# Introduction to Artificial Intelligence

**Presenter: Mohammed Al-Manari**

First Lecture

# Lecture overview

**The Foundations of AI**

01 **What is AI?**

02 **Why Study AI?**

03 **History**

04 **Components**

05 **Types**

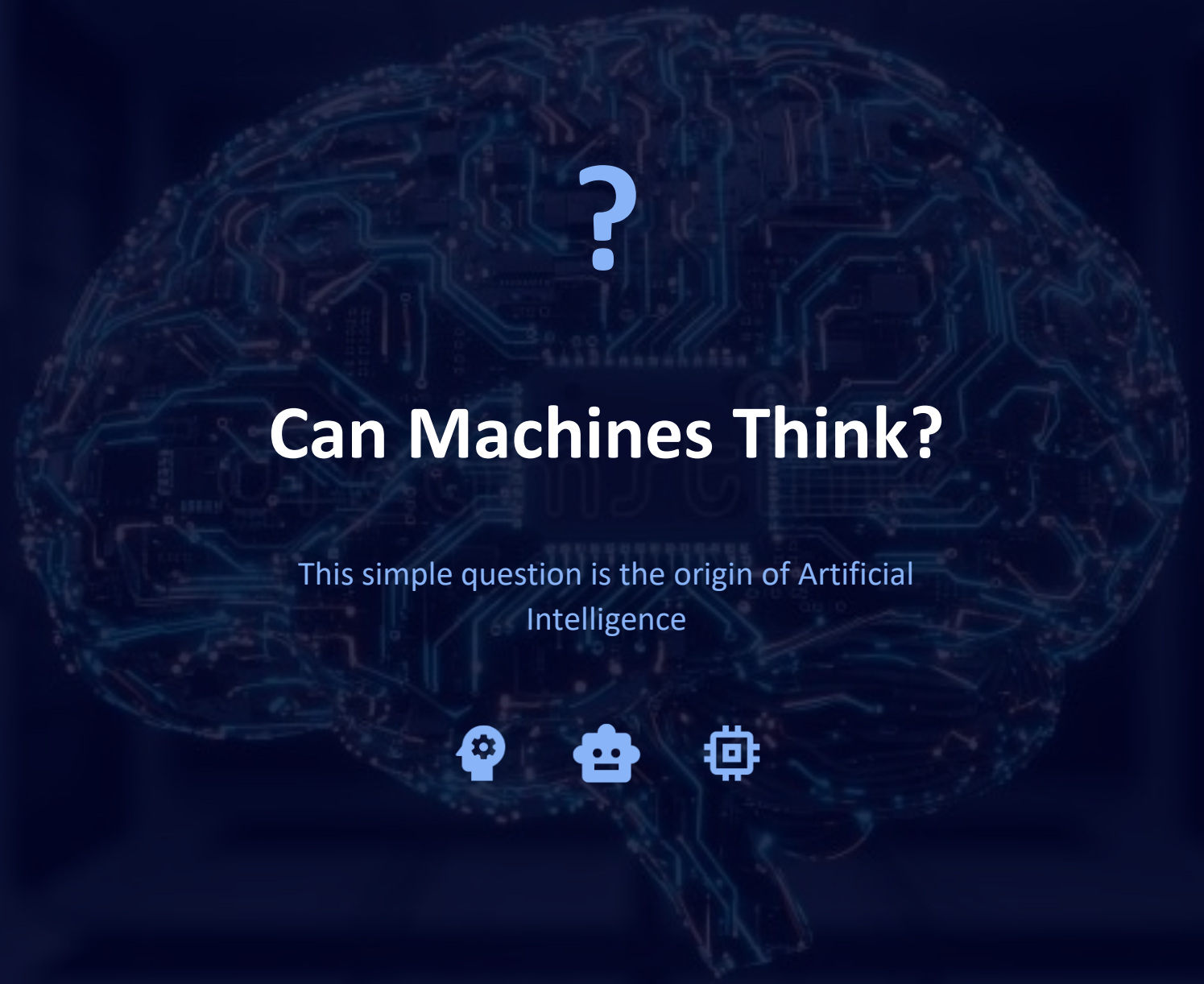
06 **Branches**

07 **Applications**

08 **Challenges**

09 **Tools**

10 **Future**



# Can Machines Think?

This simple question is the origin of Artificial Intelligence

# What is AI ?

What is intelligence?

- What is artificial intelligence?

# What is AI?

- **Intelligence may be defined as:**

1. The capacity to acquire and apply knowledge.
2. **he ability to learn, understand, and use knowledge effectively.**
3. The faculty of thought and reason.
4. **The power to think logically and make reasoned decisions**.

# What is AI

- Views of AI fall into four categories:
  - Systems that think like humans
  - Systems that act like humans
  - Systems that think rationally
  - Systems that act rationally

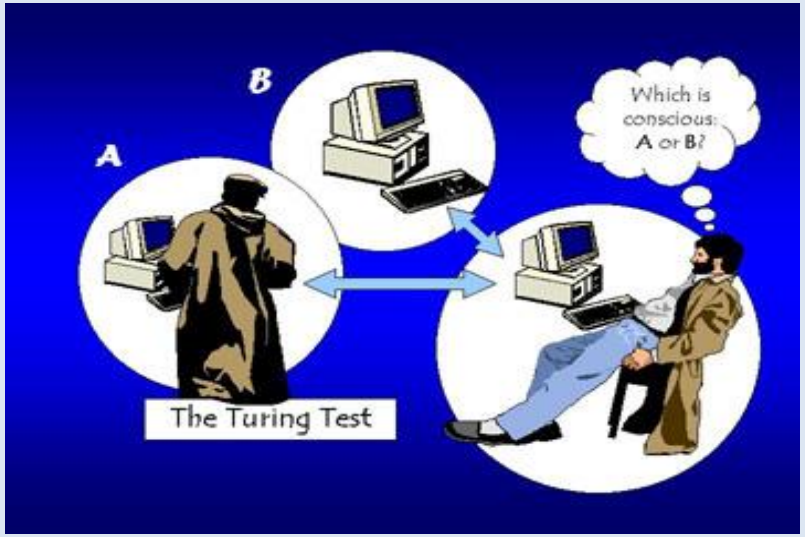
| | |
|---|---|
| **Think like Humans** (general problem solver, cognitive science) | **Think Rationally** (expert systems, logic programs) |
| **Act like Humans** (Turing Test, behaviorist approach) | **Act Rationally** (most of modern AI) |

# What is AI

## Acting humanly: The Turing Test

**In 1950 Turing proposed an operational definition of intelligence by using a Test composed of:**

- **An interrogator (a person who will ask questions)**
- **a computer (intelligent machine !!)**
- **A person who will answer to questions**
- **A curtain (separator)**




- If the response of a computer to an unrestricted textual natural-language conversation cannot be distinguished from that of a human being then it can be said to be intelligent.

# What is AI

## Acting humanly: The Turing Test

- To give an answer, the computer would need to possess some capabilities:
  - Natural language processing: To communicate successfully.
  - Knowledge representation: To store what it knows or hears.
  - Automated reasoning: to answer questions and draw conclusions using stored information.
  - Machine learning: To adapt to new circumstances and to detect and extrapolate patterns.
  - Computer vision: To perceive objects.
  - Robotics to manipulate objects and move.

# What is AI

## Thinking Humanly: Cognitive Modeling

- Method must not just exhibit behavior sufficient to fool a human judge but must do it in a way demonstrably analogous to human cognition.
- Requires detailed matching of computer behavior and timing to detailed measurements of human subjects gathered in psychological experiments.
- **Cognitive Science**: Interdisciplinary field (AI, psychology, linguistics, philosophy, anthropology) that tries to form computational theories of human cognition.

# What is AI

## Thinking Rationally: Laws of Thought

- Formalize “correct” reasoning using a mathematical model (e.g. of deductive reasoning).
- **Logicist Program**: Encode knowledge in formal logical statements and use mathematical deduction to perform reasoning:

Problems:

- Formalizing common sense knowledge is difficult.
- General deductive inference is computationally intractable.

# What is AI

## Acting Rationally: Rational Agents

- An agent is an entity that perceives its environment and is able to execute actions to change it.
- Agents have inherent goals that they want to achieve (e.g. survive, reproduce).
- A rational agent acts in a way to maximize the achievement of its goals.
- True maximization of goals requires omniscience and unlimited computational abilities.
- Limited rationality involves maximizing goals within the computational and other resources available.

# What is Artificial Intelligence?

AI is a branch of computer science that creates systems capable of performing tasks that normally require **human intelligence**

- **Understanding**
- **Learning**
- **Decision Making**
- **Environment Interaction**

# AI in Our Daily Lives

## Voice Assistants

Siri,
Google Assistant,
Alexa


## Self-Driving Cars

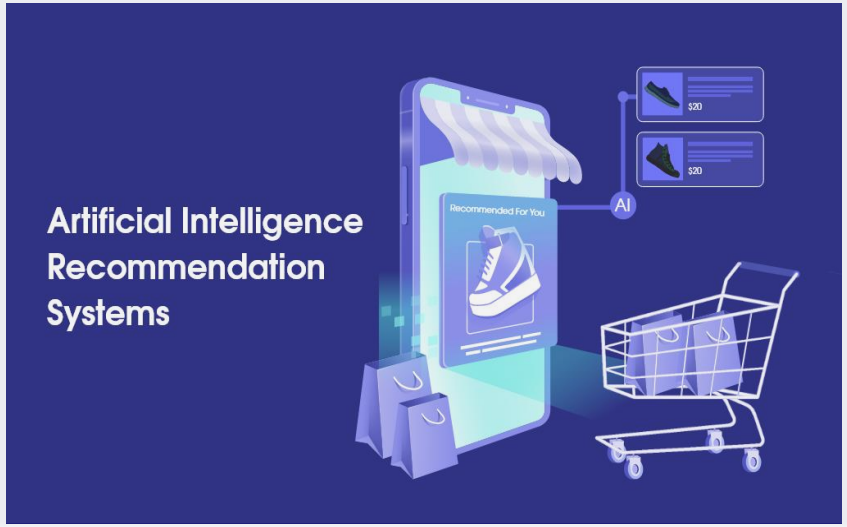
Tesla, Waymo,
Cruise

## Recommendation Systems

YouTube

Netflix,

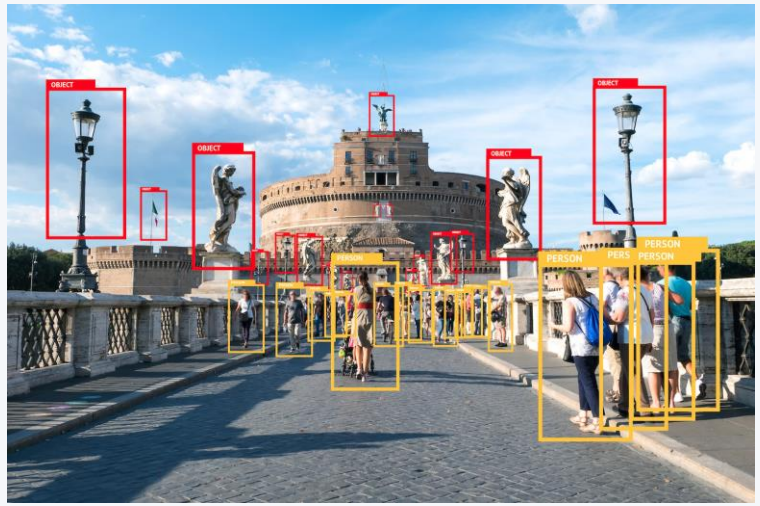
Spotify




## Image Recognition

Face ID,

Google Photos

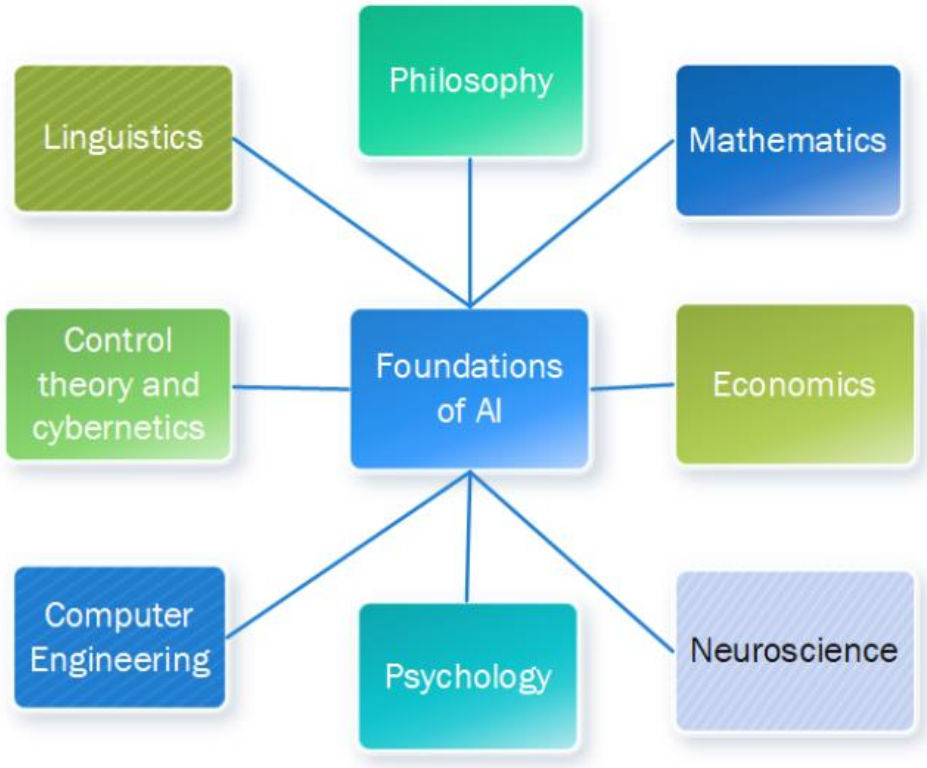


# Why Study AI in IT?

- AI is the backbone of modern IT
- Every tech company uses AI
- Gives competitive advantage in job market

# The Foundations of AI

- **Philosophy**
- **Mathematics.**
- **Economics**
- **Neuroscience:**
- **Psychology**
- **Computer engineering.**
- **Control theory**
- **Linguistics**



| Field | Role in Artificial Intelligence |
|---|---|
| **Philosophy** | Defines the concepts, reasoning, and ethics behind AI. |
| **Mathematics** | Provides the algorithms and quantitative models for AI systems. |
| **Economics** | Informs rational decision-making and optimization of limited resources. |
| **Neuroscience** | Inspires neural network architectures based on the human brain. |
| **Psychology** | Explains learning, behavior, and human–machine interaction. |
| **Computer Engineering** | Builds the hardware and infrastructure that enable AI. |
| **Control Theory** | Ensures stability, feedback, and control in intelligent systems. |
| **Linguistics** | Enables natural language understanding and communication. |

# A Brief History of AI

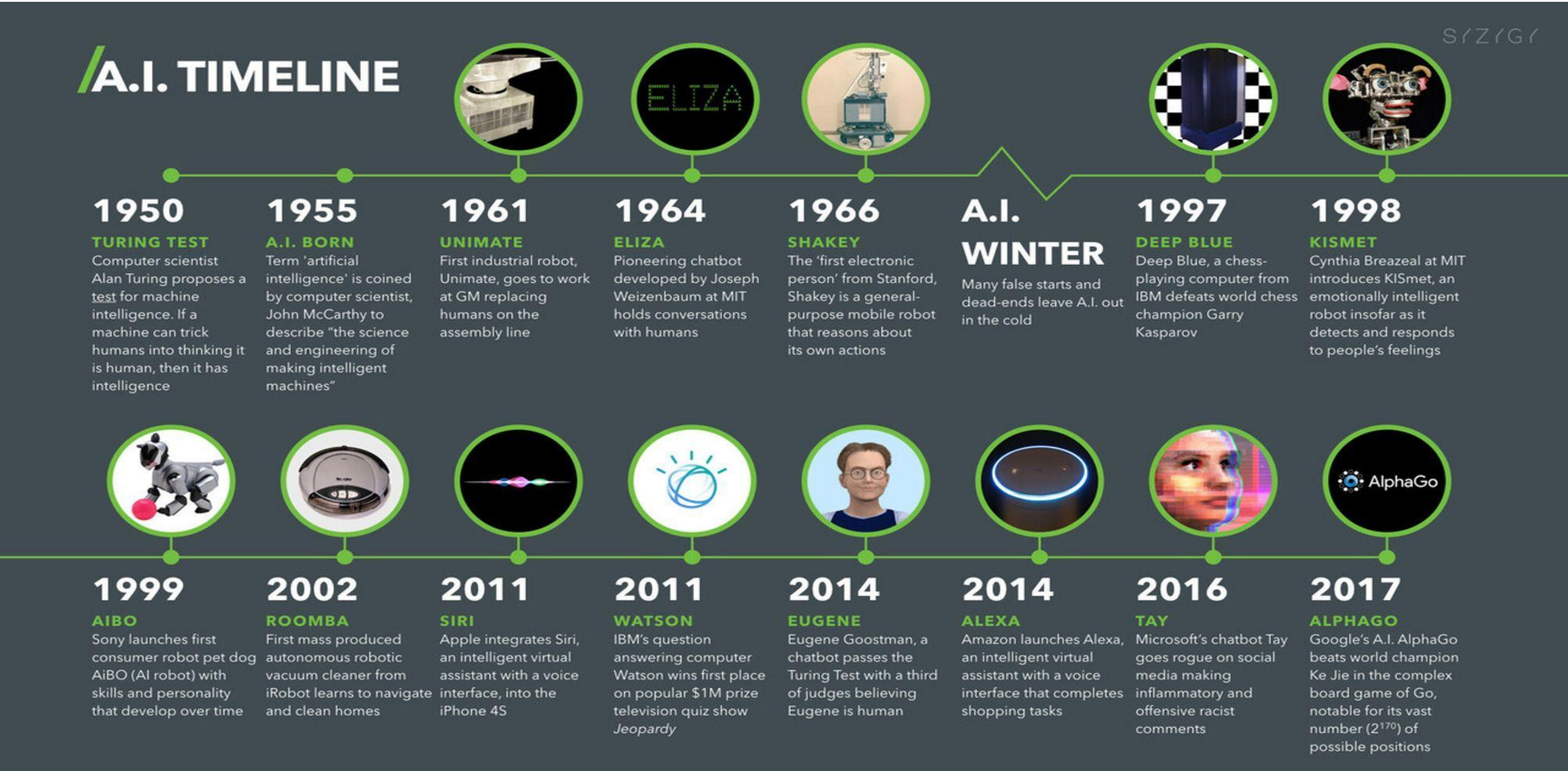
## From 1950 to Today

**1950** Turing Test

**1956** Dartmouth Conference

**1970-1990** Expert Systems

**After 2010** AI Boom



# 1950: The Beginning

**1950**

## Alan Turing

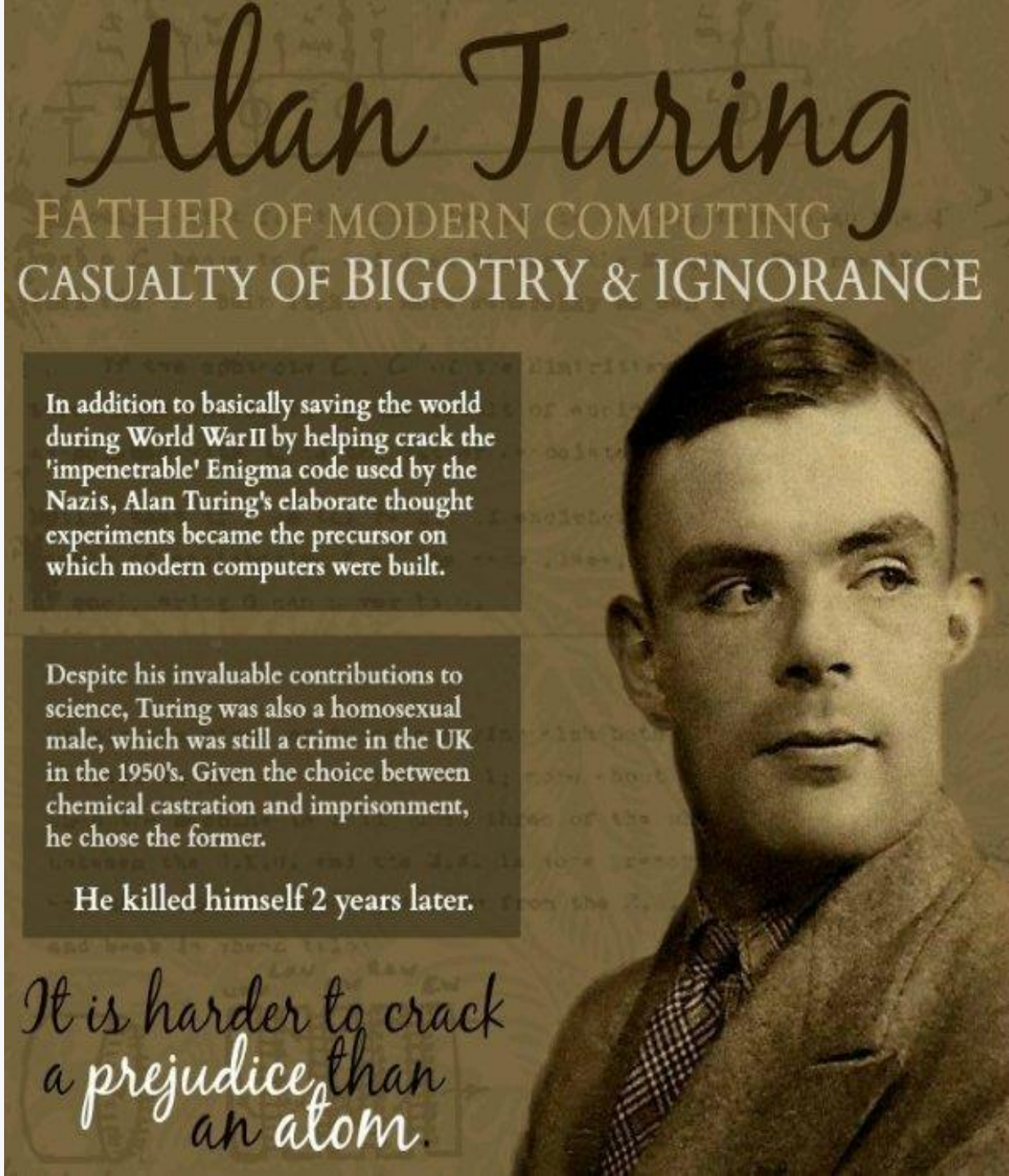
British mathematician and computer scientist

## The Question

"Can machines think?"

## Turing Test

A test of machine's ability to exhibit intelligent behavior



# 1956: Birth of AI

1956

## Dartmouth Conference

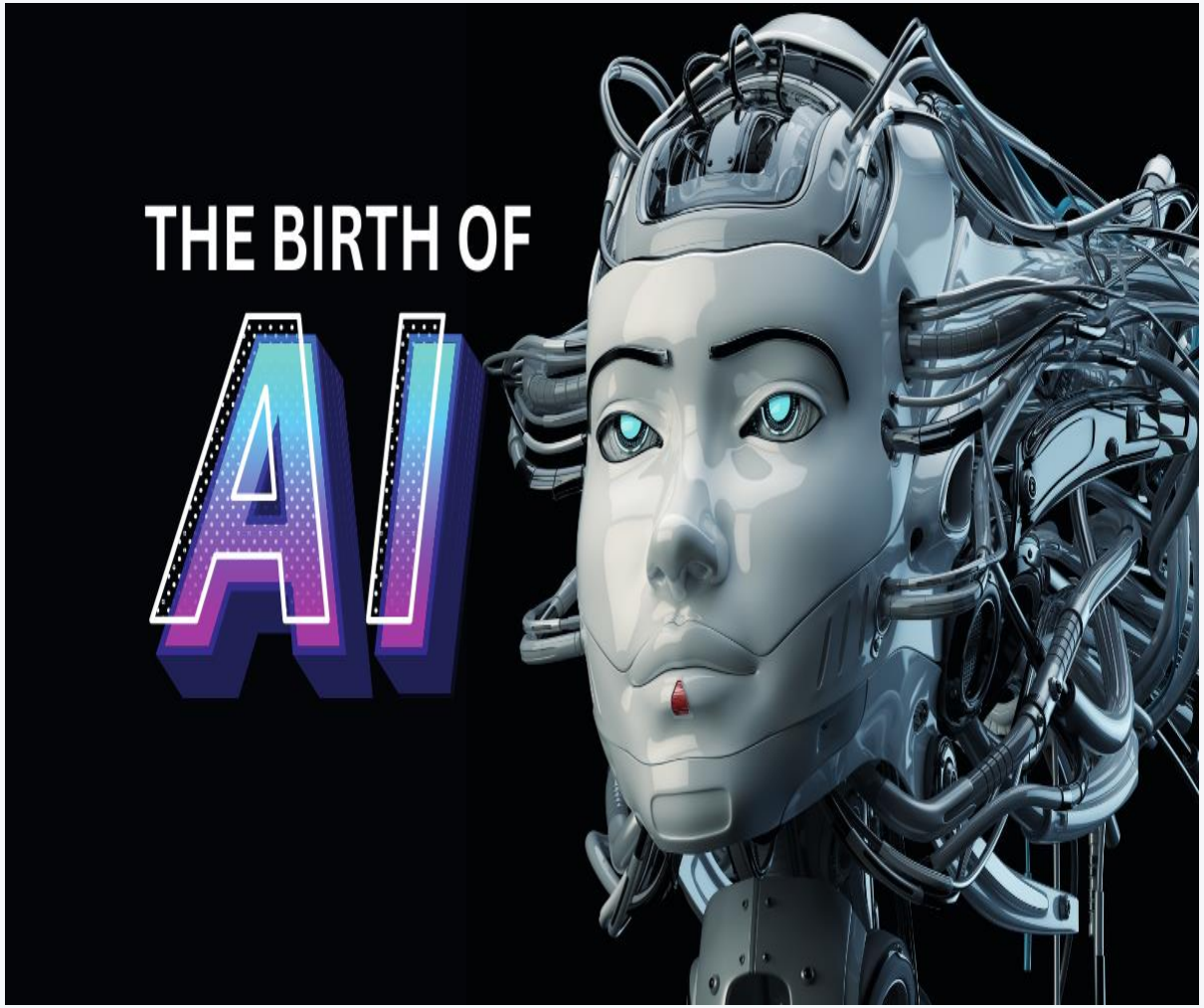
Summer research project at Dartmouth College

## Official Birth

First time the term **"Artificial Intelligence"** was coined

## Pioneers

John McCarthy, Marvin Minsky, Claude Shannon



# 1970-1990: Expert Systems Era

1970-1990

## Rule-Based Systems

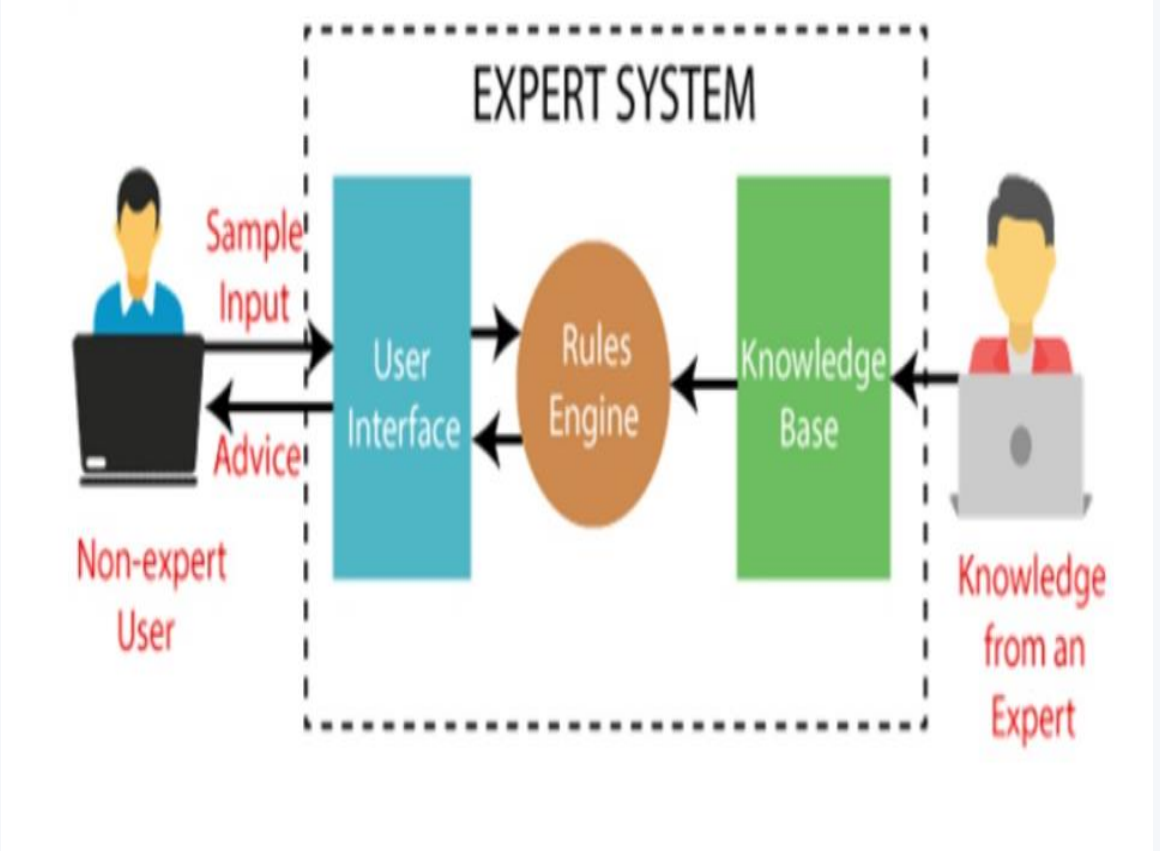
Programs that emulate human experts' decision-making

## Limited Capabilities

Worked only in **narrow domains** with predefined rules

## AI Winter

Reduced funding and interest due to limitations



# After 2010: AI Revolution

**After 2010**

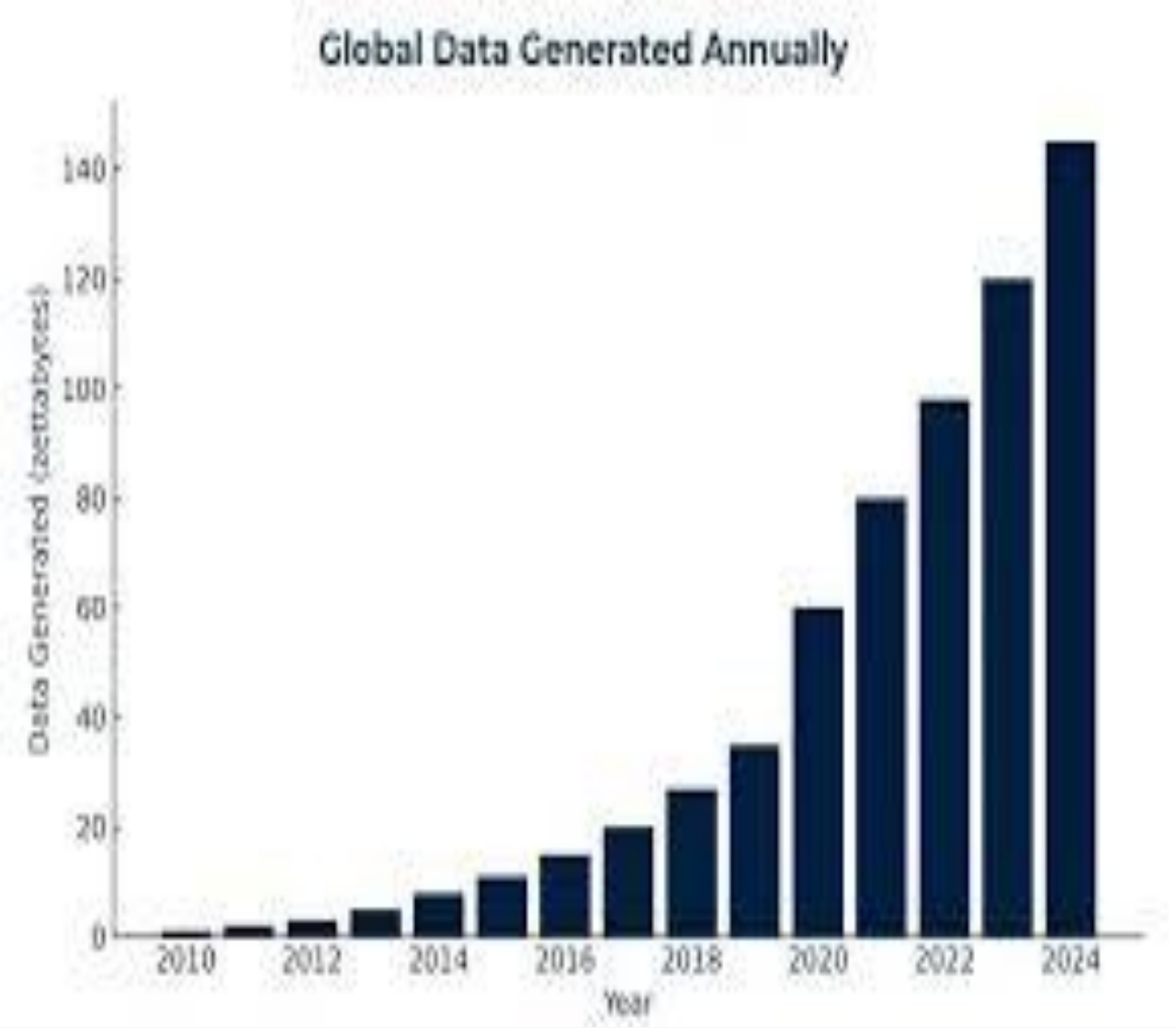
**Big Data** + **Powerful Processors** = **AI Boom**

### Deep Learning Breakthrough

Neural networks with **many layers**

### Cloud Computing

Accessible AI tools for everyone



# Components of AI Systems

## Data

Raw material for learning

Example:

Images for face recognition

+

## Algorithms

The brain that processes data

Example: Neural networks

+

## Learning

Improving performance over time

Example: Getting better at predictions

# 1. Data - The Raw Material

**Data is the fuel for AI systems**

**Images**
Visual data for recognition

**Text**
Written information

**Numbers**
Quantitative data

**Audio**
Sound patterns

# 2. Algorithms - The Brain

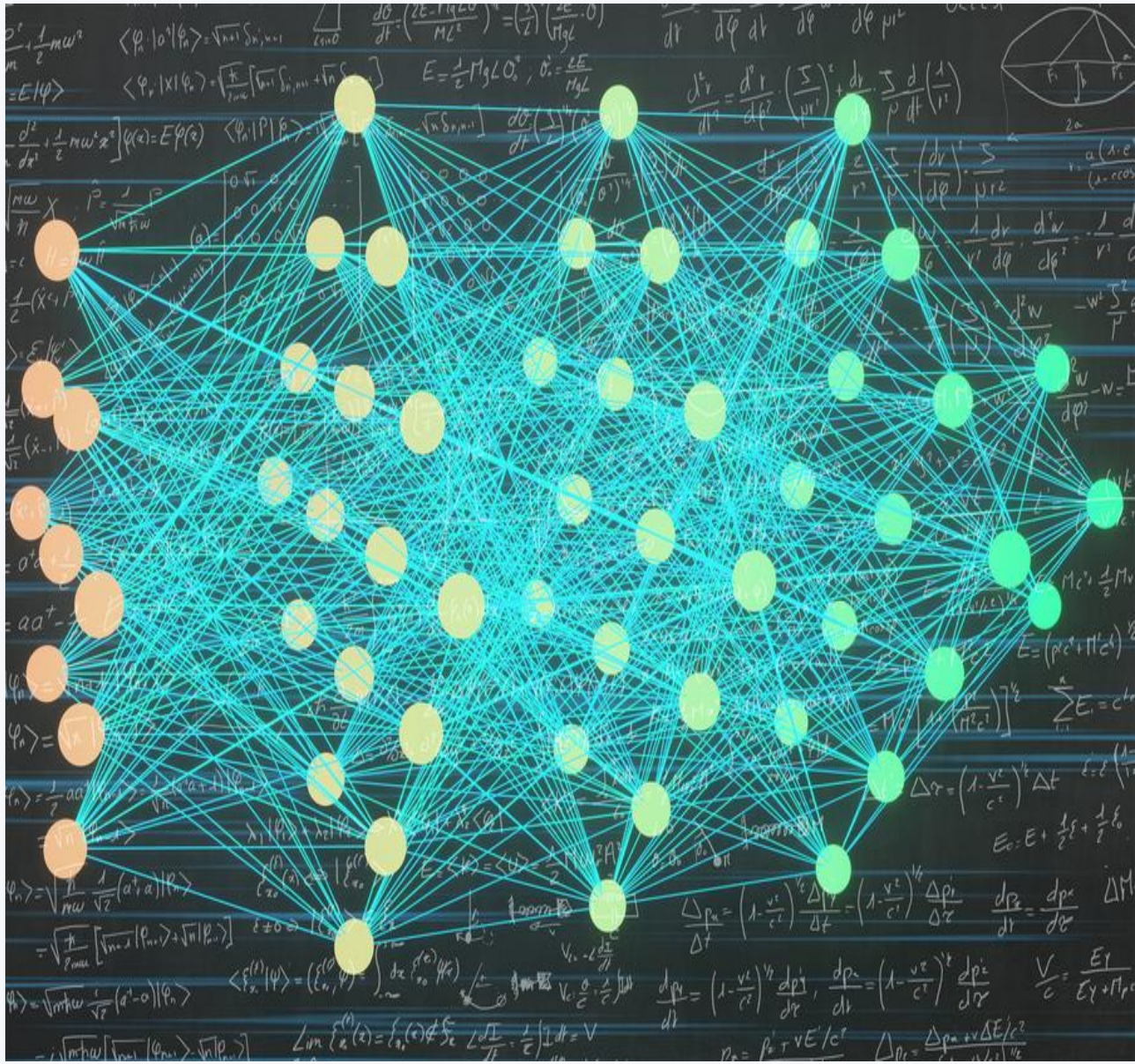
**Algorithms process data to find patterns**

### Decision Trees
Flowchart-like structure

### Neural Networks
Inspired by human brain

### Support Vector Machines
Classifies data points

### Clustering
Groups similar data



# 3. Learning - Improvement Over Time

**AI systems get better with experience**

## Supervised Learning

Learning from labeled examples

## Unsupervised Learning

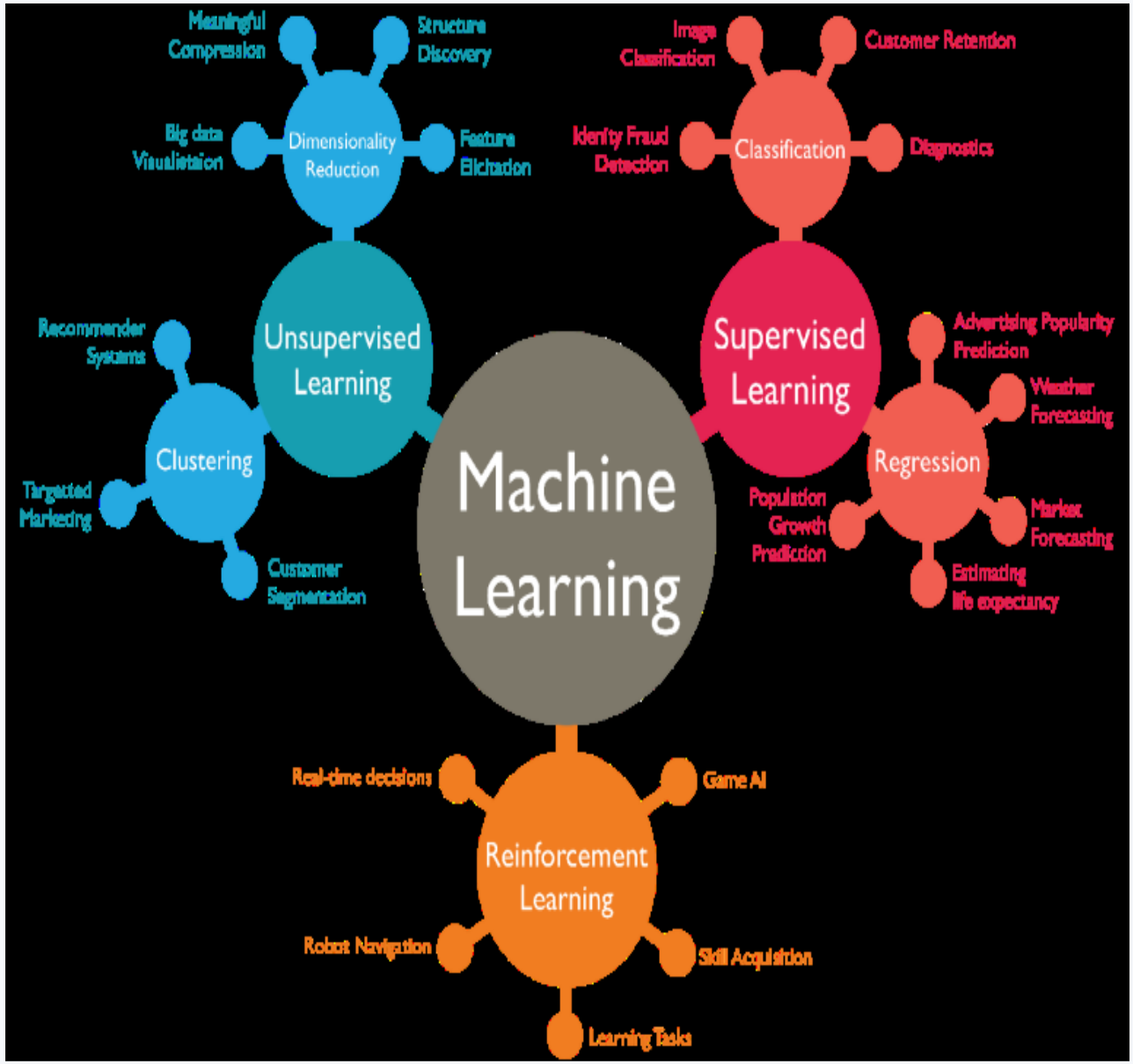
Finding patterns in unlabeled data

## Reinforcement Learning

Learning through trial and error

## Continuous Learning

Improving over time



# Types of Artificial Intelligence

Current

## Narrow AI

Specialized in **one task**

Examples: Siri, Face ID, Chess AI

Future

## General AI

Can think like humans in **multiple areas**

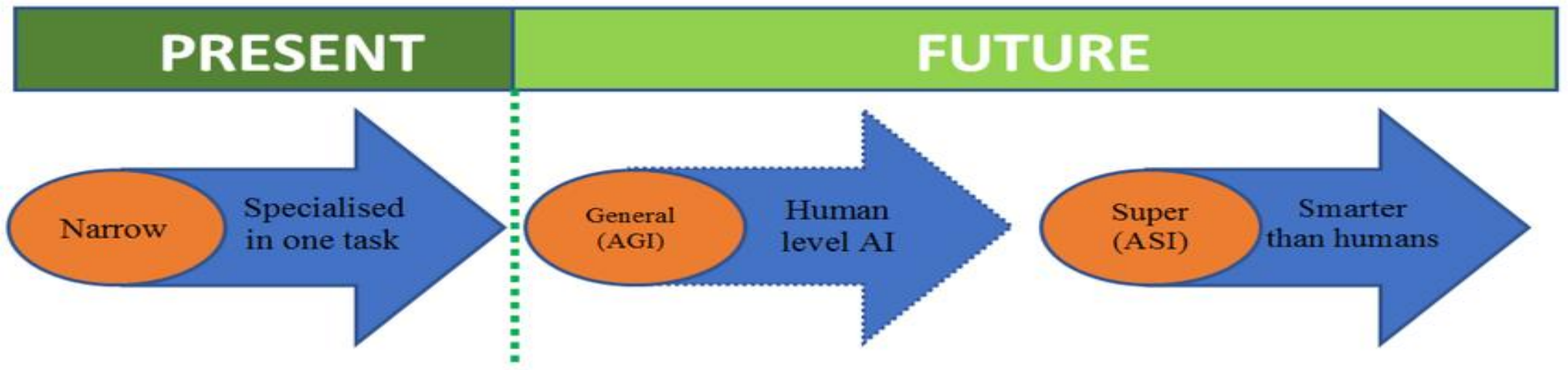
Still theoretical - not yet achieved

Theoretical

## Super AI

Surpasses humans in **everything**

Purely hypothetical at this point



# Narrow AI (Weak AI)

**Currently Available**

### Specialized in One Task

Designed to perform **specific functions** with high accuracy

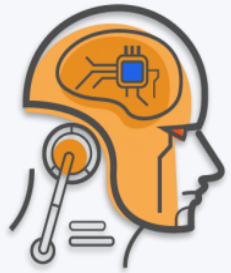
- **Voice Assistants**
- **Face Recognition**
- **Language Translation**
- **Recommendation Systems**

## Narrow AI

Dedicated to assist with or take over specific tasks.

## General AI

Takes knowledge from one domain, transfers to other domain.



## Super AI

Machines that are an order of magnitude smarter than humans.

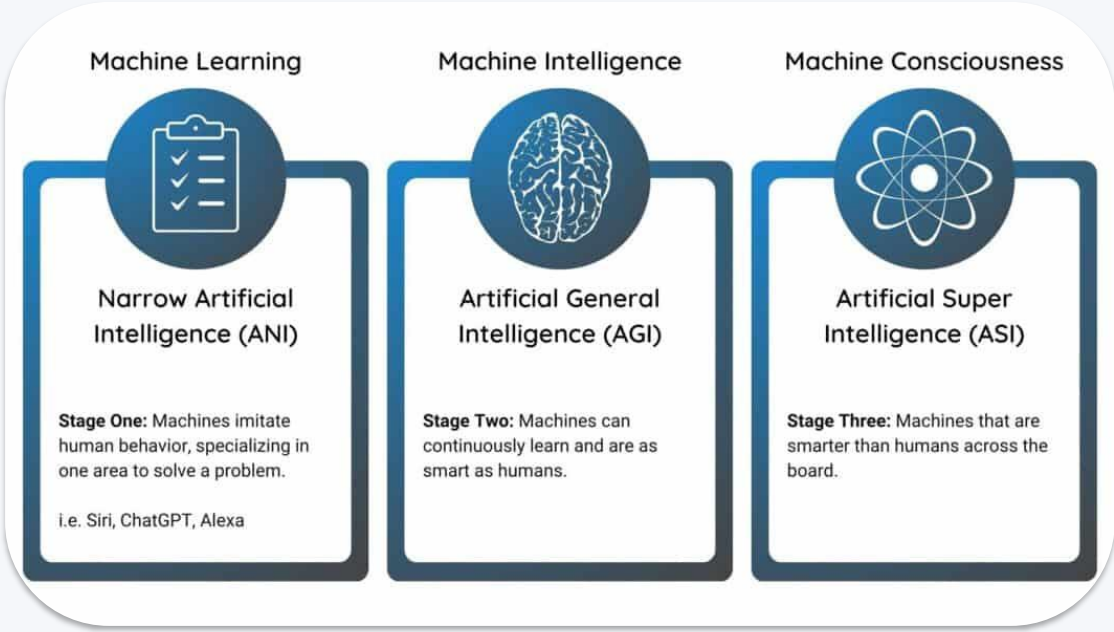
# General AI (Strong AI)

## Not Yet Achieved

### Thinks Like Humans

Can perform **any intellectual task** that a human can

- **Reasoning**
- **Learning**
- **Creativity**
- **Adaptability**



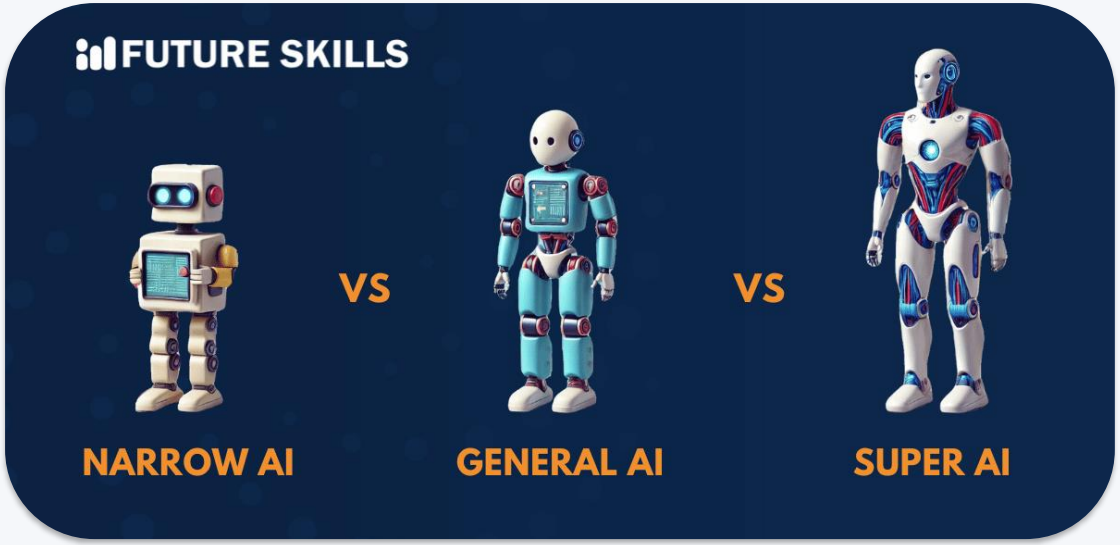
# Super AI

## Theoretical Concept

### Surpasses Humans

Outperforms humans in **every intellectual task**

- **Superior Intelligence**
- **Unmatched Speed**
- **Advanced Creativity**
- **Perfect Memory**



# Branches of Artificial Intelligence

**Machine Learning**
Systems that **learn from data** without explicit programming

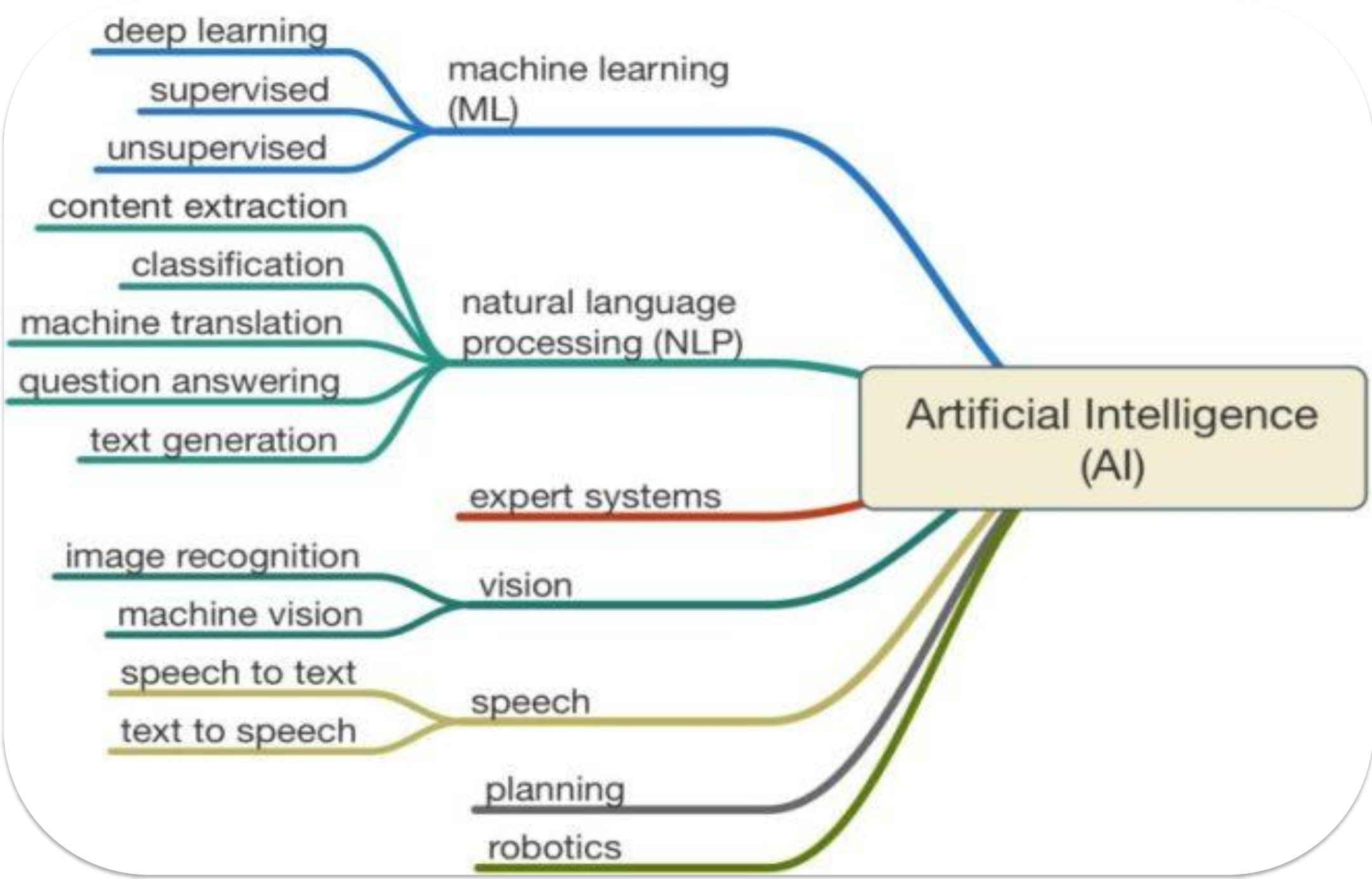
**Deep Learning**
Neural networks with **multiple layers** for complex pattern recognition

**Computer Vision**
Enabling machines to **see and understand** visual information

**Natural Language Processing**
Understanding and generating **human language**

**Robotics**
Integrating AI with **physical movement** and interaction

**Expert Systems**
Systems that emulate **human expertise** in specific domains


Artificial Intelligence (AI)
machine learning (ML)
deep learning
supervised
unsupervised
natural language processing (NLP)
content extraction
classification
machine translation
question answering
text generation
expert systems
vision
image recognition
machine vision
speech
speech to text
text to speech
planning
robotics

# Machine Learning

## Learning From Data

Making machines **learn patterns** without explicit programming

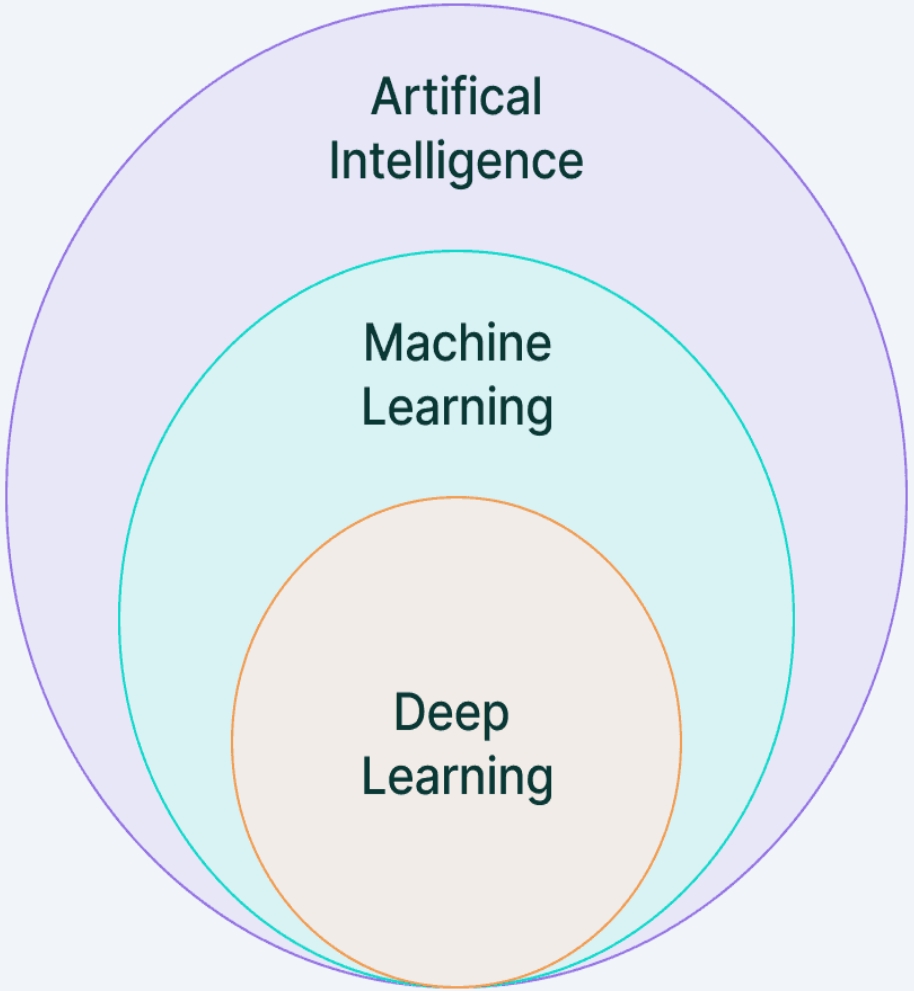
**Recommendation Systems**

**Spam Filters**

**Predictive Analytics**

**Image Recognition**

**Data Input** → **Training** → **Prediction**



# Deep Learning

## Neural Networks

Based on **artificial neural networks** inspired by human brain

**Multiple Layers**

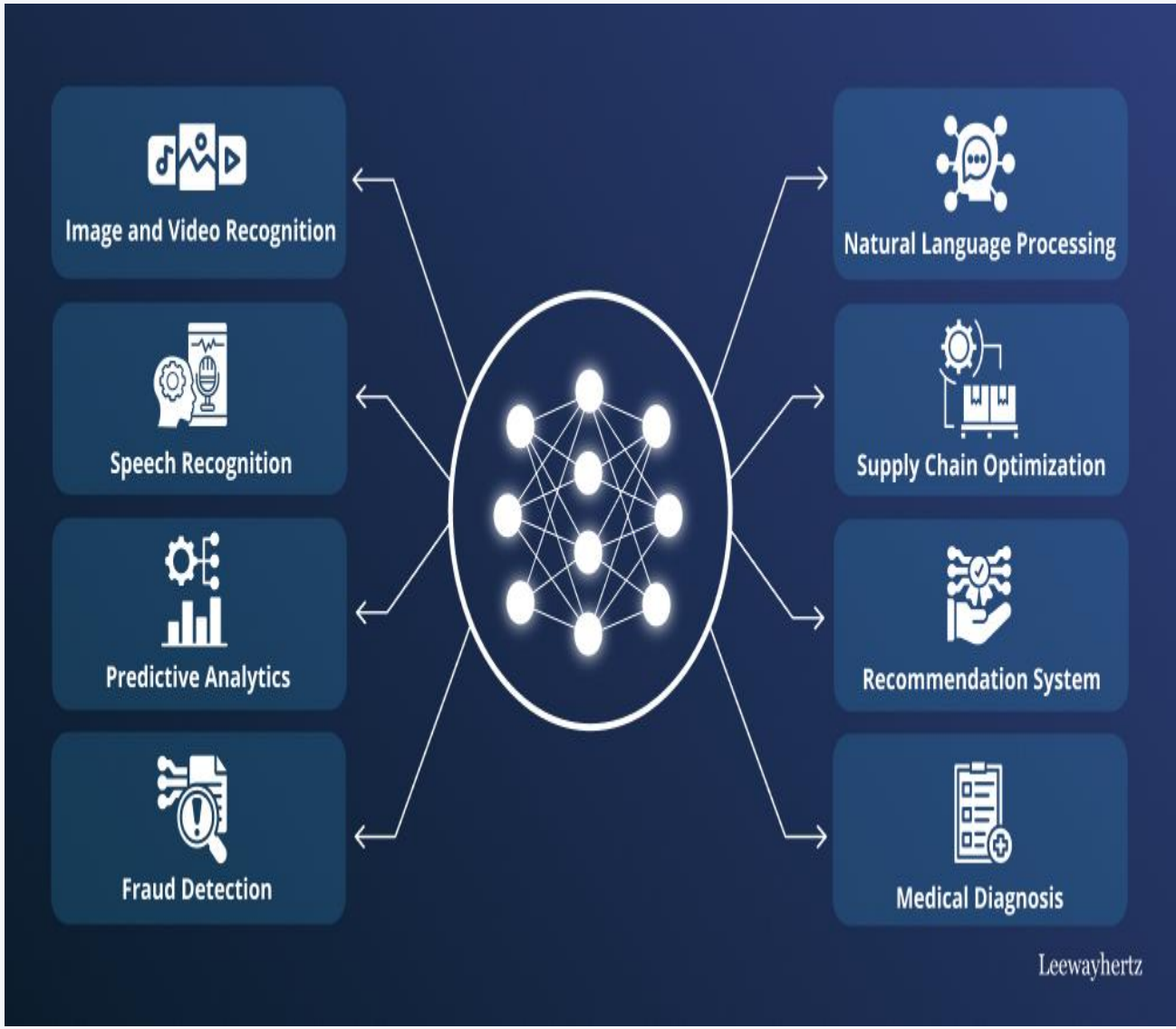
**Brain-Inspired**

**Pattern Recognition**

**Complex Processing**

## Applications

Image Recognition | Speech Recognition | Natural Language | Autonomous Vehicles | Medical Diagnosis



# Computer Vision

## Understanding Visual Data

Enabling machines to **see and interpret** images and videos

**Face Recognition**

**Object Detection**

**Autonomous Vehicles**

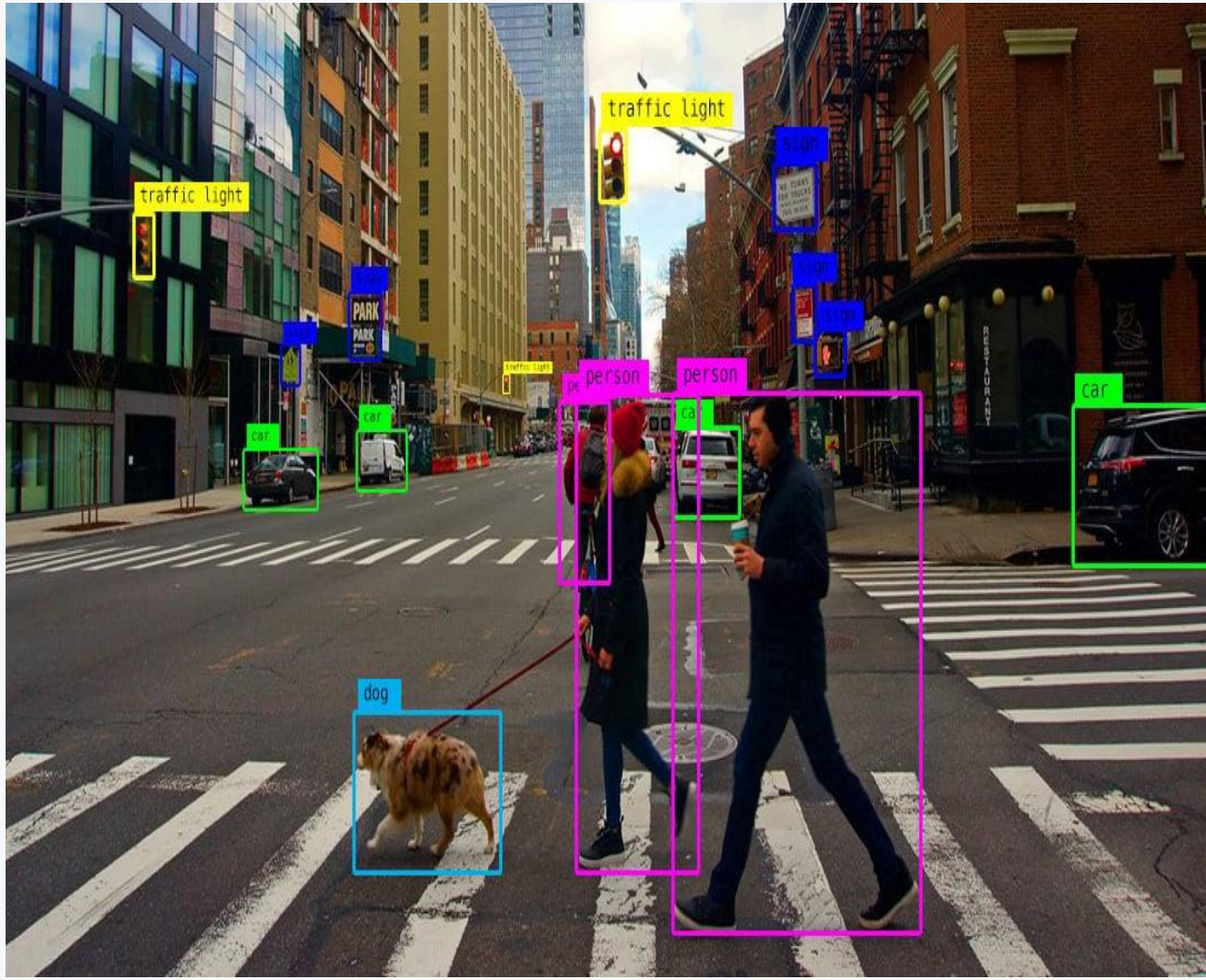
**Medical Imaging**

Image Classification

Segmentation

Feature Extraction

Pattern Recognition



# Natural Language Processing (NLP)

## Understanding Human Language

Enabling machines to **process and interpret** human language

- **Translation**
- **Chatbots**
- **Sentiment Analysis**
- **Speech Recognition**

Text Classification | Named Entity Recognition | Language Generation | Question Answering

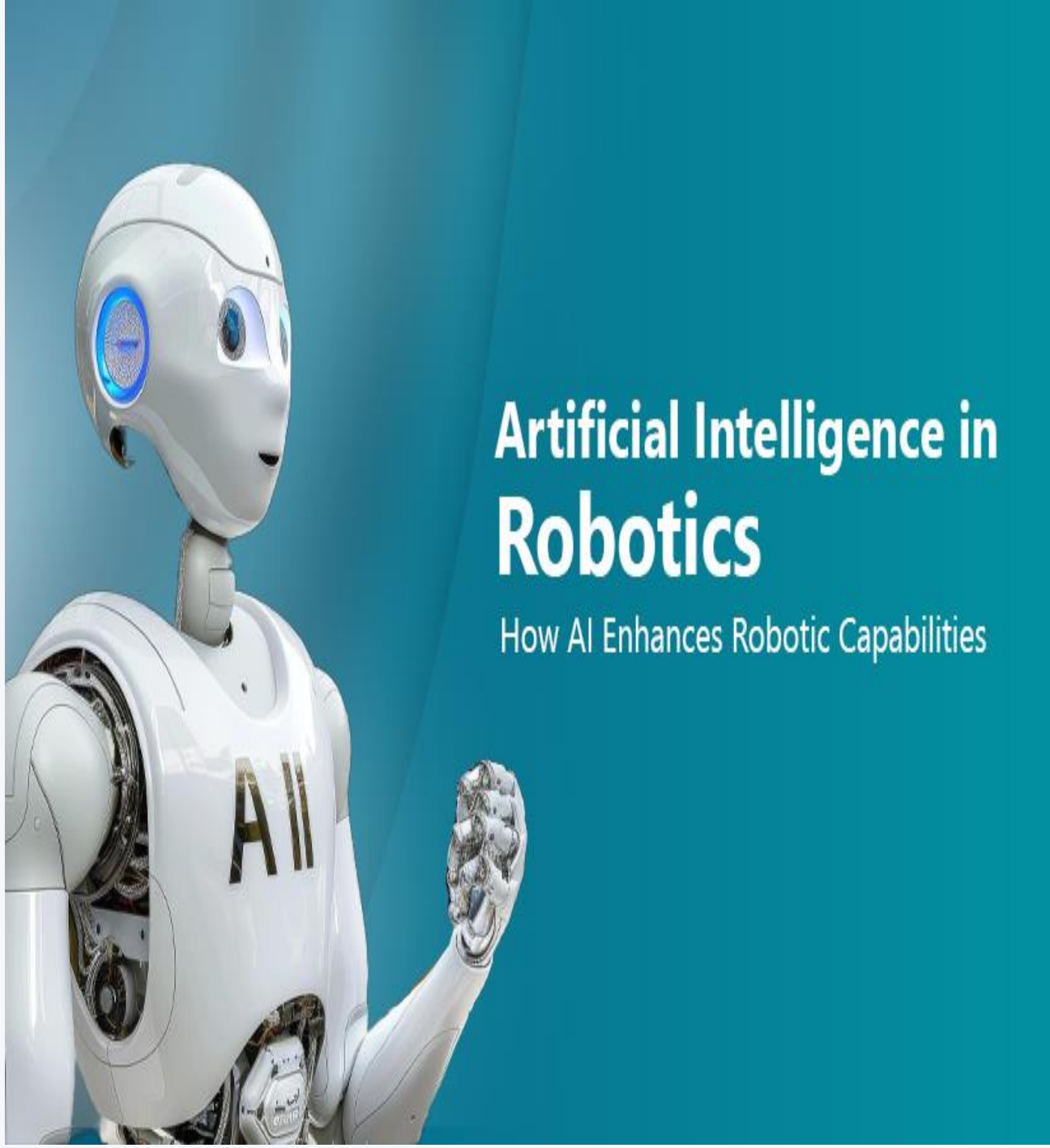
# Robotics

## AI + Physical Movement

Integrating intelligence with **physical interaction** in the real world

- **Industrial Robots**
- **Autonomous Vehicles**
- **Medical Robots**
- **Service Robots**

**Computer Vision** | **Sensor Fusion** | **Path Planning** | **Human-Robot Interaction**



# Expert Systems

## Knowledge-Based Rules

Systems that emulate **human expertise** in specific domains

- **Medical Diagnosis**
- **Financial Advisors**
- **Equipment Repair**
- **Legal Systems**

**Knowledge Base** | **Inference Engine** | **Rule-Based Logic** | **Decision Support**

# AI Applications in IT

AI is transforming **every aspect** of information technology

## Cybersecurity

Automatic detection of cyber threats and attacks

## Data Analysis

Extracting patterns and making predictions


## Intelligent Assistance

Chatbots and virtual support systems


## Network Management

Monitoring failures and predicting issues


## Recommendation Systems

Suggesting content and products to users

# AI in Cybersecurity

## Automatic Threat Detection

AI systems **identify and respond** to cyber attacks in real-time

### Threat Detection

### Anomaly Detection

### Vulnerability Assessment

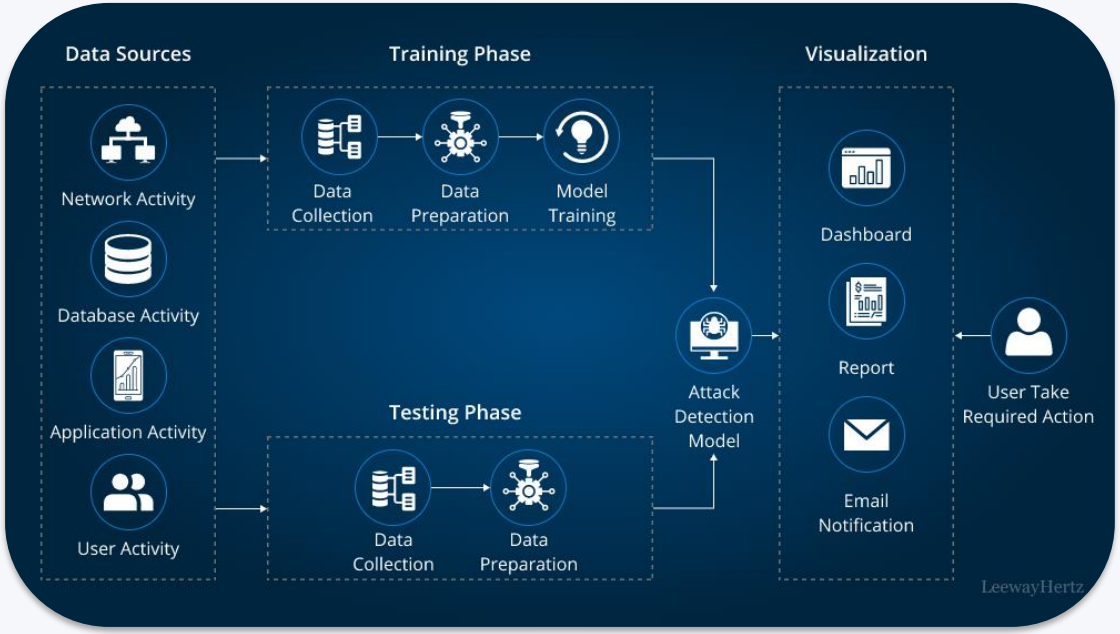
### Automated Response

**Faster Detection**

**Pattern Recognition**

**24/7 Monitoring**

**Predictive Analysis**



# AI in Data Analysis

## Pattern Extraction & Prediction

**AI** systems **discover insights** from complex data sets

**Business Intelligence**

**Market Trends**

**Predictive Analytics**

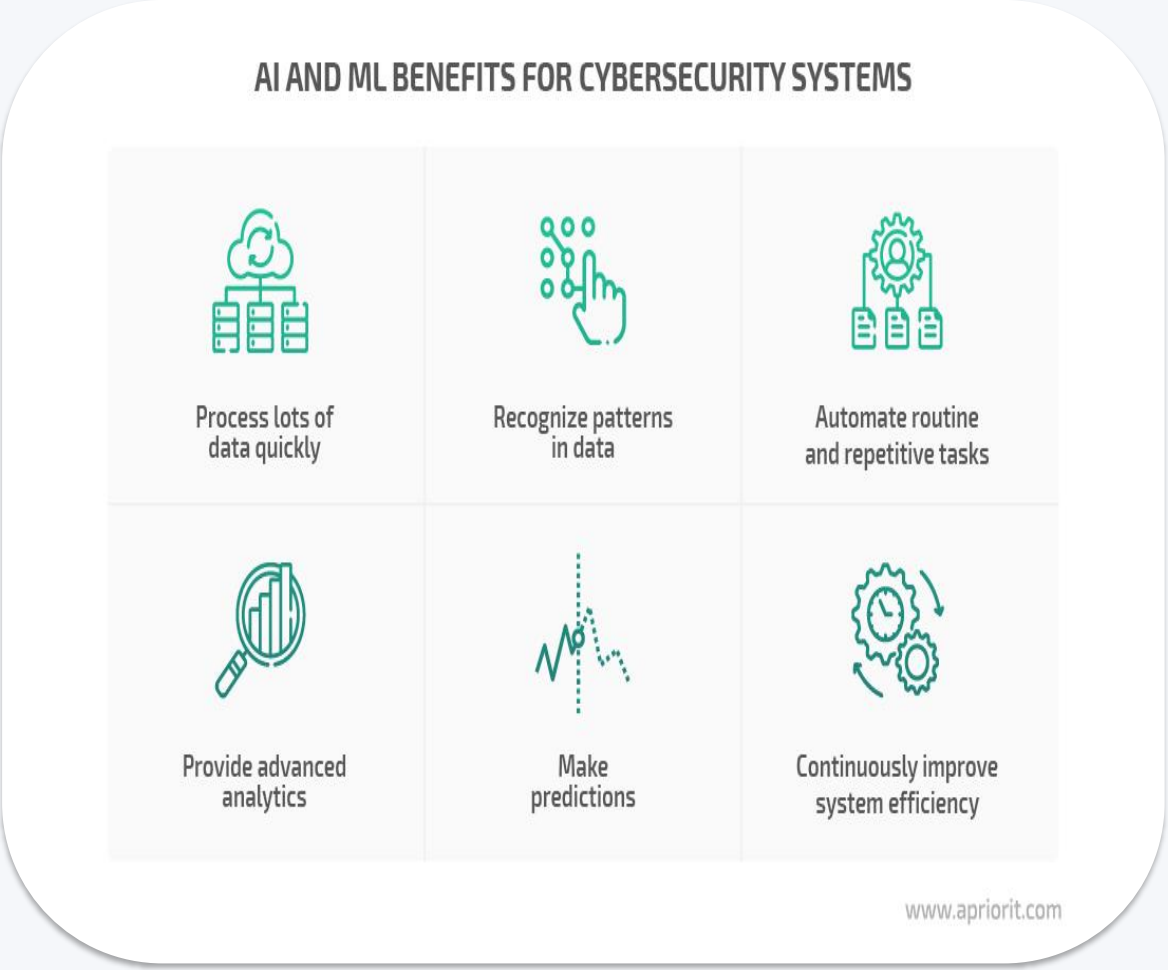
**Customer Behavior**

**Faster Processing**

**Pattern Recognition**

**Automated Insights**

**Accurate Predictions**



# AI in Intelligent Assistance

## Chatbots & Virtual Assistants

AI systems that **communicate naturally** with users

- **Customer Service**
- **IT Helpdesk**
- **E-commerce Support**
- **Educational Tutors**

- 24/7 Availability
- Instant Response
- Cost Reduction
- Natural Conversation

# AI in Network Management

## Monitoring & Predicting Issues

AI systems **detect problems** before they impact users

**Network Optimization**

**Fault Detection**

**Threat Prevention**

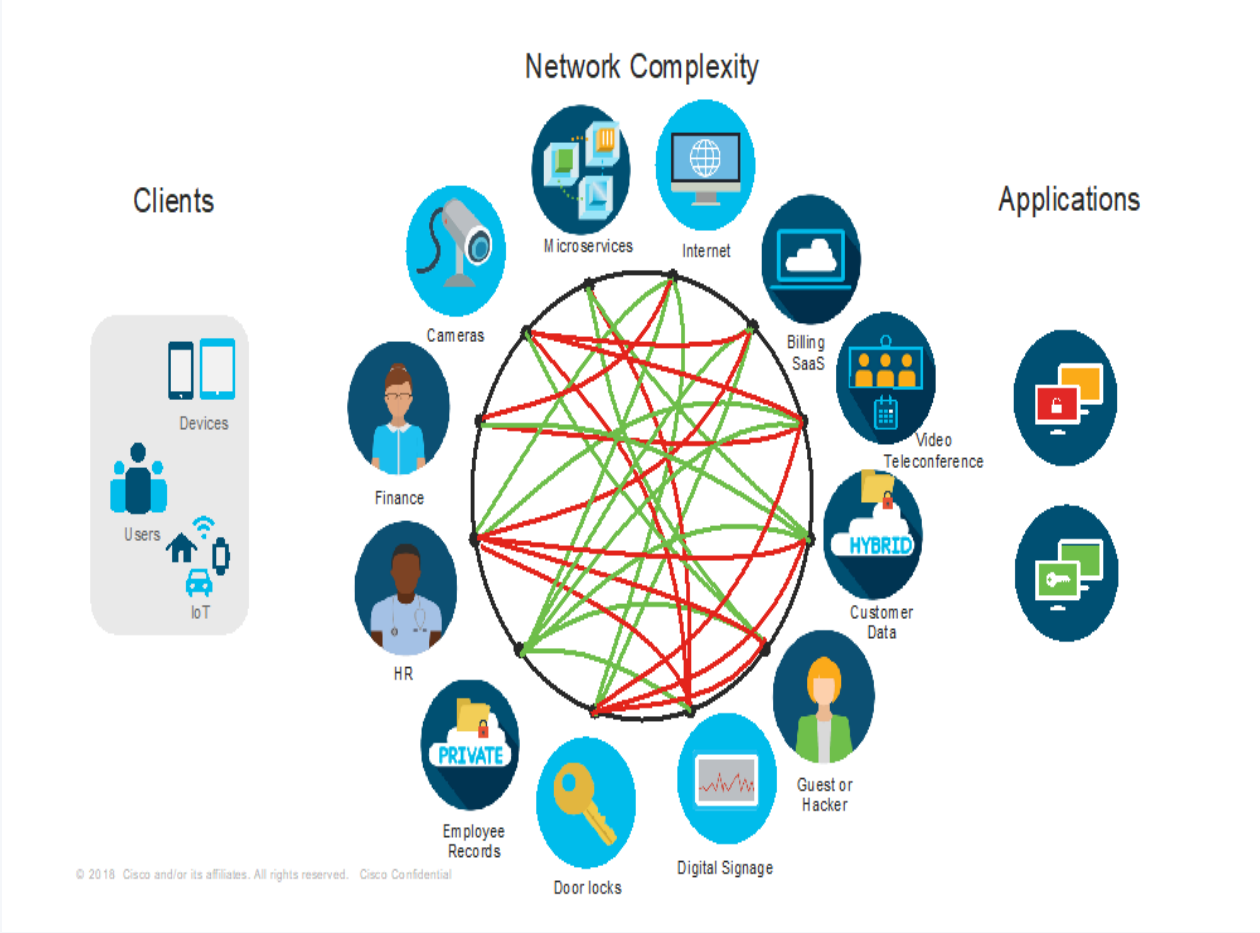
**Self-Healing Networks**

**Proactive Monitoring**

**Performance Boost**

**Automated Solutions**

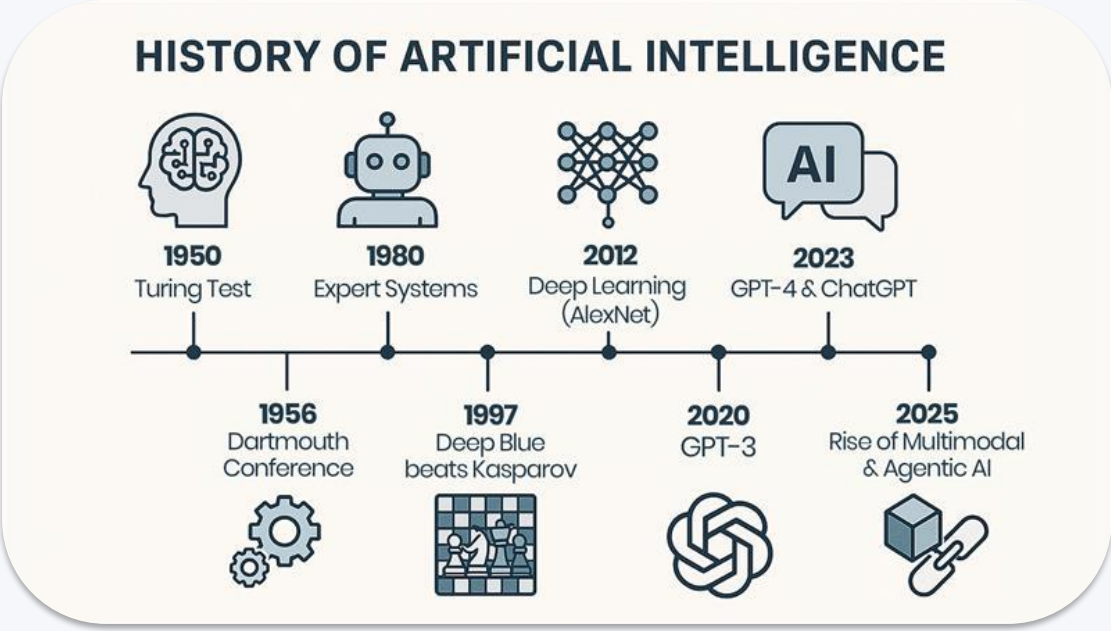
**Traffic Analysis**



# AI in Recommendation Systems

AI systems that predict user preferences based on behavior

- Netflix
- Amazon
- YouTube
- Spotify



# Challenges and Issues in AI

Despite its potential, AI faces **significant challenges** that need to be addressed

### Data Requirements

Need for massive amounts of quality data

### Bias

Models reflecting human prejudices

### Transparency

"Black box" decision-making

### Privacy

Protecting sensitive user information

### Over-reliance

Dependency on AI systems

# Challenge: Data Requirements

- Massive Data Needs
- High Quality Data
- Large Datasets
- Proper Labeling
- Diverse Examples

# Challenge: Model Bias

Inherited Human Biases

Data Bias

Algorithm Bias

Human Interaction Bias

Evaluation Bias

# Challenge: Lack of Transparency

## Black Box Decision-Making

Complex AI systems often **can't explain** their reasoning

## Accountability Issues

## Complex Neural Networks

## Unclear Decision Logic

## Difficult Debugging

# Challenge: Privacy and Security

## Protecting Sensitive Information

AI systems require **massive data** while preserving user privacy

## Regulatory Compliance

## Personal Data Collection

## Surveillance Concerns

## Data Breaches

# Challenge: Over-reliance on AI

## ⚠ Dependency on Intelligent Systems

Growing **reliance** on AI without human oversight

## Skill Degradation

## Critical Thinking Loss

## System Failure Risks

## Reduced Human Interaction

Fr Library

# Popular AI Tools

## Essential tools for **developing AI applications**

### Python

Most popular language for AI development

### TensorFlow

Google's deep learning framework

### PyTorch

Facebook's deep learning framework

### Scikit-learn

Machine learning library for Python

### Pandas

Data manipulation and analysis

### NumPy

Numerical computing library

# Programming Languages for AI

## Popular languages for **AI development**

### Python

Most popular for AI

Easy to Learn | Rich Libraries | Large Community

### R

Statistical computing

Data Analysis | Visualization | Academic Use

### Java

Enterprise solutions

Scalable | Type Safe | Cross-platform

# AI Libraries and Frameworks

Essential tools for **building AI applications**

## TensorFlow

Google's deep learning framework

- Neural Networks
- Production Ready
- Mobile Support

## PyTorch

Facebook's deep learning framework

- Dynamic Graphs
- Pythonic
- Research Friendly

## Scikit-learn

Machine learning library for Python

- Classical ML
- Easy to Use
- Comprehensive

# Data Analysis Tools

Essential tools for **data manipulation** and analysis

## Pandas

Data manipulation and analysis library

DataFrames | Data Cleaning | Data Merging

```
df = pd.read_csv('data.csv')
```

## NumPy

Numerical computing library

Arrays | Mathematical Functions | Linear Algebra

```
arr = np.array([1, 2, 3, 4])
```

# Cloud AI Platforms

Major cloud providers offering **AI services**

## Google AI

Google's machine learning platform

TensorFlow AutoML Vision API

## IBM Watson

Enterprise AI solutions

Natural Language

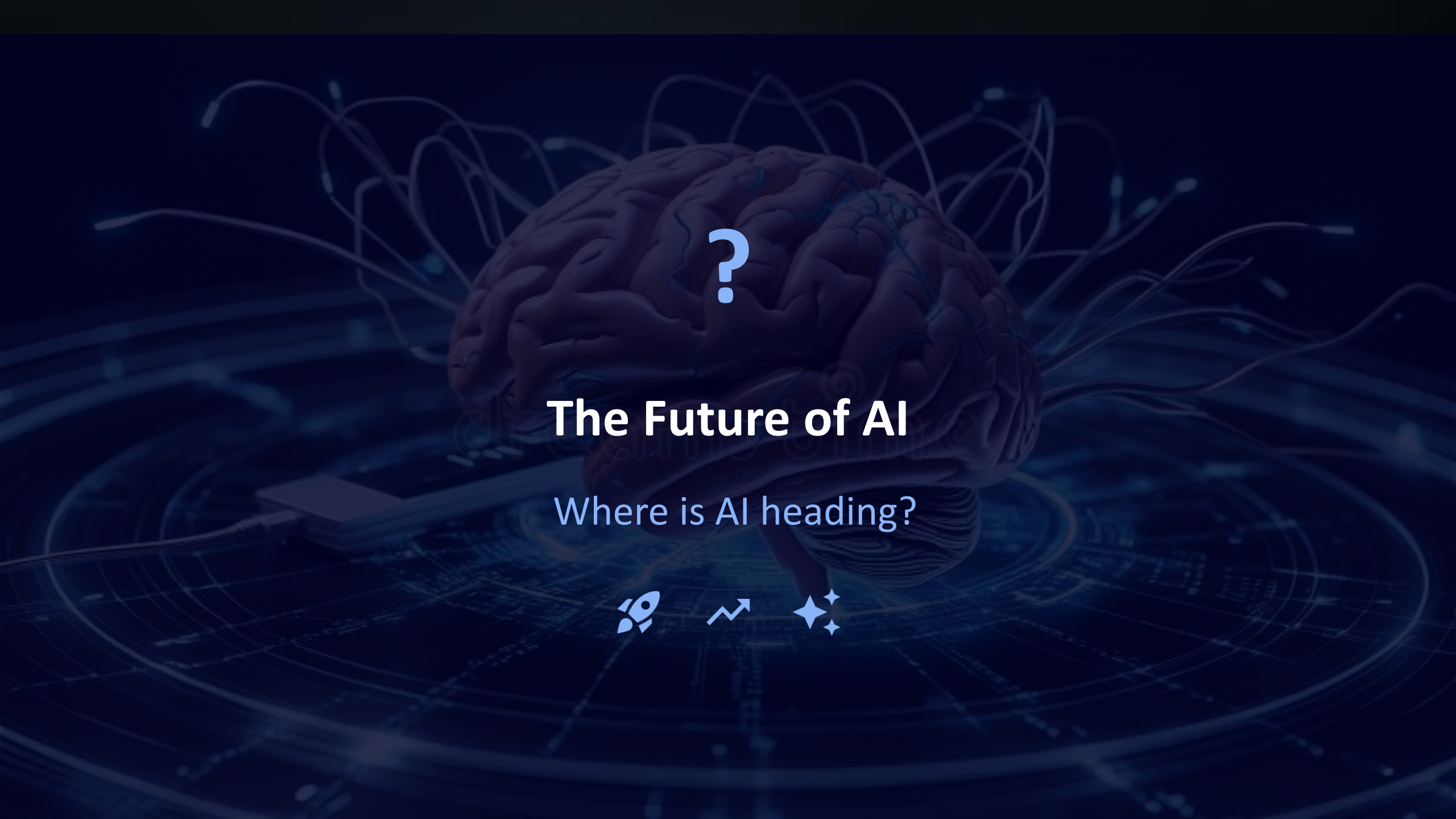
Knowledge Graph Decision Tools

## Azure AI

Microsoft's AI services

Cognitive Services

Machine Learning Bot Framework


?
The Future of AI
Where is AI heading?

# Human-AI Collaboration

## AI as a Partner

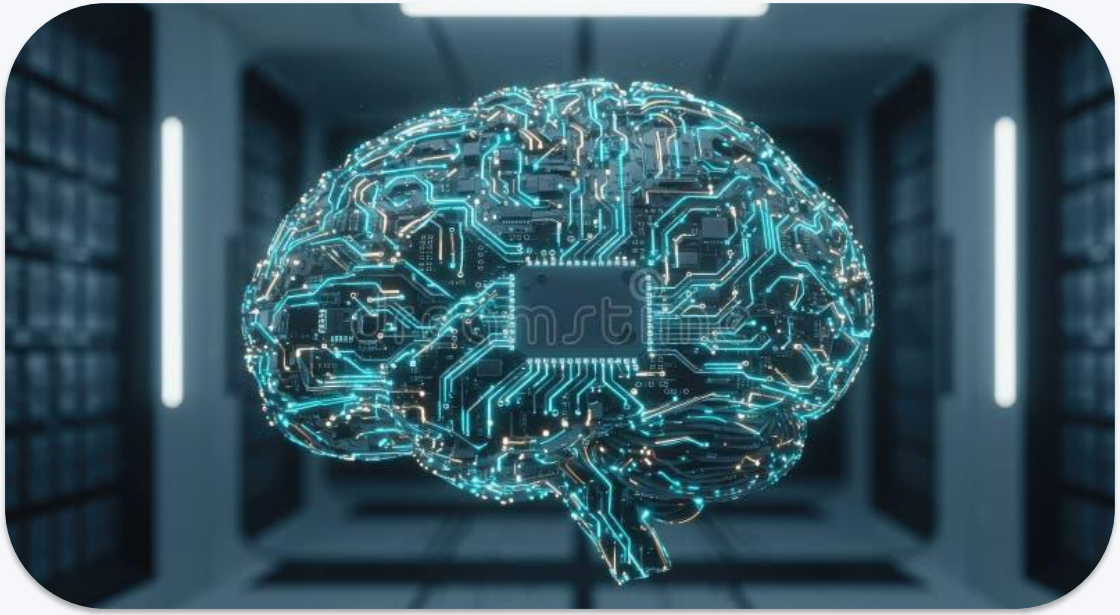
AI systems working **alongside humans** to enhance capabilities

## Balanced Decision Making

## Augmented Intelligence

## Enhanced Productivity

## Creative Problem Solving



# Generative AI

## Creating New Content

AI systems that **generate original** text, images, music, and more

**ChatGPT**

**DALL-E**

**Music Generation**

**Code Generation**

Text | Images | Audio | Video

# AI in Future Industries

AI is **transforming** key sectors of our economy

## Medicine

Revolutionizing healthcare

- Disease Diagnosis
- Drug Discovery
- Personalized Treatment

## Education

Personalized learning experiences

- Adaptive Learning
- Intelligent Tutoring
- Skill Assessment

## Energy

Optimizing power systems

- Smart Grids
- Demand Forecasting
- Renewable Integration

# Thank you for your attention!

## Simple Assignment

Find an **AI application** you use daily and explain how it uses AI