What is artificial intelligence? Machine learning, deep learning, and generative AI

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Defining artificial intelligence is not an easy task. There are many different interpretations as to what it is, but in general terms, however, artificial intelligence can be said to be a branch of computer science dedicated to creating systems that mimic human thinking and reactions, based on pattern recognition and data analysis.

These days, AI applications are used routinely, often in daily tasks where they are unnoticed by users. Spam filters and product recommendations based on user preferences are based on artificial intelligence systems, as are your mobile phone's facial recognition technologies and the chatbots used by many companies to interact with customers.

Within the broad spectrum of artificial intelligence, there are specific techniques and subcategories that merit special attention, including machine learning, deep learning and generative artificial intelligence. Although all three share share the central objective of teaching systems and machines to think like human beings, they address the challenge in different ways.

Machine learning is a technique that allows computers to learn from data and to make decisions or predictions without being expressly programmed for a specific activity. Machine learning can be classified as supervised learning (when models are trained using labeled input and output data) or unsupervised learning (when the training process uses raw or unlabeled data, so that models identify structures and patterns on their own).

For example, when a music streaming platform suggests a new album by an artist you don't know, based on similarities in rhythm with your favorite bands, it is probably using machine learning systems to identify patterns and statistics so that it can make predictions about the type of music that would appeal to you, based on your specific profile.

Deep learning is a sub-field of machine learning, inspired by the structure and functioning of the human brain, that focuses specifically on the training of artificial neural networks. The central idea in deep learning is to use artificial neural networks to model and process data in layers (and the more layers, the deeper the network) so that systems can learn and make decisions autonomously, based on large quantities of data and without the need for human intervention.

Autonomous vehicles (like cars and drones) use neural networks to detect people, objects and other vehicles in their path and surrounding area to plan routes and make decisions as they travel. For more specific uses, drones can be equipped with cameras to monitor certain situations (such as the spread

of disease in crops) and make predictions as the situation evolves.

Last, **generative artificial intelligence**, which is a sub-field of deep learning models, is not limited to interpreting and responding to data but also has the power to create something entirely new, drawing on data analyzed previously, in response to information (inputs) received from users. The process employed by generative AI generally involves the collection of large volumes of data, training models based on these data, creating latent space, generating content, and iterative refinement of generated results.

One of the most popular tools in the field of generative AI is the Generative Adversarial Network or GAN. GANs consist of two neural networks, a "generator" and a "discriminator", which are trained together. The generator tries to create outputs that appear real (i.e. that reflect the data used to train the model), while the discriminator tries to distinguish generated outputs from real data. This competition between the two networks continuously improves the quality of the output generated and the results achieved by generative AI.

Machine learning, deep learning and generative AI have their own nuances, which can generate different risks – risks addressed in the following articles of this e-book. And although these terms can seem intimidating at first glance, their practical applications are increasingly part of everyday life, creating a more connected, efficient and innovative reality.

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