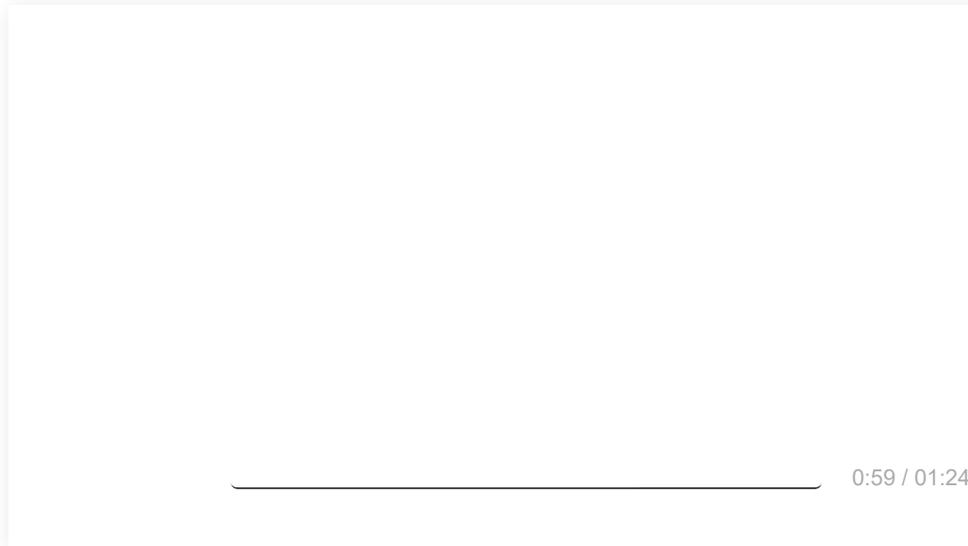


Understanding the differences between AI, machine learning, and deep learning

Artificial intelligence, machine learning, and deep learning have become integral for many businesses. But, the terms are often used interchangeably. Here's how to tell them apart.

By Hope Reese | February 23, 2017, 4:00 AM PST



With huge strides in AI—from advances in the driverless vehicle realm, to mastering games such as [poker](#) and [Go](#), to automating [customer service](#) interactions—this advanced technology is poised to revolutionize businesses. But the terms AI, machine learning, and deep learning are often used haphazardly and interchangeably, when there are key differences between each type of technology. Here's a guide to the differences between these three tools to help you master machine intelligence.

SEE: [Inside Amazon's clickworker platform: How half a million people are being paid pennies to train AI \(PDF download\)](#)(TechRepublic)

Artificial Intelligence (AI)

AI is the broadest way to think about advanced, computer intelligence. In 1956 at the Dartmouth Artificial Intelligence Conference, the technology was described as such: "Every aspect of learning or any other feature of intelligence can in principle be so precisely described that a machine can be made to simulate it."

AI can refer to anything from a computer program playing a game of chess, to a voice-recognition system like [Amazon's Alexa](#) interpreting and responding to speech. The technology can broadly be categorized into three groups: Narrow AI, artificial general intelligence (AGI), and superintelligent AI.

[IBM's Deep Blue](#), which beat chess grand master Garry Kasparov at the game in 1996, or Google [DeepMind's AlphaGo](#), which in 2016 beat Lee Sedol at Go, are examples of narrow AI—AI that is skilled at one specific task. This is different from artificial general intelligence (AGI), which is AI that is considered human-level, and can perform a range of tasks.

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Superintelligent AI takes things a step further. As [Nick Bostrom](#) describes it, this is "an intellect that is much smarter than the best human brains in practically every field, including scientific creativity, general wisdom and social skills." In other words, it's when the machines have outsmarted us.

Machine Learning (ML)

Machine learning is one subfield of AI. The core principle here is that machines take data and "learn" for themselves. It's currently the most promising tool in the AI kit for businesses. ML systems can quickly apply knowledge and training from large data sets to excel at facial recognition, speech recognition, object recognition, translation, and many other tasks. Unlike hand-coding a software

program with specific instructions to complete a task, ML allows a system to learn to recognize patterns on its own and make predictions.



Google's AlphaGo beats Lee Sedol at the game of Go
Image: Screenshot by Max Taves/CNET

While Deep Blue and DeepMind are both types of AI, Deep Blue was rule-based, dependent on programming—so it was not a form of ML. DeepMind, on the other hand, is: It beat the world champion in Go by training itself on a large data set of expert moves.

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Deep Learning

Deep learning is a subset of ML. It uses some ML techniques to solve real-world problems by tapping into neural networks that simulate human decision-making. Deep learning can be expensive, and requires massive datasets to train itself on. That's because there are a huge number of parameters that need to be understood by a learning algorithm, which can initially produce a lot of false-positives. For instance, a deep learning algorithm could be instructed to "learn" what a cat looks like. It would take a very massive data set of images for it to understand the very minor details that distinguish a cat from, say, a cheetah or a panther or a fox.

As mentioned above, in March 2016, a major AI victory was achieved when DeepMind's AlphaGo program beat world champion Lee Sedol in 4 out of 5 games of Go using deep learning. The way

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the deep learning system worked was by combining "Monte-Carlo tree search with deep neural networks that have been trained by supervised learning, from human expert games, and by reinforcement learning from games of self-play," according to Google.

Deep learning also has business applications. It can take a huge amount of data—millions of images, for example—and recognize certain characteristics. Text-based searches, fraud detection, spam detection, handwriting recognition, image search, speech recognition, Street View detection, and translation are all tasks that can be performed through deep learning. At Google, deep learning networks have replaced many "handcrafted rule-based systems," for instance.

SEE: [Machine learning: The smart person's guide \(TechRepublic\)](#)

Deep learning is also highly susceptible to bias. When Google's facial recognition system was initially rolled out, for instance, it tagged many black faces as gorillas. "That's an example of what happens if you have no African American faces in your training set," said Anu Tewary, chief data officer for Mint at Intuit. "If you have no African Americans working on the product. If you have no African Americans testing the product. When your technology encounters African American faces, it's not going to know how to behave."

Some also believe that [deep learning is overhyped](#). Sundown AI, for instance, has mastered automated customer interactions using a combination of ML and policy graph algorithms—not deep learning.

[The automated office: 8 ways companies are using AI to increase productivity](#)

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[Quick glossary: Artificial intelligence \(Tech Pro Research\)](#)
