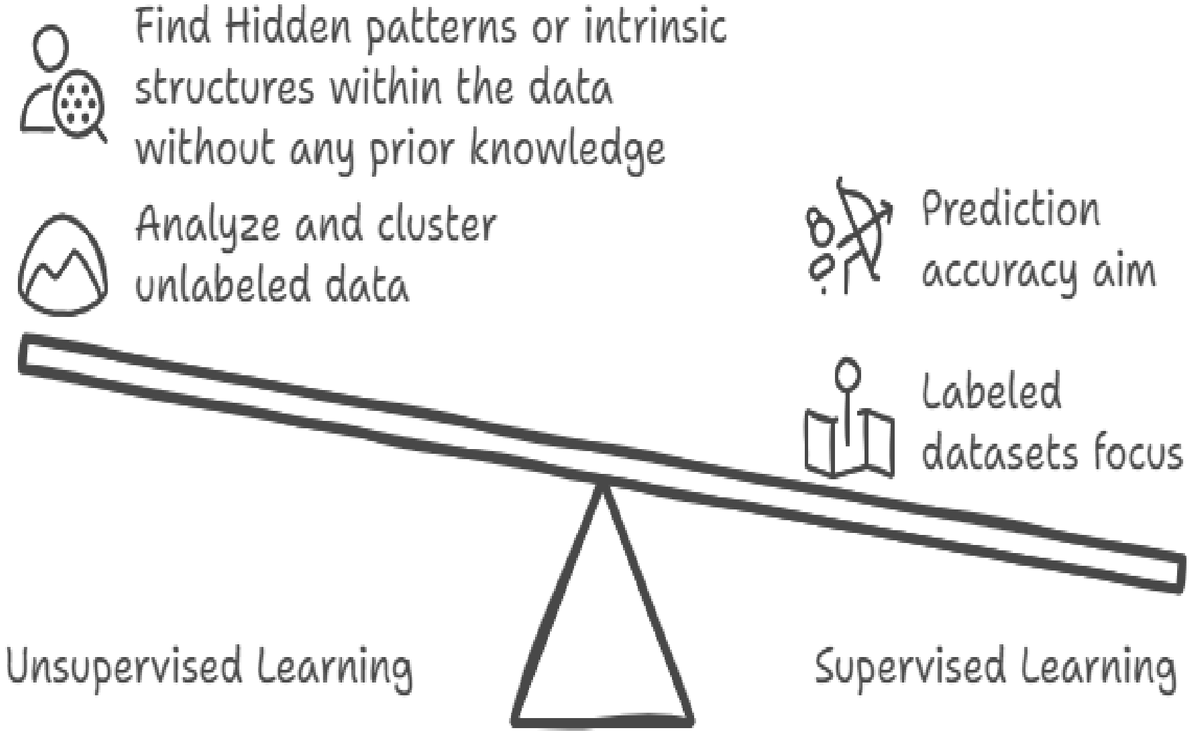


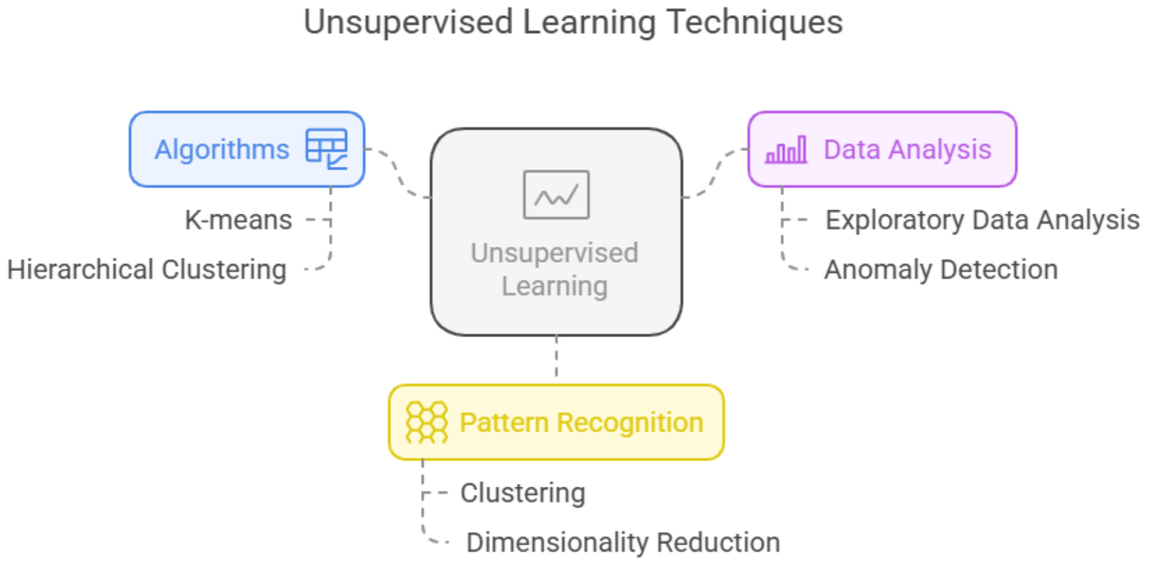

Applications

- Image recognition,
- Natural language processing
- Recommendation systems
- Fraud detection
- Predictive maintenance.

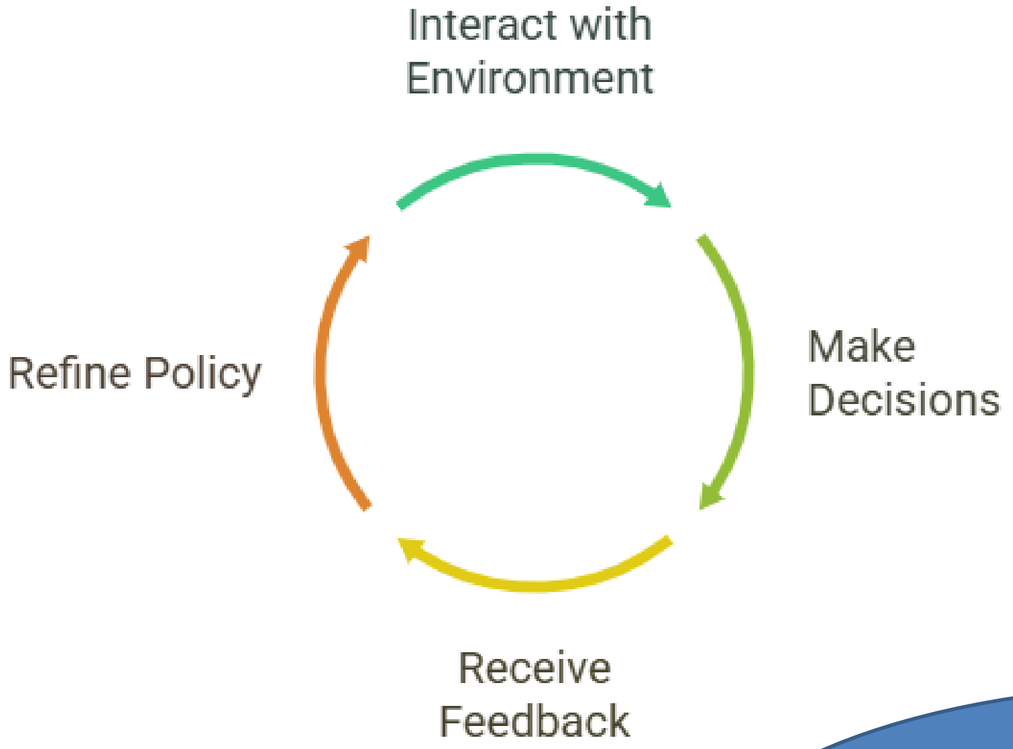


# Unsupervised Learning

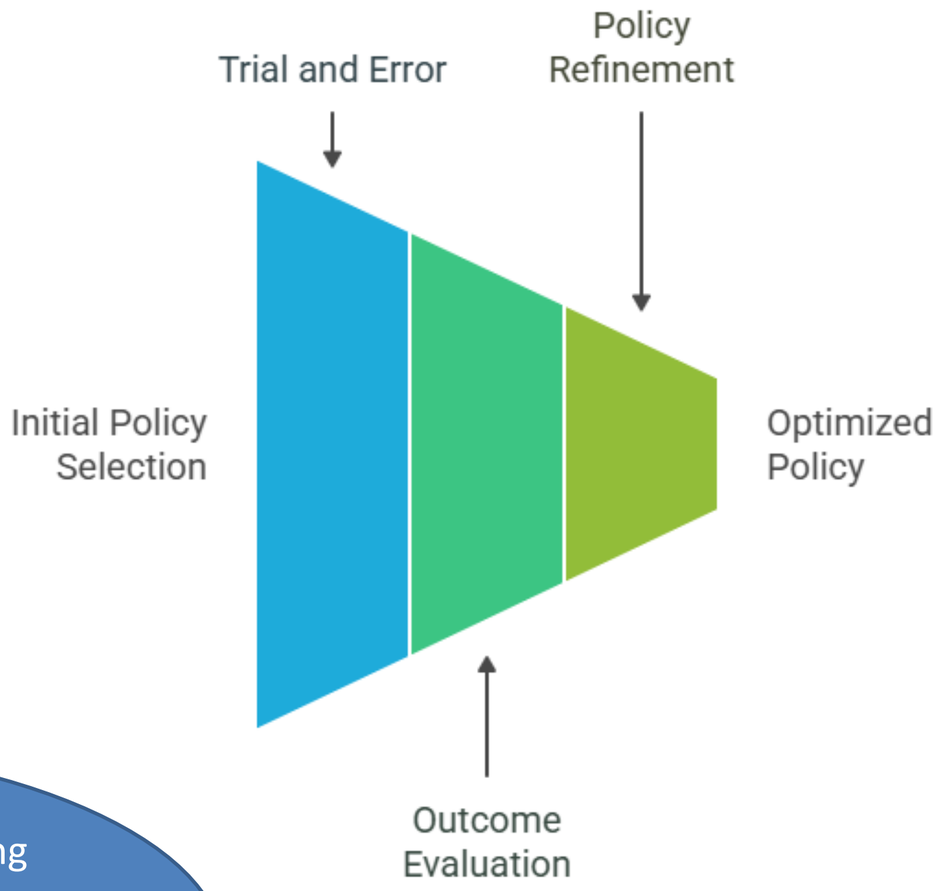


## Reinforcement Learning




## Refining Agent Policy through Feedback




Algorithms that learn by interacting with an environment and receiving feedback in the form of rewards or penalties, such as Q-learning, deep Q-networks (DQN), and policy gradients.

# Deep Learning Techniques

## Neural Networks

Explore the fundamental building blocks of deep learning, where interconnected nodes, inspired by the human brain, learn to recognize patterns in data.

## Convolutional Neural Networks (CNNs)

Power of CNNs, specialized architectures that excel at processing and analyzing visual data, with applications in image classification, object detection, and more.

## Recurrent Neural Networks (RNNs)

Uncover the capabilities of RNNs, which are designed to process sequential data, making them valuable for tasks like natural language processing, speech recognition, and time series analysis.

## Generative Adversarial Networks (GANs)

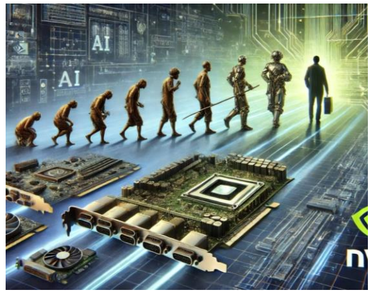
Explore the fascinating world of GANs, where two neural networks compete to generate realistic synthetic data, with applications in image and video generation, as well as data augmentation.

## Deep Learning Use Cases

Discuss real-world applications of deep learning, such as image recognition, natural language processing, speech recognition, autonomous vehicles, and medical diagnosis, highlighting the transformative impact of these techniques.

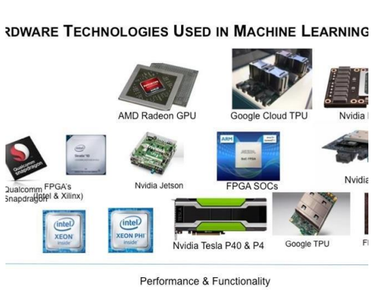
Anderson Cooper, 4K Original/(Deep)Fake Example - YouTube

# AI Hardware in Action



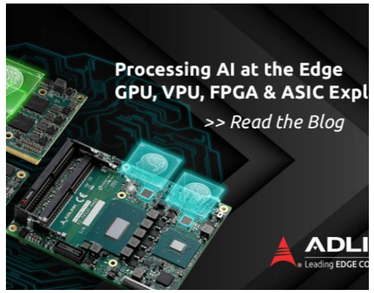

## Graphic Processing Unit (GPU)

GPUs, with their massively parallel architecture, excel at the matrix operations essential for powering deep learning algorithms in AI applications such as image and video recognition.



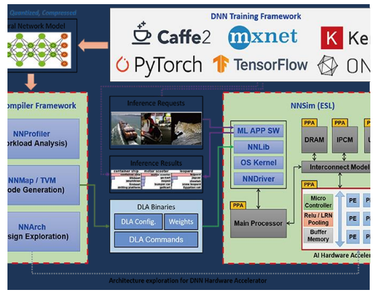

## Application-Specific Integrated Circuit (ASIC)

ASICs are custom-designed chips optimized for specific AI tasks, such as Google's Tensor Processing Unit (TPU) for efficient neural network inference.



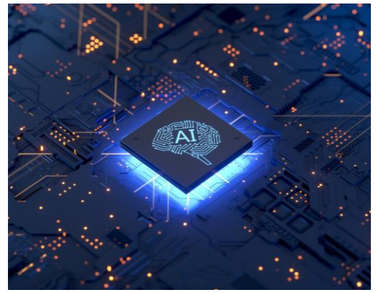

## Field-Programmable Gate Array (FPGA)

FPGAs offer flexible hardware acceleration for AI, allowing developers to reconfigure the chip's logic gates to efficiently execute diverse AI workloads.




## System-on-Chip (SoC)

SoCs integrate multiple AI-optimized components, such as CPUs, GPUs, and dedicated AI accelerators, onto a single chip to power AI applications in embedded devices.




## Neuromorphic Chip

Neuromorphic chips are designed to mimic the brain's neural architecture, enabling efficient and low-power AI processing for applications like edge computing and Internet of Things (IoT).

## Quantum Computer

Quantum computers leverage quantum mechanical phenomena to perform certain computations exponentially faster than classical computers, with potential applications in advanced AI and machine learning.

# The Future of AI Hardware

## Neuromorphic Chips

Neuromorphic chips are hardware inspired by the human brain, designed to mimic the brain's neural structure and function. These chips are energy-efficient and can excel at tasks like pattern recognition, classification, and decision-making.

## Quantum Computing for AI

Quantum computers have the potential to revolutionize AI by enabling faster and more efficient processing of complex algorithms. Researchers are exploring ways to integrate quantum computing into AI systems to tackle problems that are challenging for classical computers.

## Edge AI Devices

Edge AI devices are hardware designed to perform AI tasks at the edge of a network, closer to the data source. These devices can process data locally, reducing the need for cloud connectivity and enabling faster response times for real-time applications.

## Application-Specific Integrated Circuits (ASICs)

ASICs are custom-designed chips optimized for specific AI tasks, such as image recognition or natural language processing. These chips can provide significant performance improvements and energy efficiency compared to general-purpose processors.

## Reconfigurable Hardware

Reconfigurable hardware, such as Field-Programmable Gate Arrays (FPGAs), allow for the dynamic reconfiguration of their internal logic, enabling them to adapt to changing AI workloads and optimize performance on the fly.

# Humanoid Robots: Key Milestones

**2022**

AMECA by Engineered Arts: Realistic AI Interaction facial expressions, conversational AI Human-robot interaction, research

**2023**

DIGIT by Agility Robotics: Warehouse Logistics

**2024**

ATLAS (Electric) by Boston Dynamics: Dynamic Movement, high dexterity, Industrial Automation

**2023**

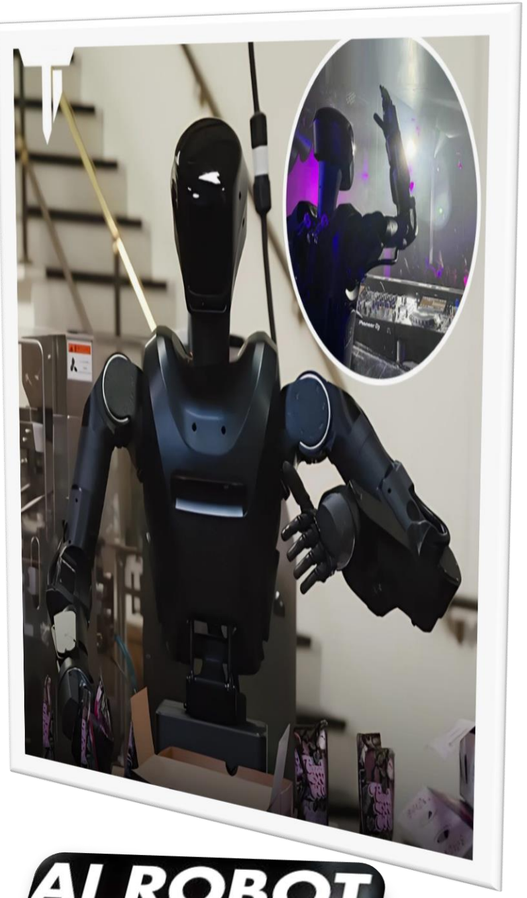
TESLA OPTIMUS by Tesla Inc.: AI-Powered Factory automation, general assistance

**2024**

NEO Beta by 1X Technologies: Home Assistance

**2025**

PHANTOM MK1 by Foundation Robotics Labs: Precision Engineering, Manufacturing, Military, entertainment



# AI Applications

**Healthcare:**

AI assists in disease diagnosis, personalized treatment plans, and drug discovery.

**Finance:**

AI algorithms power fraud detection, algorithmic trading, & risk assessment in financial markets.

**Automotive**

Self-driving cars utilize AI for navigation, object recognition, and decision-making on the road.

**Customer Service**

Chatbots provide automated customer support and assistance in various industries.

**Gaming**

AI opponents in video games employ adaptive strategies and behaviors to challenge players.

## Challenges in AI Development

### Data Quality

AI systems heavily rely on quality data for training and decision-making.

### Security

Risks of AI systems being exploited or manipulated for malicious purposes.

### Interpretability

Understanding how AI systems arrive at their decisions is crucial for trust and accountability.

## Future Trends

### Autonomous Systems

Continued development of self-learning and self-optimizing AI systems.

### Human-AI Collaboration

Enhancing human capabilities through AI augmentation rather than replacement.

# ETHICAL AI

- **Fairness:** should be designed to avoid bias and discrimination and ensure equal treatment for all individuals, regardless of their race, gender, age, or other personal characteristics.
- Transparency: should be transparent and explainable, with clear documentation of how they make decisions and recommendations.
- Privacy: respect the privacy of individuals and protect their personal data from unauthorized access or misuse.
- Accountability: Those who develop and deploy AI systems should be accountable
- Safety: to ensure the safety and well-being of users and others who may be affected by their use.

# Building Tomorrow, Today

- **Future-Proofing Your Skills**
  - Individuals should continuously update their skills and acquire new competencies to stay relevant in an automated job market
  - Employers should invest in training programs to help their workforce adapt to changing technological demands.
- **Promoting Lifelong Learning**
  - Encourage a culture of continuous learning and adaptation. Individuals should seek out educational opportunities, while policymakers can support accessible and affordable upskilling initiatives.
- **Fostering Creativity and Critical Thinking**
  - Develop skills that are less susceptible to automation, such as creativity, problem-solving, and critical thinking. These capabilities allow individuals to be in market that require uniquely human abilities.
- **Embracing Flexibility and Adaptability**
  - Cultivate a mindset of flexibility and adaptability, as the job market will continue to evolve. Individuals should be open to career transitions, and employers should offer opportunities for internal mobility.

# Thank you