Artificial intelligence (**AI**) is intelligence—perceiving, synthesizing, and inferring information—demonstrated by machines, as opposed to intelligence displayed by animals and humans. Example tasks in which this is done include speech recognition, computer vision, translation between (natural) languages, as well as other mappings of inputs. The *Oxford English Dictionary* of Oxford University Press defines artificial intelligence as:[1]

the theory and development of computer systems able to perform tasks that normally require human intelligence, such as visual perception, speech recognition, decision-making, and translation between languages.

AI applications include advanced web search engines (e.g., Google), recommendation systems (used by YouTube, Amazon and Netflix), understanding human speech (such as Siri and Alexa), self-driving cars (e.g., Tesla), automated decision-making and competing at the highest level in strategic game systems (such as chess and Go).[2] As machines become increasingly capable, tasks considered to require "intelligence" are often removed from the definition of AI, a phenomenon known as the AI effect.[3] For instance, optical character recognition is frequently excluded from things considered to be AI,[4] having become a routine technology.[5]

Artificial intelligence was founded as an academic discipline in 1956, and in the years since has experienced several waves of optimism,[6][7] followed by disappointment and the loss of funding (known as an "AI winter"),[8][9] followed by new approaches, success and renewed funding.[7][10] AI research has tried and discarded many different approaches since its founding, including simulating the brain, modeling human problem solving, formal logic, large databases of knowledge and imitating animal behavior. In the first decades of the 21st century, highly mathematical-statistical machine learning has dominated the field, and this technique has proved highly successful, helping to solve many challenging problems throughout industry and academia.[10][11]

The various sub-fields of AI research are centered around particular goals and the use of particular tools. The traditional goals of AI research include reasoning, knowledge representation, planning, learning, natural language processing, perception, and the ability to move and manipulate objects.[a] General intelligence (the ability to solve an arbitrary problem) is among the field's long-term goals.[12] To solve these problems, AI researchers have adapted and integrated a wide range of problem-solving techniques – including search and mathematical optimization, formal logic, artificial neural networks, and methods based on statistics, probability and economics. AI also draws upon computer science, psychology, linguistics, philosophy, and many other fields.

Learning

Main article: Machine learning

Machine learning (ML), a fundamental concept of AI research since the field's inception,[j] is the study of computer algorithms that improve automatically through experience.[k]

Unsupervised learning finds patterns in a stream of input. Supervised learning requires a human to label the input data first, and comes in two main varieties: classification and numerical regression. Classification is used to determine what category something belongs in – the program sees a number of examples of things from several categories and will learn to classify new inputs. Regression is the attempt to produce a function that describes the relationship between inputs and outputs and predicts how the outputs should change as the inputs change. Both classifiers and regression learners can be viewed as "function approximators" trying to learn an unknown (possibly implicit) function; for example, a spam classifier can be viewed as learning a function that maps from the text of an email to one of two categories, "spam" or "not spam".[65] In reinforcement learning the agent is rewarded for good responses and punished for bad ones. The agent classifies its responses to form a strategy for operating in its problem space.[66] Transfer learning is when the knowledge gained from one problem is applied to a new problem.[67]

Computational learning theory can assess learners by computational complexity, by sample complexity (how much data is required), or by other notions of optimization.[68]