What is artificial intelligence (AI)?

Artificial intelligence is the simulation of human intelligence processes by machines, especially computer systems. Specific applications of AI include expert systems, natural language processing, speech recognition and machine vision.

How does AI work?

As the hype around AI has accelerated, vendors have been scrambling to promote how their products and services use it. Often, what they refer to as AI is simply a component of the technology, such as machine learning. AI requires a foundation of specialized hardware and software for writing and training machine learning algorithms. No single programming language is synonymous with AI, but Python, R, Java, C++ and Julia have features popular with AI developers.

In general, AI systems work by ingesting large amounts of labeled training data, analyzing the data for correlations and patterns, and using these patterns to make predictions about future states. In this way, a chatbot that is fed examples of text can learn to generate lifelike exchanges with people, or an image recognition tool can learn to identify and describe objects in images by reviewing millions of examples. New, rapidly improving generative AI techniques can create realistic text, images, music and other media.

AI programming focuses on cognitive skills that include the following:

Learning. This aspect of AI programming focuses on acquiring data and creating rules for how to turn it into actionable information. The rules, which are called algorithms, provide computing devices with step-by-step instructions for how to complete a specific task.

Reasoning. This aspect of AI programming focuses on choosing the right algorithm to reach a desired outcome.

Self-correction. This aspect of AI programming is designed to continually fine-tune algorithms and ensure they provide the most accurate results possible.

Creativity. This aspect of AI uses neural networks, rules-based systems, statistical methods and other AI techniques to generate new images, new text, new music and new ideas.

Differences between AI, machine learning and deep learning

AI, machine learning and deep learning are common terms in enterprise IT and sometimes used interchangeably, especially by companies in their marketing materials. But there are distinctions. The term AI, coined in the 1950s, refers to the simulation of human intelligence by machines. It covers an ever-changing set of capabilities as new technologies are developed. Technologies that come under the umbrella of AI include machine learning and deep learning.

Machine learning enables software applications to become more accurate at predicting outcomes without being explicitly programmed to do so. Machine learning algorithms use historical data as input to predict new output values. This approach became vastly more effective with the rise of large data sets to train on. Deep learning, a subset of machine learning, is based on our understanding of how the brain is structured. Deep learning's use of artificial neural networks structure is the underpinning of recent advances in AI, including self-driving cars and ChatGPT.

Why is artificial intelligence important?

AI is important for its potential to change how we live, work and play. It has been effectively used in business to automate tasks done by humans, including customer service work, lead generation, fraud detection and quality control. In a number of areas, AI can perform tasks much better than humans. Particularly when it comes to repetitive, detail-oriented tasks, such as analyzing large numbers of legal documents to ensure relevant fields are filled in properly, AI tools often complete jobs quickly and with relatively few errors. Because of the massive data sets it can process, AI can also give enterprises insights into their operations they might not have been aware of. The rapidly expanding population of generative AI tools will be important in fields ranging from education and marketing to product design.

Indeed, advances in AI techniques have not only helped fuel an explosion in efficiency, but opened the door to entirely new business opportunities for some larger enterprises. Prior to the current wave of AI, it would have been hard to imagine using computer software to connect riders to taxis, but Uber has become a Fortune 500 company by doing just that.

AI has become central to many of today's largest and most successful companies, including Alphabet, Apple, Microsoft and Meta, where AI technologies are used to improve operations and outpace competitors. At Alphabet subsidiary Google, for example, AI is central to its search engine, Waymo's self-driving cars and Google Brain, which invented the transformer neural network architecture that underpins the recent breakthroughs in natural language processing.

What are the advantages and disadvantages of artificial intelligence?

Artificial neural networks and deep learning AI technologies are quickly evolving, primarily because AI can process large amounts of data much faster and make predictions more accurately than humanly possible.

While the huge volume of data created on a daily basis would bury a human researcher, AI applications using machine learning can take that data and quickly turn it into actionable information. As of this writing, a primary disadvantage of AI is that it is expensive to process the large amounts of data AI programming requires. As AI techniques are incorporated into more products and services, organizations must also be attuned to AI's potential to create biased and discriminatory systems, intentionally or inadvertently.

Advantages of AI

The following are some advantages of AI.

Good at detail-oriented jobs. AI has proven to be as good or better than doctors at diagnosing certain cancers, including breast cancer and melanoma.

Reduced time for data-heavy tasks. AI is widely used in data-heavy industries, including banking and securities, pharma and insurance, to reduce the time it takes to analyze big data sets. Financial services, for example, routinely use AI to process loan applications and detect fraud.

Saves labor and increases productivity. An example here is the use of warehouse automation, which grew during the pandemic and is expected to increase with the integration of AI and machine learning.

Delivers consistent results. The best AI translation tools deliver high levels of consistency, offering even small businesses the ability to reach customers in their native language.

Can improve customer satisfaction through personalization. AI can personalize content, messaging, ads, recommendations and websites to individual customers.

AI-powered virtual agents are always available. AI programs do not need to sleep or take breaks, providing 24/7 service.

Disadvantages of AI

The following are some disadvantages of AI.

Expensive.

Requires deep technical expertise.

Limited supply of qualified workers to build AI tools.

Reflects the biases of its training data, at scale.

Lack of ability to generalize from one task to another.

Eliminates human jobs, increasing unemployment rates.

Strong AI vs. weak AI

AI can be categorized as weak or strong.

Weak AI, also known as narrow AI, is designed and trained to complete a specific task. Industrial robots and virtual personal assistants, such as Apple's Siri, use weak AI.

Strong AI, also known as artificial general intelligence (AGI), describes programming that can replicate the cognitive abilities of the human brain. When presented with an unfamiliar task, a strong AI system can use fuzzy logic to apply knowledge from one domain to another and find a solution autonomously. In theory, a strong AI program should be able to pass both a Turing test and the Chinese Room argument.

What are the 4 types of artificial intelligence?

Arend Hintze, an assistant professor of integrative biology and computer science and engineering at Michigan State University, explained that AI can be categorized into four types, beginning with the task-specific intelligent systems in wide use today and progressing to sentient systems, which do not yet exist. The categories are as follows.

Type 1: Reactive machines. These AI systems have no memory and are task-specific. An example is Deep Blue, the IBM chess program that beat Garry Kasparov in the 1990s. Deep Blue can identify pieces on a chessboard and make predictions, but because it has no memory, it cannot use past experiences to inform future ones.

Type 2: Limited memory. These AI systems have memory, so they can use past experiences to inform future decisions. Some of the decision-making functions in self-driving cars are designed this way.

Type 3: Theory of mind. Theory of mind is a psychology term. When applied to AI, it means the system would have the social intelligence to understand emotions. This type of AI will be able to infer human

intentions and predict behavior, a necessary skill for AI systems to become integral members of human teams.

Type 4: Self-awareness. In this category, AI systems have a sense of self, which gives them consciousness. Machines with self-awareness understand their own current state. This type of AI does not yet exist.

four types of ai.DAVID PETERSSON

These are commonly described as the four main types of AI.

What are examples of AI technology and how is it used today?

AI is incorporated into a variety of different types of technology. Here are seven examples.

Automation. When paired with AI technologies, automation tools can expand the volume and types of tasks performed. An example is robotic process automation (RPA), a type of software that automates repetitive, rules-based data processing tasks traditionally done by humans. When combined with machine learning and emerging AI tools, RPA can automate bigger portions of enterprise jobs, enabling RPA's tactical bots to pass along intelligence from AI and respond to process changes.

Machine learning. This is the science of getting a computer to act without programming. Deep learning is a subset of machine learning that, in very simple terms, can be thought of as the automation of predictive analytics. There are three types of machine learning algorithms:

Supervised learning. Data sets are labeled so that patterns can be detected and used to label new data sets.

Unsupervised learning. Data sets aren't labeled and are sorted according to similarities or differences.

Reinforcement learning. Data sets aren't labeled but, after performing an action or several actions, the AI system is given feedback.

Machine vision. This technology gives a machine the ability to see. Machine vision captures and analyzes visual information using a camera, analog-to-digital conversion and digital signal processing. It is often compared to human eyesight, but machine vision isn't bound by biology and can be programmed to see through walls, for example. It is used in a range of applications from signature identification to medical image analysis. Computer vision, which is focused on machine-based image processing, is often conflated with machine vision.

Natural language processing (NLP). This is the processing of human language by a computer program. One of the older and best-known examples of NLP is spam detection, which looks at the subject line and

text of an email and decides if it's junk. Current approaches to NLP are based on machine learning. NLP tasks include text translation, sentiment analysis and speech recognition.

Robotics. This field of engineering focuses on the design and manufacturing of robots. Robots are often used to perform tasks that are difficult for humans to perform or perform consistently. For example, robots are used in car production assembly lines or by NASA to move large objects in space. Researchers also use machine learning to build robots that can interact in social settings.

Self-driving cars. Autonomous vehicles use a combination of computer vision, image recognition and deep learning to build automated skills to pilot a vehicle while staying in a given lane and avoiding unexpected obstructions, such as pedestrians.

Text, image and audio generation. Generative AI techniques, which create various types of media from text prompts, are being applied extensively across businesses to create a seemingly limitless range of content types from photorealistic art to email responses and screenplays.