Lesson 3
▷ 🔖 Lesson 3: Types of AI

LESSON SKILLS

After completing this lesson, you will be able to:

- Define the three types of AI based on technology.
- Describe what narrow intelligence is and provide examples of it.
- Identify the four types of AI based on functionality.
- Explain why artificial super intelligence is "a thing of the future".
- Provide examples of natural language processing in everyday AI.

KEY TERMS

- Artificial General Intelligence (AGI) (strong AI or deep AI)
- Artificial Narrow Intelligence (ANI) (weak or narrow AI)
- Artificial Super Intelligence (ASI)
- Image Recognition Limited Memory
- Limited-Memory AI
- Natural Language Processing (NLP)
- Reactive AI
- Reactive Machines
- Self-Aware AI
- Self-Awareness
- Theory of Mind

Points to Ponder

These Points to Ponder are designed to help you focus on key elements in this lesson. They are also suitable for use to spark discussions or individual research.

- What are the differences between the three types of AI based on technology?
- What capabilities does artificial narrow intelligence have? Why is it the commonly used one?
- Why is artificial general intelligence difficult to attain?
- In the future of AI, what are some possibilities for super intelligence?
- What are some examples of narrow AI?
- Describe the four types of AI based on functionality.
- What are some examples of natural language processing used in AI that we access everyday?
- Compare and contrast limited memory and reactive machines.
- Explain the components of Theory of Mind and what needs to be developed to reach that.
- Self-aware AI is a concept for the future, explain why.

Overview

This lesson introduces different types of AI categorized in two different ways. One way is based on technology and the other is based on their functionality. AI based on technology is divided into three parts: narrow AI, general AI and super AI. You will understand what narrow AI is, and why it is the only type achieved so far. There are four types of AI based on functionality: reactive machines, limited memory, Theory of Mind and self awareness. You will see how these are defined and how they function along with some examples.

## ▷ 🔖 AI Based on Technology

Objectives
3.1: Types of AI according to technology
3.1.1: Identify the three types of AI that are divided by technology
3.1.5: Explain the difference between reactive AI and limited memory AI
3.1.6: Describe examples of narrow AI in today's world

The lesson begins with types of AI that are categorized by technology and then goes on to explain how there are four types based on functionality. There are three types of AI technology based on technology or ability: Artificial Narrow Intelligence, Artificial General Intelligence and Artificial Superintelligence. These are also known by their abbreviations: ANI, AGI and ASI. Let's explore artificial narrow intelligence first as this is the only real type of AI humans have perfected in the present day. Then we will go on to see the other types and understand the differences between them and what needs to be accomplished to achieve them.
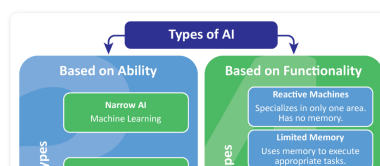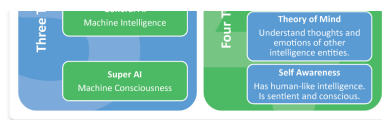
Figure 3-1: Types of AI

Suggested activity:

- Types of AI (See below)

🔖 Artificial Narrow Intelligence

Objectives
3.1.1: Identify the three types of AI that are divided by technology
3.1.2: Explain why narrow AI is the only one achieved so far
3.1.3: Describe some examples of narrow AI

This category is also known by the terms weak AI and narrow AI. It operates under a set of rules that have a specific goal and they perform tasks. Narrow AI is taught to perform specific tasks and becomes very good at performing those tasks. The last decade has seen numerous breakthroughs and developments in narrow AI. There are many examples of this today. See the table below.

Artificial Narrow Intelligence	Example	Purpose or Use
Question/Answer Computer System	IBM Watson	Capable of answering questions posed in natural language. Developed in IBM's DeepQA project.
Virtual Assistants	Apple Siri (the first modern digital virtual assistant installed on a smartphone, introduced as a feature of the iPhone 4S on 4 October 2011.) Amazon Echo – "Alexa" Google	Also called AI assistant or digital assistant, it is an application program that understands natural language voice commands and completes tasks for the user.
Recommendation Systems	Netflix	Movie recommendations
Manufacturing Robots	Articulated robots	These are the most common robots used in manufacturing processes. They perform complex operations such as welding, product assembly and machining.
AI Programmatic Advertising	"The Economist," a digital and print publication, used programmatic advertising with success by referencing subscriber, cookie and content data.	AI is used to profile visitors to a website or app, then that information is used to target and deliver ads thanks to a complicated network of platforms and services that play different roles at each stage of the ad supply chain.

Table 3-1: Examples of Artificial Narrow Intelligence

Natural Language Processing

Objective

Many applications of narrow artificial intelligence rely on natural language processing. Natural language processing (NLP) is a branch of artificial intelligence that helps computers understand, interpret and manipulate human language. Sometimes referred to as 'text analytics', NLP helps machines to understand what people write or say, conversationally.

Figure 3-2: Natural Language Processing

Here are just a few ways that NLP is used in today's world:

- **Email filters** — Email filters are one of the most basic applications of NLP online, and one of the first ways it was used. It started out with spam filters, uncovering certain words or phrases that signal a spam message, and now it can even categorize mail into different folders based on its contents.

- **Smart assistants** — Another way NLP is used is with smart assistants like Apple's Siri and Amazon's Alexa. They recognize patterns in speech thanks to voice recognition, then infer meaning and provide a helpful response. As we have conversations with our personal assistants they recognize our habits, needs and can even respond with humor!

- **Online translators** — With NLP, online translators can translate languages more accurately and have results with correct grammar. This is so helpful when trying to communicate with someone in another language.

- **Chatbots** — Chatbots are another fantastic use of NLP. They simulate human conversation and provide customer service. Expedia has a chatbot that allows customers to book flights, find hotels and check on their trip status.

> 🔗 **Link to Learn More**
>
> Read more about chatbots and natural language processing
>
> - Chatterbot facts🔗
> - Natural language processing facts🔗

Suggested activities

- Kids ChatGPT | Learn, Play & Talk🔗 (Online)
- Artificial Narrow Intelligence Poster🔗 (Hands-on)
- Class Survey - Ways ANI is Used by Students🔗 (Teacher-Led)
- Create a Chatbot🔗 (Team)
- Natural Language Processing (See below)

Natural Language Processing	⤢ FULL SCREEN	↻ RESET	☑ SUBMIT

Read the statement and mark each example True or False.

STATEMENT: The following Artificial Narrow Intelligence examples use Natural Language Processing.	True	False
Email filters	🟢	🔴
Smart assistants	🟢	🔴
Online translators	🟢	🔴
Chatbots	🟢	🔴
Recommendation systems	🟢	🔴
Manufacturing robots	🟢	🔴

Demonstration videos

- Natural Language Processing in 5 minutes🔗

▷ 🔖 Artificial General Intelligence ●

Objectives
3.1.6: Describe examples of narrow AI in today's world
3.1.7: Define what factors make AI considered to be "Deep AI" type
3.1.8: Explain how Deep AI is different from Narrow AI

Artificial general intelligence is also called **strong AI** or **deep AI**. This type of AI would have the ability to learn from humans and imitate their behaviors. It would behave like a human! Strong AI would require cognitive abilities, emotions, beliefs and complex thought processes. The model for AGI is the human brain. Let's look at the differences in human intelligence and artificial intelligence.

This helps us understand why deep AI is something not yet achieved.

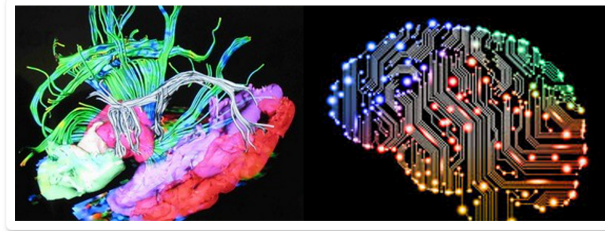| Human Intelligence	Artificial Intelligence
intuition	responsive to data
quickly adjust to a variety of changes	long time to adopt to change usually one at a time
can make judgements	has no common sense
creativity	no imagination
critical thinking	cannot deal with mixed knowledge
emotions	no feelings

Table 3-2: Humans vs. AI

Figure 3-3: Human Brain vs. Artificial Intelligence

🔗 **Link to Learn More**

Read more about deep mind and a leader in AGI

- Demis Hassabis facts🔗
- DeepMind facts🔗

Suggested activity:

- Human Intelligence vs. Artificial Intelligence (See below)

Human Intelligence vs. Artificial Intelligence   ⤢ FULL SCREEN   ↻ RESET   ☑ SUBMIT

Mark whether the listed attribute is Human Intelligence or Artificial Intelligence.

Attributes	Human Intelligence	Artificial Intelligence
quickly adjust to changes	🟢	🔴
has no common sense	🟢	🔴
critical thinking	🟢	🔴
responsive to data	🟢	🔴
no imagination	🟢	🔴
can make judgements	🟢	🔴

Artificial Super Intelligence

Objective
3.1.9: Define Artificial Super Intelligence

This type of AI is far, far in the future and even if it will ever be achieved is highly questionable. It would begin mimicking humans and it would surpass them. It would have its own emotions, ideas and beliefs. In theory, it would be able to outdo humans in all areas. You can see why this is a fantasy type of AI. Some books and movies have been created about this type of AI and usually are negative in nature.

🔗 **Link to Learn More**

Review on the three types of AI based on technology.

- Three Types of AI - Based on Technology🔗 (Slideshow)

Types of AI Based on Functionality

Objective
4.1: Types of AI according to functionality

There exists four types of AI based on functionality: reactive machines, limited memory, Theory of Mind and self-awareness.

Reactive machines are the simplest type of AI. They can't use previous experiences to perform tasks. They react and make decisions on the spot. They can predict and make decisions in real time. An example of a reactive machine is IBM's Deep Blue. It is a chess-playing supercomputer which analyzes the current board, predicts future actions, and moves its pieces based on that information. The AI was able to beat Garry Kasparov, the world's chess champion in 1997. Another example of a reactive machine would be Google's AlphaGo. It is a Go (board game that originated in Southeast Asia) playing supercomputer that has beat Go champions. Reactive machines are solely reactive. They can only perform tasks they were programmed and assigned to do.

Figure 3-4: IBM's Deep Blue chess-playing supercomputer

Limited memory has exactly what the name implies, limited memory. Since they have memory, they can use previous experiences to perform tasks. This makes them more skilled than reactive machines. However, they only have limited memory and so information about their past lasts for only a short time. An example of AI that possesses limited memory is self-driving cars. Self-driving cars, such as the Tesla, use their previous experiences with their pre-programmed actions to make decisions on the roads. They use a wide range of technologies like radar, cameras, ultrasound, and radio antennas to navigate roads.
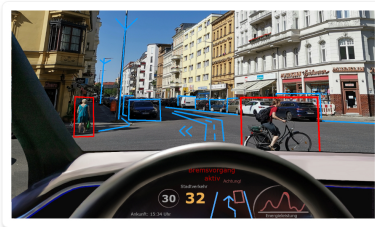

Figure 3-5: Self-driving car

The third type of AI based on functionality uses Theory of Mind, which is defined as "the understanding that people, creatures and objects in the world have thoughts and emotions that affect their own behavior." This type of AI would have the ability to understand and replicate our goals, motives and activities. They would have to learn our customs and behave appropriately to live harmoniously with humanity. Sophia is the closest we have come to this type of AI so far. Sophia is a realistic humanoid robot that can display human-like expressions and interact with people. It's designed for research, education and entertainment, Sophia spurs discussion about AI ethics and the future of robotics.
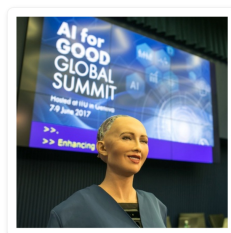

Figure 3-6: Sophia, realistic humanoid robot

The fourth and last type of AI based on functionality would be those that possess self-awareness. This type of AI would be an extension of the third type. Self-aware AI would have a consciousness, would be aware of themselves and would be able to predict the feelings of others.
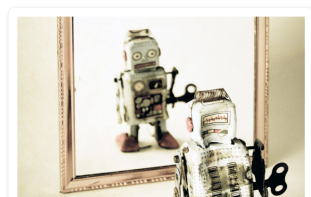
Figure 3-7: Self-aware AI

Regardless of how AI is categorized one thing is clear, its development is constant and new ways to help humans and their planet are always being discovered. The organization AI for Good has a global summit each year. It is a year-round digital platform of the United Nations, where AI innovators and problem owners discuss, learn and connect to identify AI solutions to advance the United Nations Sustainable Development Goals. These goals are geared to address world issues like hunger, quality education, and clean energy, to name a few. AI for Good addresses how the latest developments in AI can help the world. Each year there are many sessions and speakers for people to learn from. In recent years, more women than ever before have been at the forefront of some projects. A few data set projects that deal with the environment include Global Forest Watch, Ocean Tracking Network and NOAA/Climate.gov 🔗.

This organization, and others, envision AI as a way for us to create a better planet and future for all.

Figure 3-8: Women at the forefront of AI

> 🔗 **Link to Learn More**
>
> Read more about self-driving cars, AlphaGo, Sophia, The United Nations Global Goals and AI for Good.
> - Driverless car facts 🔗
> - AlphaGo facts 🔗
> - Hanson Robotics' Sophia 🔗
> - Sustainable Development Goals - United Nations 🔗
> - AI for Good 🔗

Suggested Activities
- Four Types of AI Based on Functionality 🔗 (Teacher-Led Slideshow)
- Hour of Code - A MINECRAFT TALE OF TWO VILLAGES 🔗 (Online)
- Define a Type of AI 🔗 (Hands-on)
- Human Abilities 🔗 (Teacher-Led - Class Discussion)
- Theory of Mind - Cultures 🔗 (Team)

Demonstration videos
- The Four Types of Artificial Intelligence 🔗

Glossary

▷ 🔖 **Artificial general intelligence**

Also called strong AI or deep AI. This type of AI would have the ability to learn from humans and imitate their behaviors.

▷ 🔖 **Artificial narrow intelligence**

AI designed to perform a specific task or a limited set of tasks, often better than humans, but without general intelligence or broader understanding.

▷ 🔖 **Artificial Super Intelligence**

A hypothetical form of AI that surpasses human intelligence in all areas, including creativity, problem-solving, and decision-making.

▷ 🔖 **Image Recognition Limited Memory**

AI that identifies and classifies objects in images by learning from past data and experiences, but it only stores information temporarily rather than permanently like humans do.

▷ 🔖 **Limited Memory**

An AI type that learns from past data and experiences to make better decisions, but its memory is not permanent or human-like.

▷ 🔖 **Natural Language Processing**

AI's ability to understand, interpret, and generate human language so people can communicate with computers naturally.

▷ 🔖 Reactive AI

The simplest type of AI that responds to current inputs without memory or learning from past experiences.

▷ 🔖 Reactive Machines

AI systems that can only respond to present situations using pre-set rules, without memory or the ability to learn from past experiences.

▷ 🔖 Self-aware AI

A hypothetical form of AI that possesses consciousness, emotions, and awareness of its own existence, similar to human self-awareness.

▷ 🔖 Self-awareness

The ability to recognize yourself as an individual, separate from others and your environment, with an understanding of your own thoughts, feelings, and actions.

▷ 🔖 Theory of Mind

The ability to recognize yourself as an individual, separate from others and your environment, with an understanding of your own thoughts, feelings, and actions.

Next Steps

1. Study flashcards to ensure your understanding of the material.   [Open]

2. Quiz yourself to check your understanding of fundamental facts.   [Open]

3. Proceed to the next lesson.   [Open]