

# Introduction of AI

Thien Huynh-The

Department of Computer and Communications Engineering  
HCMC University of Technology and Education

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# Artificial Intelligence?



With artificial intelligence we are summoning the demon – Elon Musk

# Artificial Intelligence?

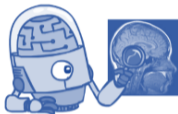


We're really closer to a smart washing machine than Terminator. If you look at today's AI, we're really very nascent. I am really excited and passionate about AI's potential. – Fei-Fei Li, Director of Stanford AI Lab.

# 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.

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

Table: Comparison of Human and Computer 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
<b>Traditional CS (Non-AI)</b>	Programs following explicit instructions.	No learning or adaptation; excels at speed, precision, and repetition; lacks generalizability.	Calculators, basic software applications, operating systems	Very Limited
<b>Narrow/ Weak AI</b>	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
<b>General/ Strong AI (AGI)</b>	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)
<b>Super-intelligence</b>	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)