

## Lesson 1

## ▷ 📚 Lesson 1: Understanding Artificial Intelligence



## LESSON SKILLS

After completing this lesson, you will be able to:

- Define artificial intelligence.
- Describe how AI works.
- Provide examples of AI in everyday life.
- Explain what role data and algorithms have in AI.
- Identify the three subsets of AI.
- Consider an ethical scenario concerning bias in AI training sets.
- Describe how AI can help solve problems.

## KEY TERMS

- [algorithm](#)
- [Artificial Intelligence \(AI\)](#)
- [bias](#)
- [Big Data](#)
- [Computer Science](#)
- [ethics](#)
- [flowchart](#)
- [intelligence](#)
- [John McCarthy](#)
- [learning algorithm](#)
- [prediction](#)

## 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.

- Describe an algorithm. Consider how AI works and create visuals of the three subsets. How does the visual of the subsets help clarify how AI works?
- After reading the text on the subject and reviewing the slides, name three examples of AI in our everyday lives.
- How is AI different from hard coding (step-by step-directions)?
- Who is considered the "father" of AI?
- How is big data used in different fields?
- How is AI trained in image recognition?
- What are ethics in AI and why are they so important?
- After reading the text, name three components of an AI system.

## Overview

This lesson introduces you to artificial intelligence, how it is defined, and what its subsets are. It will explore examples of how AI is used in everyday life. You will be completing activities that enable you to understand how it works. This first lesson will make you aware that there are many issues that intertwine with AI such as ethics, safety, privacy, and security.



## Defining Artificial Intelligence (AI)

*Objective 1.1: Defining Artificial Intelligence*

*Objective 1.1.1: Define Artificial Intelligence and how it relates to problem solving*

*Objective 1.1.4: Define "Big Data" and examples of it in today's world*

*Objective 1.1.6: Describe AI's significant impact on worldwide business*

## ⌚ Think About This

Artificial Intelligence is a branch of computer science. What do you already know about computer science? What are your experiences with it?

Artificial intelligence (AI) is a very exciting branch of computer science. It has grown and developed rapidly. Computer science is the study of computers and computing as well as their theoretical and practical applications. Computer science is the study of how to manipulate, manage, transform, and encode information. AI is a branch of computer science that enables computers to mimic or copy human behavior. John McCarthy, who is considered the father of AI, defines it as such: *"Artificial Intelligence is the science and engineering of making intelligent machines, especially intelligent computer programs."* Being intelligent is to have intelligence. Understanding artificial intelligence requires that we understand what the word "intelligence" means. The ability to acquire knowledge and skills is a basic definition of intelligence.

Examples of acquiring knowledge and skills are the ability to:

- plan
- recognize patterns
- solve problems
- create memory
- adapt to situations

Artificial Intelligence (AI) is a field that combines computer science and robust datasets to enable problem-solving. It encompasses sub-fields of machine learning and deep learning, which are frequently mentioned in conjunction with AI.

AI problem-solving often involves investigating potential solutions to problems through reasoning techniques, making use of polynomial and differential equations, carrying them out, and using modeling frameworks. The same issue can have a number of solutions, all accomplished using a unique algorithm.



Figure 1-1: Artificial Intelligence

## ⌚️ Understanding AI

Understanding AI requires that you know what allows it to work. AI is a complicated subject that involves many things. To know what is included within it will help you gain knowledge about how it works. AI has some basic beginnings, let's explore data and algorithms.

To begin with, AI works by using large amounts of data and [algorithms](#). Data is facts and statistics that are collected together to reference or analyze. Large amounts of data are often referred to as "big data". These are extremely large data sets that can reveal patterns and trends. [Big Data](#) is used for different purposes. Here are examples of ways big data is used in different fields.

Field	Use
Health	Monitoring health conditions through data collected on "wearables" (smart bracelet)
Retail	Advertising through data collected on customer shopping habits
Education	Tutoring recommended based on data collected on grades
Meteorology	Forecasts given based on discovering weather patterns through data collection
Banking	Alerts sent out based on credit card use data

Table 1-1: Fields using big data



Figure 1-2: Data

### Links to Learn More

Read more about AI, and data

- [Artificial intelligence facts](#)
- [Big data facts](#)

### Suggested activity

- Uses for Big Data (See below)

⌚️ Uses for Big Data

✖ FULL SCREEN ⌂ RESET  SUBMIT

⌚️ Select the field from the dropdown list with the ways it uses big data.

Field	Use
Please Select	Forecasts given based on discovering weather patterns through data collection
Please Select	Alerts sent out based on credit card use data
Please Select	Tutoring recommended based on data collected on grades
Please Select	Monitoring health conditions through data collected on "wearables" (smart bracelet)
Please Select	Advertising through data collected on customer shopping habits

## Algorithms

Objective 1.1.2: Describe how algorithms are used in AI

Objective 1.1.3: Explain what an algorithm consists of and how they are used in problem solving

Objective 1.1.5: Describe some everyday examples of AI and their purposes

Along with data AI uses algorithms. Algorithms are a set of steps or rules to be followed in problem solving operations. Algorithms are used to accomplish tasks; a recipe can be considered an algorithm. In essence the directions on a cake mix box are an algorithm. A flowchart is a visual representation of an algorithm so it can be easily seen. This image is an example of an algorithm in flowchart form showing how to repair a lamp.

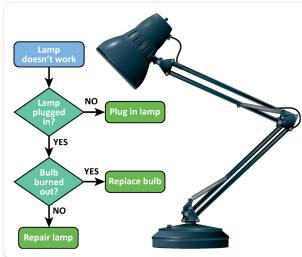


Figure 1-3: Algorithms

Using block coding is an example of an algorithm. In block coding you drag and drop coded instruction blocks to construct things like games or stories. Snap! and Scratch are online programs where students can create interactive stories, games and animation using block coding. Some very simple block coding experiences can allow you to program a character to move in a specific way. When first learning Snap! or Scratch you program a sprite how to move. Dance Party in Hour of Code is an example of this as well. The way the characters move and dance is created using block coding. Coding is a method of giving computers instructions on how to perform a specific task.

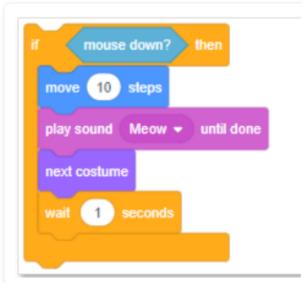


Figure 1-4: Block-Level Coding

The difference between AI and regular (hard) coding is that AI "trains" a program and allows it to explore and improve on its own. Regular programs can only operate within defined scenarios. AI can figure out what to do on its own when it encounters new situations. AI gets "smarter" over time and use.

Algorithms in AI are instruction manuals that tell the computer how to operate and can become "smarter" so the computer can be more efficient and improve processes. An example is when you use Alexa (virtual assistant technology device). The more you interact with it the better it gets at noticing your individual preferences. AI algorithms make it possible for Alexa to tell the difference between voices, remember the name of a song and then to play the track accordingly from YOUR individual streaming account. If someone else gives it the same command, it will play music from THEIR account because it can tell the difference between the two voices and whose accounts they are connected to. It learns that information over time by the input it gets.



Figure 1-5: Voice recognition

In summary, AI works by combining big data with fast interactive processing and intelligent algorithms which allows the software to learn automatically from patterns or features in the data. Algorithms analyze, classify, and draw **predictions**. AI is a branch of computer science that concentrates on the development of intelligent machines that think and work using skills associated with humans. For example they use speech recognition, problem solving, learning and planning.

AI is all around and we use it everyday.

Field	Use
Maps & Navigation	Now your family can get places easily by just listening to directions given by Google Maps, WAZE, or Apple

	Maps.
<b>Chatbots</b>	Using a chatbot allows you to get information and have answers in real time! Chatbots use natural language processing (NLP) to impersonate the conversational styles of customers.
<b>Digital Assistants</b>	There are many digital assistants for mobile phones. Along with Siri, Google Now, Cortana, and Facebook M are very popular.
<b>Facial Recognition in Social Media</b>	Many Apps such as Facebook and Snapchat have utilized AI in their facial recognition technology. Fun filters can be applied to selfies and provide a way to customize facial photos.
<b>Media Recommendations</b>	Netflix and other media streaming programs such as YouTube will show you recommendations based on what you have already watched, reacted to or liked.

Table 1-2: Uses for AI

### Links to Learn More

Read more about AI, algorithms, flowcharts, coding, Snap! and Scratch

- [Everyday Artificial Intelligence](#) (Slideshow)
- [Flow chart facts](#)
- [Algorithm facts](#)
- [Computer programming facts](#)
- [About Snap!](#)
- [Scratch \(programming language\) facts](#)

### Suggested activities

- [Hour of Code Dance Party](#) (Online)
- [Snap!: Beauty and Joy of Computing: Snap! Crash Course](#) (website)
- [Snap!: Introduction to Video Game Coding using Snap!](#) (YouTube, 18:14)
- [Scratch: Getting Started Tutorial](#) (Online)
- [Scratch: Animate a Sprite](#) (Online)
- [Creating a Flowchart](#) (Hands on)
- [Dance Party Unplugged](#) (Online Teacher-Led)
- [Creating Algorithms](#) (Team)

### Demonstration videos

- [Introduction to Artificial Intelligence](#) (YouTube 5 minutes)

## AI Subsets

*Objective 2.1.1: Define the three subsets of AI*

*Objective 2.1.2: Describe how these subsets are connected*

*Objective 5.1.6: Explain how machine learning works*

Now that you have a beginning understanding of AI, how it works, and examples of it in our world today, let's take a look at its subsets to deepen your knowledge. Inside AI is machine learning and inside that is deep learning.

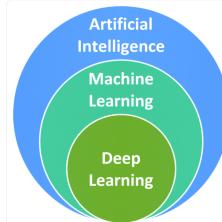


Figure 1-6: AI subsets

### Suggested activity:

- AI Subsets (See below)

AI Subsets

Label the subsets of AI.

Type here...

Type here...

FULL SCREEN    RESET    SUBMIT



## ④ 📒 Machine Learning

- Objective 2.1.3: Explain why machine learning is the most used area of AI
- Objective 2.1.4: Explain the difference between machine learning and deep learning
- Objective 5.1.1: Define machine learning
- Objective 5.1.2: Describe how artificial intelligence applies machine learning
- Objective 5.1.6: Identify examples of machine learning

In **machine learning** algorithms identify patterns and sometimes predict outcomes, and there is an algorithm system that can self-learn. These systems get smarter over time without human intervention. A good example of this is the way Netflix (subscription-based movie and show streaming service) applies your viewing history data to personalize the recommendations you receive. Machine learning is what allows robots to learn from mistakes and adapt. Machine learning can accomplish large amounts of work in much less time than humans can.

Another example of machine learning is how a Robot Tutor can adapt to finding the best ways to teach students and discovering what they need to learn the most.

Machine learning is a very important part of AI and is the most commonly used subset. In this course you will learn much more about machine learning and robots in future lessons.

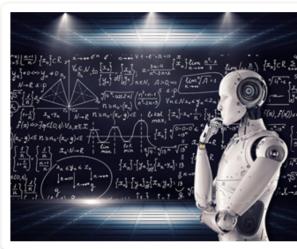


Figure 1-7: Robot thinking

### Links to Learn More

Read more about robot tutors, machine learning, deep learning and neural networks

- Machine learning facts [🔗](#)
- Time for Kids: I, Tutor

### Suggested activities

- Class Search to Narrow Results [🔗](#) (Teacher-Led)

## ④ 📒 Deep Learning

- Objective 7.1.3: Define deep neural networks
- Objective 2.1.4: Explain the difference between machine learning and deep learning

Deep learning is a subset of machine learning. When it is applied to a neural network, it allows it to learn without human supervision from data that isn't classified or labeled. Deep neural networks can be trained to identify and classify objects and get better as time goes by as they are fed more data. A neural network is very complicated and you will be learning more about it in future lessons. In essence, it is a series of algorithms that recognizes relationships through a process that attempts to copy how the human brain operates. It uses hidden layers to find correlations, cluster, classify data, and it continuously learns and improves over time.

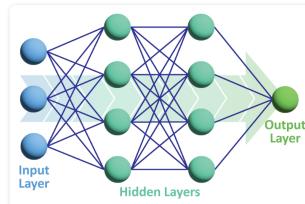


Figure 1-8: Deep neural network

## ④ 📒 Facial Recognition

- Objective 8.1.2: Explain some security issues that arise with AI

In China they use facial recognition, which is an example of using neural networks. In one University, they take attendance by facial recognition and can even judge when students are paying attention, are on their phones or sleeping, all by monitoring and analyzing their facial expressions. Facial recognition has developed rapidly in recent years. It can be used in a variety of ways and situations.

These are other examples of how face recognition is being used in different areas to benefit society.

Area	What it's used for	How it benefits society
Mobile Payments	Face recognition is linked to your mobile payment (WeChat Pay and Alipay)	Provides security and convenience can especially assist senior citizens
Identify Criminals	Law enforcement find and track objects (Cloudwalk, SenseTime)	Can locate people based on their face even in very large crowds or from far away. Allows more accurate arrested to be made
Unlocking Phones	To unlock your phone (IPhones and many others)	Protects personal data and reduces the number of stolen phones
Find Missing Persons	Find missing children, victims of trafficking, and lost senior or disabled citizens	Bring people back to safety and their families
Find Lost Pets	App connects pictures owners upload to those of pets in shelters (Finding Rover)	Bring pets in shelters back to their owners
Diagnose Diseases	National Human Genome Research Institute uses to identify diseases that cause facial changes (DiGeorge Syndrome)	Identify disease so people can receive appropriate medical care

Table 1-3: Uses for facial recognition

### 💡 Think About This

Facial recognition is a fast-growing area of AI being used in many different situations. How does it impact people's privacy? Are there laws that deal with facial recognition and how it's used?

Deep learning is a type of machine learning and AI that imitates the way humans gain knowledge and uses algorithms that are complex. They adapt and learn from vast amounts of data. The future of AI will be dependent on the development of deep learning and neural networks.

### Link to Learn More

Read more deep learning

- Deep learning facts 

### Suggested activity:

- Facial Recognition (See below)

 Facial Recognition ✖ FULL SCREEN  RESET  SUBMIT

 Match the area of facial recognition with the people who use it.

Area	Who uses it?
1. Identify Criminals	A. Cell phone users
2. Find Lost Pets	B. Law enforcement
3. Mobile Payments	C. Animal shelters
4. Unlocking Phones	D. Senior citizens and Banks
5. Diagnose Diseases	E. National Human Genome Research Institute

### 💡 Neural Networks

*Objective 2.1.4 Explain the difference between machine learning and deep learning*

*Objective 7.1.3 Define deep neural networks*

*Objective 8.1.3 Explain what "algorithmic bias" means.*

When we consider how a neural network recognizes images it is very similar to the way we do. When we have the image of a pizza in our minds, what do we see? What are some common features that all pizzas have? Most of you would say sauce, cheese, crust. But when you really think about it, there are many varieties of pizza, some have no sauce, some are square, some are even cooked in very unique ways, and don't forget about dessert pizza!





Figure 1-9: Pizza comes in many varieties

Training a computer to recognize pizza images would take so much mega data. With an AI recognition system, it would get better over time as more images pour into its database. It would also require getting input from all over the world so the program isn't biased in just identifying pizza that was of the American sort. **Bias** means that there is a prejudice in favor of one thing over the other that is considered unfair.

In the world's largest doodling data set (Quick Draw), the public can contribute to help the neural network recognize drawings. Because people all around the world contribute millions of drawings, it creates a data set to train the neural network, and it shows how people around the globe uniquely draw. Did you know that even circles are drawn differently by people in different countries? Those in Japan draw circles clockwise because of how they learned to write letters and those in America normally go counter-clockwise.

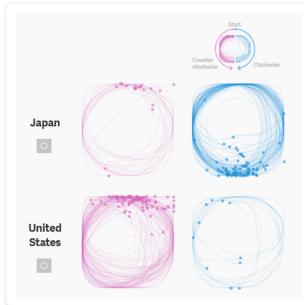


Figure 1-10: Quick Draw, neural network to recognize doodling

Using Google to search for a topic uses the same idea. The more specific your topic search is, or applying Boolean Operations to your search, will narrow it down. It gets information from many different sources, including webpages, public databases, book scanning, and maps. The goal is to get you the information you need in the fastest possible way with the most accurate results.

Learning about AI includes understanding machine learning, deep learning, and neural networks. It is a branch of computer science that is very beneficial to society. It can make work much more efficient, which frees people up to complete more creative tasks. It can help people and society at large in so many ways. It has positive results for research, development, safety, and problem-solving, just to name a few.

#### Links to Learn More

Read more about neural networks, and Google Search.

- [Neural network facts](#)
- [Google Search facts](#)

#### Suggested activities

- [Quick Draw](#), [Quick Draw-The Data](#), and [The Way You Draw Circles](#) (Online)
- [AI for Oceans - Code.org](#) (Online)
- [Creating Visuals of AI Subset](#) (Hands on)
- [Collaborative Project - AI in My World](#) (Team)
- [Bias in Datasets](#) (Hands-on Scenario)

#### Demonstration videos

- [What is Artificial Intelligence?](#) (YouTube 3 minutes)

#### Glossary

##### algorithm

A list of clear, step-by-step instructions to solve a problem or do a task.

##### algorithm

A list of clear, step-by-step instructions to solve a problem or do a task.

##### Artificial Intelligence (AI)

The ability to train computers how to learn by problem-solving using large amounts of data.

##### Bias

A prejudice in favor of one thing over the other that is considered unfair.

##### Big Data

Large amounts of data that are collected and analyzed to help make decisions.

Large amounts of information that are too complicated for normal software to handle and require special tools and methods to look at and manage.

### Computer Science

The study of computers and how they work, including programming, data, algorithms, and the design of hardware and software systems.

### Flowchart

A diagram that shows the steps in a process or task using pictures and shapes.

### Intelligence

The ability to learn, understand, and apply knowledge to solve problems or adapt to new situations.

### John McCarthy

The father of AI.

### Learning Algorithm

An algorithm system that can self-learn.

### Prediction

A statement about what is likely to happen in the future based on pattern and evidence.

## Next Steps

1. Study flashcards to ensure your understanding of the material.
2. Quiz yourself to check your understanding of fundamental facts.
3. Proceed to the next lesson.

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