ALGORITHMS AND THEIR ROLE IN
CONTEMPORARY DIGITAL MEDIA BUSINESS

GO BACK TO BASICS

LESSON 1

What Is An Algorithm?

In essence, algorithms are simply **a series of instructions** that are followed, step by step, to do something useful or solve a problem. You could consider a cake recipe an algorithm for making a cake, for example.

When bakers follow a recipe to make a cake, they end up with cake. If you follow that recipe precisely, time after time your cake will taste the same. But deviate from that recipe, even a little, and what emerges from the oven may disappoint your taste buds.

Some steps in an algorithm depend on what happened or was learned in earlier steps.

Consider the cake example.

Dry ingredients and wet ingredients might need to be combined in separate bowls before they can be mixed together. Similarly, some cookie batters must be chilled before they can be rolled out and cut into shapes. And some recipes call for the oven to be set to one temperature for the first few minutes of baking, and then changed for the rest of the cooking or baking time.

But Why Are They Called Algorithms?

Algorithms have been around for longer than you might expect. From ancient Babylon to the present day, algorithms have been an important feature of our society for millennia.

The very first examples were simple algorithms used by ancients to track their grain and livestock, among other things. In their wake, and with the advent of a formalized numerical system, other technological and conceptual leaps were achieved, including the invention of abacus, algebra, and the concept of variables.

Ancient Greek thinkers like Euclid, Archimedes, and Eratosthenes would use early algorithms to do things like determine the greatest common divisor of different numbers, approximate Pi, and calculate prime numbers. Over time, such feats would give rise to symbols and rules involved in formulating evaluation systems.

Back in the 9th century, a famous mathematician and astronomer made a lot of discoveries in science, math and the number system that we now use. His name was **Muhammad ibn Musa al-Khwarizmi**. His last name is Persian for the area of his birth: Khwãrezm.

Over the centuries, as his fame grew, people outside the Middle East altered his name to **Algoritmi**.

This version of his name would later be adapted as the English term that describes the step-by-step recipes we now know as algorithms.

How Do Computer Algorithms Work?

Things are a bit more complicated in the computer science context where the term most often comes up, but only ever so slightly.

In his book *The Master Algorithm*, Pedro Domingos offers a masterfully simple definition: “An algorithm is,” Domingos writes, “a sequence of instructions telling a computer what to do.” As Domingos goes on to explain, algorithms are reducible to three logical operations: **AND, OR, and NOT**. While these operations can chain together in extraordinarily complex ways, at core algorithms are built out of simple rational associations.

Computer algorithms work via **input and output**. They take the input and apply each step of the algorithm to that information to generate an output. For example, a search engine is an algorithm that takes a search query as an input and searches its database for items relevant to the words in the query. It then outputs the results.

You can easily visualise algorithms as a flowchart. The input leads to steps and questions that need handling in order. When each section of the flowchart is completed, the generated result is the output.

What Is An Algorithm Used For?

Algorithms are used throughout all areas of IT and computing. They can manipulate and process data and perform calculations or actions in various ways.

A great example of algorithms in action is with automation software. This is because automation works by following set rules to complete tasks. Those rules form an algorithm. So, automation software is made up of many algorithms all working to automate your processes.

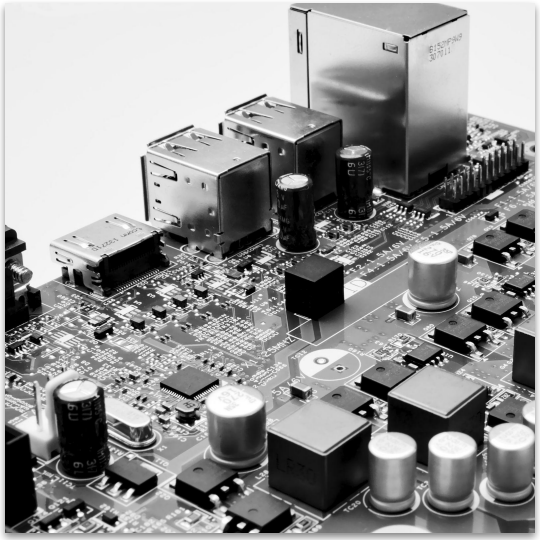
For example, one of your automated tasks requires your automation software to take all billing information received by email and put it into a spreadsheet. To do this, you set up a series of rules and conditions for the program to follow – an algorithm.

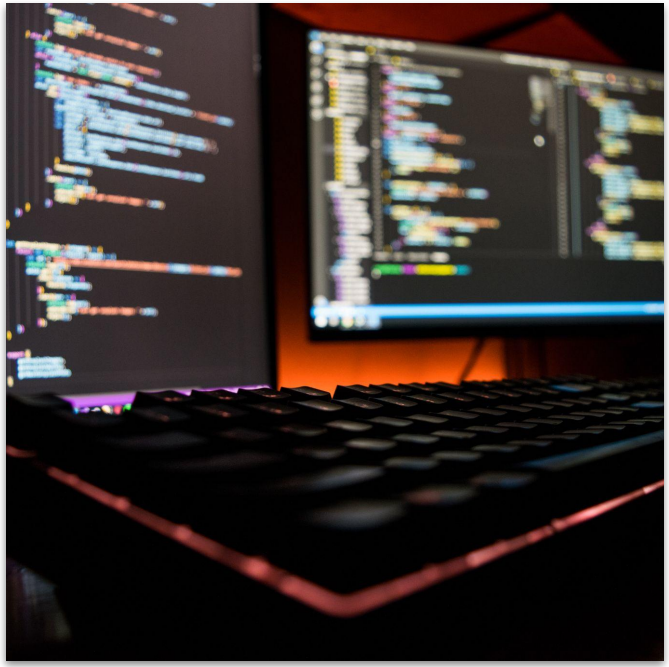
In this instance, the input is every incoming email. Each of these emails are then put through each step – or rule – to complete the task. This might include scanning each email for key terms. Emails that contain these terms then move to the next step, continuing to follow each step to identify and extract the relevant data. The output is the information that's placed into a spreadsheet.

How Do We Use Algorithms In Our Everyday Lives?

We use computer algorithms for so many things. New or improved ones emerge every day.

For instance, specialized ones help explain how diseases spread. Some help predict the weather. Others choose investments in the stock market.





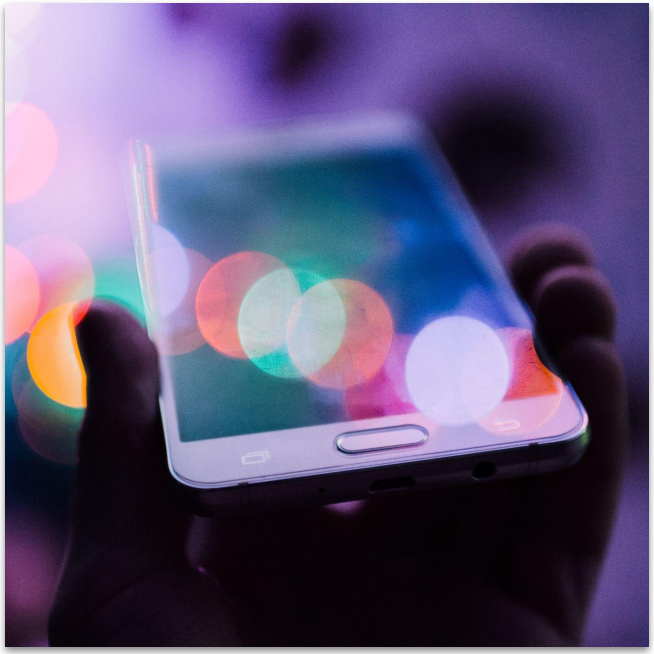
They're used these days for a host of purposes, such as automating stock market trading or serving ads to website visitors.

One of the earliest applications of this technology, one that we're still working on, was so-called **machine vision**, in which computers try to identify the various elements of a picture. It's the kind of system that can tell you (or claim to) how hot you look in a picture or identify the most inventive paintings of all time.

Another area being developed is a faster way to sort through images. There are apps that pull up possible plant names based on a photograph. Such tech currently works better on plants than it does on people. Apps that are designed to recognize faces may be fooled by haircuts, glasses, facial hair or bruises, for instance. These algorithms are still not as accurate as people tend to be.

When you ask a digital assistant, like Siri or Cortana, a question, algorithmic operations inform both its sense of what you've asked and the information it provides in response.

Machine learning likewise helps Google Maps determine the best route from one location to another.



And there's a virtually unlimited array of other functions that algorithms can serve. Some of the earliest commercial applications of algorithms involved automating tasks such as payroll management, but with the rise of contemporary machine learning, they're used for much more sophisticated tasks. Algorithms determine who should receive government benefits, contribute to predictive policing, help anticipate health crises, reschedule airline flights, and much more.

Machine learning means that algorithms "learn" how to carry out tasks under various levels of human oversight.

There are still plenty of things that algorithms can't do. For example, while algorithms are pretty good at booking travel, airlines have found that they can't dispense with human reservation agents. While the algorithms are good at guaranteeing efficiency, they're not great at simulating compassion and other human characteristics.

The future will include algorithms that teach computers how to better understand more complex data. This is the beginning of what people call machine learning: computers teaching computers.

Generally speaking, when people talk about algorithms these days, they're talking about something more specific, like the operations that power our social media news feeds.

In one way or another, most of these systems are examples of a technology called **machine learning**. Instead of repeatedly processing a stable set of instructions, systems based on machine learning rewrite themselves as they work. It's this that frightens some people, since it makes algorithms sound like they're alive, possibly even sentient. **To be clear, they are neither.**

In an article on Domingos' *The Master Algorithm*, David Auerbach notes that "even within computer science, machine learning is notably opaque." But it's also increasingly central to the ways that we live, making it all the more important to disperse that fog.

Part of the issue, though, is that machine learning algorithms are effectively programming themselves, meaning that they can sometimes be unpredictable, or even slightly alien. Their operations are sometimes obscure even to those who originally created them!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