NO PREP

# The Difference Between AI, Machine Learning, and Algorithms

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# The Difference Between AI, Machine Learning, and Algorithms

### Three Terms, One Confusion

If you have spent any time reading about technology, you have almost certainly encountered three terms that seem to get used interchangeably: artificial intelligence, machine learning, and algorithms. A news article will say an algorithm recommended a video to you. A tech company will claim their product uses machine learning to personalize your experience. A politician will warn about the dangers of AI decision-making. In many cases, these terms point to different things, but the people using them often do not make the distinction clear, and sometimes they use one term when they really mean another. This matters because the differences are real, and mixing them up leads to confused thinking about what these technologies actually do and who is responsible for them. This reading is going to cut through that confusion. By the end, you will have a clear mental model of how these three concepts relate to each other: which ones are larger categories, which are subsets, and which is the foundation everything else is built on. Think of it like the relationship between vehicles, cars, and electric cars: one contains the others, and understanding that hierarchy helps you ask the right questions.

### Start With Algorithms: They Are the Foundation

An algorithm, at its most basic, is a set of step-by-step instructions for solving a problem or completing a task. There is nothing futuristic or complicated about this concept. Algorithms are ancient. A recipe is an algorithm. Long division is an algorithm. The directions from your house to the grocery store are an algorithm. What all algorithms share is that they are precise, ordered instructions that, when followed correctly, reliably produce a specific outcome. In computing, algorithms are the instructions that tell a computer exactly what to do. The program that sorts your photos by date uses an algorithm. The formula that calculates your GPA is an

algorithm. The code that decides which posts appear at the top of your social media feed is an algorithm (a very complicated one, but still a set of instructions a programmer wrote). What is crucial to understand is that traditional algorithms are deterministic: given the same input, they always produce the same output. They do not learn, adapt, or change unless a programmer explicitly updates them. When you hear someone say 'the algorithm put this video in my feed,' they are usually referring to a recommendation system. Whether that system uses traditional rule-based logic or something more sophisticated involving machine learning depends on the company and the product. The word 'algorithm' in everyday speech has come to mean approximately 'the automated system that made this decision,' which is technically imprecise but reflects how people experience these technologies.

**Machine Learning: Algorithms That Learn**

Machine learning is a specific approach to building software where, instead of writing out every rule, you train the program on data and let it figure out the patterns itself. Machine learning is a subset of AI, meaning all machine learning is AI, but not all AI is machine learning. It is also a more specialized use of algorithms, where the algorithm is not just following instructions but updating its own internal parameters based on feedback. Here is a concrete example. Imagine you want to build a system that can tell whether an email is spam or not. One approach: write rules. If the subject contains the phrase 'click here to claim,' mark it as spam. If the sender is not in the contact list and the email contains the word 'urgent,' mark it as spam. This rule-based approach can work reasonably well, but it requires someone to anticipate every variation of spam and update the rules constantly as spammers adapt. The other approach: machine learning. Collect a million emails, label them 'spam' or 'not spam,' and train a model on that data. The model learns to recognize patterns in spam that the rule-writer never explicitly defined. These include things like unusual combinations of words, suspicious formatting patterns, or links to certain domains. Over time, as spammers change tactics, you retrain the model on new data. Machine learning has become the dominant approach in modern AI because it scales much better than hand-coding rules. The more data you have, and the more powerful your computers, the better the system gets, without requiring a programmer to sit down and update a rulebook. This is why the explosion in internet data over the past two decades has been so important to AI progress.

**Artificial Intelligence: The Umbrella Term**

Artificial intelligence is the broadest of the three terms. It refers to any software system that performs tasks which would normally require human judgment or intelligence. This includes machine learning systems, but it also includes older approaches that use hand-coded rules rather than training on data. An expert system from the 1980s that diagnoses diseases based on a doctor-written decision tree is technically AI. A modern deep learning model that identifies cancer in medical scans is also AI. The common thread is the goal: performing intelligent tasks, not the method used. The relationship looks like this: AI is the largest circle. Inside AI is machine learning — the subset of AI approaches that involve training on data. Inside machine learning is deep learning — the most powerful subfield, which uses multi-layered neural networks to tackle extremely complex tasks like language understanding and image generation. Most of the AI you interact with today — ChatGPT, image generators, voice assistants, recommendation systems — uses deep learning, which is machine learning, which is AI. Knowing this hierarchy helps you ask better questions. When a company says their product 'uses AI,' you can ask: is it rule-based AI or machine learning? If it is machine learning, what data was it trained on? If deep learning, what does the neural network look like and how large was the training set? These are the questions that get you past the marketing language and into the actual engineering.

**Why the Distinction Matters in Real Life**

The difference between these terms is not just academic. It has real consequences for how we hold companies and systems accountable. If an algorithm — in the traditional sense — makes a biased decision about a loan application, the bias was put there by a programmer. Someone wrote a rule that explicitly or implicitly disadvantaged certain groups, and that person (and their employer) is responsible. If a machine learning model makes a biased decision, the bias came from the training data — from historical patterns in society that the model learned to replicate. The responsibility is more diffuse and harder to trace, but it is not zero. Understanding these distinctions also helps you be a smarter consumer of AI tools. When a tool claims to be 'powered by AI,' that tells you almost nothing. When you know it uses machine learning trained on a specific dataset, you can ask intelligent questions: was the training data diverse? Was it recent? Was it representative of people like me?

These questions matter whether you are using a medical diagnostic tool, a hiring platform, a criminal justice risk assessment, or just a recommendation engine on a streaming service. The labels are less important than what is actually happening inside the system.

**Key Information: AI, Machine Learning, and Algorithms**

| Term | Definition and Relationship |
|---|---|
| Algorithm | Step-by-step instructions for solving a problem; the foundation of all computing |
| Traditional algorithm | Deterministic — same input always produces same output; does not learn |
| Artificial Intelligence (AI) | Broadest term — any software performing tasks requiring human judgment |
| Machine Learning (ML) | Subset of AI; systems trained on data rather than hand-coded rules |
| Deep Learning | Subset of ML; uses multi-layered neural networks for complex tasks |
| Training data | The labeled examples a machine learning model learns patterns from |
| Expert system | Rule-based AI using hand-coded if-then logic; dominant in the 1980s |
| Hierarchy | AI contains ML contains Deep Learning; algorithms underlie all three |

**Case Study: Jasmine's Job Application**

**Jasmine is a recent high school graduate applying for a warehouse job at a large retail company. She submits her resume through an online portal and never hears back. A friend who works there tells her the company uses 'AI screening' to sort applications before any human sees them. Jasmine does some research and learns that the system was trained on historical hiring data from the company's past ten years. She also learns that the warehouse workforce was historically around 80 percent male. 'Wait,' she says to her friend, 'does that mean the AI learned to prefer male applicants?' Her friend shrugs. 'I don't know how it works. I just know HR doesn't look at anyone the system flags as low-probability.' Jasmine wonders: if the bias came from historical data rather than a rule someone wrote, does that make it any less discriminatory? And who is responsible — the AI, the company that trained it, or the society whose hiring patterns the AI learned from?**

1. Based on the reading's explanation of how machine learning works, explain in your own words why Jasmine's concern about biased training data is legitimate. What is the source of the potential bias in this scenario?

2. The reading draws a distinction between bias in traditional algorithmic systems and bias in machine learning systems. How does that distinction apply to Jasmine's situation, and what does it mean for accountability?

**Multiple Choice**

1. According to the reading, what is the key characteristic of a traditional (non-ML) algorithm?

a) It requires an uninterrupted internet connection to function correctly

b) It is deterministic — the same input always produces the same output

c) It is always more accurate than machine learning systems

d) It improves automatically the more data it processes

2. Which of the following correctly describes the relationship between AI, machine learning, and deep learning?

a) They are three separate and unrelated fields of computer science

b) AI is the broadest category; machine learning and deep learning are subsets

c) Deep learning contains machine learning, which contains AI

d) Machine learning is the broadest category; AI is a type of machine learning

3. What does the reading identify as the main advantage of machine learning over rule-based AI systems?

a) Machine learning systems are cheaper and faster to build than rule-based systems

b) Machine learning does not require any training data whatsoever to perform effectively

c) Machine learning scales better — more data and computing power means better results

d) Machine learning systems never make mistakes or produce biased results

**Matching**

Write the letter of the correct definition on the line next to each term.

| Term | Definition |
|---|---|
| 1. ___ Algorithm | A) ML subfield using multi-layered neural networks for complex tasks like language and images |
| 2. ___ Machine Learning | B) Producing the same output every time given the same input, without learning or adapting |
| 3. ___ Deep Learning | C) Labeled examples a machine learning model uses to learn patterns and make predictions |
| 4. ___ Training Data | D) A set of step-by-step instructions for solving a problem or completing a task |
| 5. ___ Deterministic | E) AI approach where systems train on data and learn patterns rather than following coded rules |

**Fill-in-the-Blank**

1. A recipe and long division are both examples of _____, because they are precise, ordered instructions that reliably produce a specific outcome.

2. Machine learning is a _____ of artificial intelligence, meaning all machine learning is AI, but not all AI is machine learning.

3. If a machine learning model produces biased results, the bias often came from the _____ the model was trained on, not from a rule a programmer explicitly wrote.

**Short Answer**

Answer each question in 2-4 complete sentences.

1. Explain the difference between a traditional algorithm and a machine learning model, using the spam filter example from the reading or an example of your own choosing.

2. The reading says that when a company claims their product 'uses AI,' that tells you almost nothing. What specific follow-up questions does the reading suggest you should ask, and why does each question matter?

3. In everyday speech, people often use the word 'algorithm' to mean something like 'the automated system that made this decision.' Based on the reading, what is imprecise about this usage and why does precision in language matter when discussing these technologies?