AIM learning

Artificial Intelligence – General Information about AI

Estimated Learner Skill Level: Beginner

Definition

Artificial Intelligence (AI) is the simulation of human intelligence in machines programmed to think and learn like humans. These machines can do tasks typically requiring human intelligence, such as speech recognition, decision-making, problem-solving, analysis, and natural language understanding. A **model** is essentially an AI program trained for a task.
AI has many potential and realised applications in various fields, including transportation, safety, healthcare, agriculture, finance, and entertainment.

Exercise: Complete the definition of artificial intelligence.

AI is the development of one or more ___ that can simulate ___ cognitive processes, enabling them to ___ (ponder) and ___ (acquire knowledge) as ___ do.
machines _ human _ think _ learn _ humans

Reflection Task: What AI applications do you know, have encountered, and perhaps use?

Categorisation of AI

Weak vs. Strong AI

Artificial Narrow Intelligence (ANI or Weak AI) is artificial intelligence designed and trained for a specific task.
Artificial General Intelligence (AGI or Strong AI) is artificial intelligence that can understand, learn, and apply knowledge across various tasks. It can perform these at least on the same level as human beings.
Examples of ANI include virtual assistants (Siri, Alexa), recommendation systems (search engines, e-commerce, streaming services), and image recognition (face detection, optical character recognition).
AGI, on the other hand, remains largely theoretical, but **Large Language Models** such as Copilot are a significant step towards it.

Unimodal vs. Multimodal AI

Unimodal AI is the type of AI that understands only one form of data input, such as text, image, or speech (or other audio).
Multimodal AI is the type of AI that supports and integrates multiple forms of input; for example, it can combine images and text for a more comprehensive understanding of the task.

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Examples of unimodal AI include text-based (GPT-3), image-based (image recognition), and speech-recognition-based (many virtual assistants) AIs.
Examples of multimodal AI include GPT-4 and other models that accept text and images.

Reaction-based vs. Limited Memory

Reaction-based AI responds to specific inputs with pre-determined responses. It does not remember past events or learn from them.
Limited Memory AI uses past experiences to inform current decisions and can learn from recent events.

Generative vs. Non-generative

Generative AI is a system that generates content, such as text or images.
Non-generative AI analyses existing data without creating new content.

Learning-based Categorisation

Supervised Learning AI uses labelled data.
Unsupervised Learning AI uses unlabelled data.
Semi-supervised Learning AI uses a combination of labelled and unlabelled data.
Self-supervised Learning AI uses data that provides its supervision.
Reinforcement Learning AI interacts with the environment, trying to maximise reward (or minimise punishment), and learns that way.

Summing Up

Exercise: Match ways to categorise AI to their corresponding statements.

Strong	AI uses labelled data to gain knowledge.
Modality	AI bases its decisions on recent events.
Reaction/Memory	AI writes code.
Generative	AI can do various tasks at the same level as humans.
Supervised	AI understands text and images.
	5,3,4,1,2

Subdomains of AI

The field of artificial Intelligence contains huge number of methods and can be divided in multiple different ways, such as

- **Neural networks**, or systems that replicate the ways humans process information.
- **Machine learning**, or a principle where a computer learns to act in a desired way based on input data.

    - **Deep learning** is a subfield of machine learning. In deep learning, the architecture of the models is more complex than in traditional machine learning, and the AI can distinguish relevant features from data better.
- **Computer vision**, which means that the computer analyses and interprets images.
- **Pattern recognition** or identifying and distinguishing interesting or relevant observations or objects from data.
- **Robotics** which is the field of creating robots. Here, AI plays a crucial part in making the machines replicate or substitute human actions.
- **Natural language processing**, or processing languages humans use in their lives, for example, English.
- **Expert systems** which are systems that can answer questions given by users. These systems have been taught using knowledge from professionals and subject-matter experts.

(Analytics Steps 2020; Kayid 2020; Software Testing Help 2020; Wang 2021.)
There often is **overlap** between these subdomains; for example, **neural networks** are often able to learn, making them belong in the **machine learning** subdomain as well, and in addition, they can be used for image recognition tasks – an application of **computer vision**.

Next Step

Move on to AI Technologies, Applications, and Limitations.

References

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