

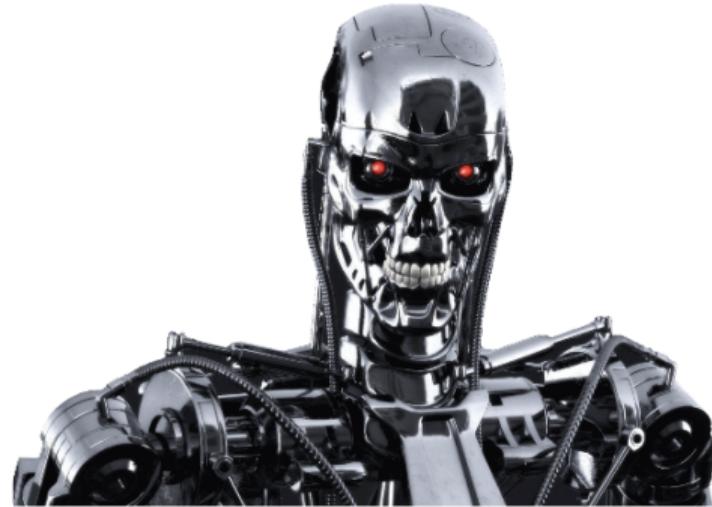
# Introduction of AI

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# Artificial Intelligence?



With artificial intelligence we are summoning the demon – Elon Musk

# Artificial Intelligence?

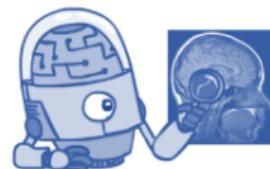


We're really closer to a smart washing machine than Terminator. If you look at today's AI, we're really very nascent. I am really excited and passionate about AI's potential. – Fei-Fei Li, Director of Stanford AI Lab.

# Definition

Artificial intelligence is the science of making machines or programs that

*Think like people*



*Think rationally*



*Act like people*



*Act rationally*



# Definition

Artificial intelligence (AI) is a broad field of computer science focused on creating machines capable of performing tasks that typically require human intelligence. This includes abilities like:

- Learning: Acquiring information and rules for using the information.
- Reasoning: Using rules to reach approximate or definite conclusions.
- Problem-solving: Finding solutions to problems.
- Perception: Using sensors to perceive the environment.
- Language understanding: Understanding and generating human language.

# Definition

AI is a rapidly evolving field with many subfields, including:

- Machine learning: Algorithms that allow computers to learn from data without explicit programming.
- Deep learning: A subfield of machine learning that uses artificial neural networks with multiple layers to analyze data.
- Natural language processing (NLP): Focuses on enabling computers to understand, interpret, and generate human language.
- Computer vision: Enables computers to “see” and interpret images and videos.
- Robotics: Designing and building robots that can perform tasks autonomously.

# Turing Test

The Turing Test, proposed by Alan Turing in his 1950 paper “Computing Machinery and Intelligence,” is a test of a machine’s ability to exhibit intelligent behavior equivalent to, or indistinguishable from, that of a human.

- Three participants: A human evaluator (C), a human respondent (B), and a computer respondent (A).
- Text-based communication: All communication is carried out via text, such as through a keyboard and screen, to eliminate the need for the machine to physically resemble a human.
- The evaluator’s task: The evaluator (C) engages in natural language conversations with both the human (B) and the computer (A), without knowing which is which.
- The goal: The computer (A) attempts to convince the evaluator (C) that it is the human.

# Turing Test

## Key Concepts:

- Imitation: Testing a machine's ability to imitate human conversation.
- Behavior-focused: Measuring intelligence by observable behavior (language).
- NLP-centric: Relies heavily on natural language processing.
- Deception involved: Machine attempts to deceive the evaluator.

## Implications:

- Behavior over definition: Shifts focus to intelligent behavior, not defining intelligence.
- Progress benchmark: Provides a measurable goal for AI progress.
- Philosophical questions: Raises questions about intelligence, consciousness, and humanity.
- Influenced AI development: Spurred research in NLP, dialogue systems, etc.
- Ethical concerns: Raises ethical questions about AI deception.

# Human Intelligence

Human intelligence is a multifaceted phenomenon comprising:

- Learning and Adaptation: The ability to acquire knowledge, identify patterns, and adjust behavior to new situations.
- Reasoning and Problem-Solving: Utilizing logic, intuition, and abstract thinking to make decisions and solve problems.
- Creativity and Imagination: Generating novel ideas, creating art, and exploring hypothetical scenarios.
- Emotional Intelligence: Understanding and managing emotions, fostering empathy, and maintaining relationships.
- Consciousness and Self-Awareness: Experiencing the world subjectively and reflecting on one's own thoughts and actions.

# Human Intelligence

Feature	Human Intelligence	Computer (CPU)
Learning	Adapts, generalizes from experience	Learns from data, struggles to generalize
Reasoning	Logic, intuition, common sense	Logic, algorithms, lacks common sense
Creativity	Generates novel ideas	Limited, relies on programming
Emotional Intel.	Empathy, social awareness	Lacks emotions
Consciousness	Self-aware, subjective	Lacks self-awareness
Processing	Slow, parallel	Fast, sequential
Adaptability	Highly adaptable	Requires reprogramming
Energy	Efficient	Can be inefficient

Table: Comparison of Human and Computer Intelligence

# Human Intelligence

While neuroscience provides some insights, advanced AI development should focus on leveraging computational strengths to augment human decision-making rather than simply mimicking human limitations.

- Limited understanding of the human brain's higher-level functions hinders direct application to complex AI.
- Neuroscience is helpful for lower-level AI (e.g., vision), but less so for higher-level AI.
- Humans are flawed decision-makers, making them a suboptimal sole benchmark for AI.
- AI can improve human decisions by processing data, finding patterns, and offering objective analysis.

# Rationality

- Rationality as an alternative approach: AI development can focus on rationality, defined as the optimal action in any given situation.
- Benefits of the rationality approach:
  - Provides a clear framework for analyzing ideal behavior.
  - Establishes a precise benchmark for evaluating AI systems.
- Precision and study of rationality: While there's no single best definition, the precision of these definitions allows for rigorous study of their strengths and weaknesses.
- Focus on acting rationally: The primary focus will be on acting rationally, which has implications for understanding thinking and reasoning.

# Sub-areas of AI

Machine Learning (ML): This is arguably the most popular and rapidly evolving subfield. It focuses on enabling computers to learn from data without explicit programming.

- Supervised Learning: The algorithm learns from labeled data (input-output pairs) to make predictions on new, unseen data. Examples include classification (categorizing data) and regression (predicting continuous values).
- Unsupervised Learning: The algorithm learns from unlabeled data to discover patterns and structures within the data. Examples include clustering (grouping similar data points) and dimensionality reduction (simplifying complex data).
- Reinforcement Learning: An agent learns to interact with an environment by taking actions and receiving rewards or penalties. This is often used in robotics, game playing, and control systems.

# Sub-areas of AI

Deep Learning (DL): A subfield of machine learning that uses artificial neural networks with multiple layers (hence **deep**) to analyze data. Deep learning excels at complex tasks like image recognition, natural language processing, and speech recognition.

- Convolutional Neural Networks (CNNs): Primarily used for image and video analysis.
- Recurrent Neural Networks (RNNs): Designed for sequential data like text and time series.
- Transformers: A more recent architecture that has revolutionized NLP and is now being applied to other areas like computer vision.

# Sub-areas of AI

Natural Language Processing (NLP): Focuses on enabling computers to understand, interpret, and generate human language.

- Natural Language Understanding (NLU): Focuses on understanding the meaning of text and speech.
- Natural Language Generation (NLG): Focuses on generating human-like text and speech.
- Tasks within NLP: Text classification, sentiment analysis, machine translation, question answering, chatbots, and more.

# Sub-areas of AI

Computer Vision (CV): Enables computers to "see" and interpret images and videos.

- Image Recognition: Identifying objects, people, and places in images.
- Object Detection: Locating and identifying multiple objects within an image.
- Image Segmentation: Dividing an image into different regions based on their content.
- Image Generation: Creating new images from text descriptions or other inputs.

# Sub-areas of AI

- Robotics: Designing and building robots that can perform tasks autonomously or semi-autonomously. This often combines other AI subfields like computer vision, machine learning, and control systems.
- Expert Systems: Computer systems designed to mimic the decision-making abilities of a human expert in a specific domain.
- Planning and Scheduling: Developing algorithms for planning sequences of actions and scheduling tasks to achieve specific goals.
- Knowledge Representation and Reasoning: Developing methods for representing knowledge in a way that computers can understand and use for reasoning and problem-solving.
- AI Ethics and Safety: A growing area that focuses on the ethical implications of AI and developing methods to ensure AI systems are safe, fair, and beneficial to society.

# Degree of Intelligence

Discussing the ability of a system to perform tasks that typically require human intelligence, such as:

- Learning and adaptation: How well can the system learn from data and adapt to new situations?
- Problem-solving and reasoning: How effectively can the system solve problems and draw inferences?
- Generalization: How well can the system apply learned knowledge to new, unseen situations?
- Autonomy: How independently can the system operate and make decisions?

# Degree of Intelligence

Category	Description	Key Characteristics	Examples	Degree of Intelligence
Traditional CS (Non-AI)	Programs following explicit instructions.	No learning or adaptation; excels at speed, precision, and repetition; lacks generalizability.	Calculators, basic software applications, operating systems	Very Limited
Narrow/ Weak AI	AI systems designed for specific tasks.	Excels within a narrow domain; can surpass human performance on specific tasks; lacks general intelligence.	Spam filters, recommendation systems, chess-playing programs	Limited, task-specific
General/ Strong AI	Hypothetical AI with human-level intelligence, capable of performing any intellectual task a human can.	Abstract thinking, common sense reasoning, creative problem-solving, generalizability across domains; still largely theoretical.	(Hypothetical) Human-like robots, AI capable of scientific discovery	Human-level (Hypothetical)
Super-intelligence	Hypothetical AI that surpasses human intelligence in all aspects.	Exceeds human capabilities in all areas of intelligence; potential for unpredictable and profound societal impact.	(Hypothetical) AI capable of solving currently unsolvable global problems	Beyond Human (Hypothetical)

Table: Comparison of Levels of Intelligence in Computer Systems

I am AI (2022)

I am AI (2024)