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Artificial intelligence (AI), the ability of a digital computer or computer-controlled robot to perform tasks commonly associated with intelligent beings. The term is frequently applied to the project of developing systems endowed with the intellectual processes characteristic of humans, such as the ability to reason, discover meaning, generalize, or learn from past experience. Since the development of the digital computer in the 1940s, it has been demonstrated that computers can be programmed to carry out very complex tasks—as, for example, discovering proofs for mathematical theorems or playing chess—with great proficiency.

Babbage, Charles, (born December 26, 1791, London, England—died October 18, 1871, London), English mathematician and inventor who is credited with having conceived the first automatic digital computer.

Colossus, also called Mark I, early electronic computer, built during World War II in England. The exigencies of war gave impetus and funding to computer research. In Britain, for example, the impetus was code breaking. The Ultra project was funded with much secrecy to develop the technology necessary to crack ciphers and codes produced by German electromechanical devices such as the Schlüsselzusatz SZ40, produced in 1940 by the Lorenz company and code-named Tunny by the British. Colossus was designed by engineer Thomas Flowers to crack Tunny.

Connectionism, an approach to artificial intelligence (AI) that developed out of attempts to understand how the human brain works at the neural level and, in particular, how people learn and remember.

Cryptography, Practice of the enciphering and deciphering of messages in secret code in order to render them unintelligible to all but the intended receiver. Cryptography may also refer to the art of cryptanalysis, by which cryptographic codes are broken. Collectively, the science of secure and secret communications, involving both cryptography and cryptanalysis, is known as cryptology.

ENIAC, in full Electronic Numerical Integrator and Computer, the first programmable general-purpose electronic digital computer, built during World War II by the United States···ENIAC was something less than the dream of a universal computer. Designed for the specific purpose of computing values for artillery range tables, it lacked some features that would have made it a more generally useful machine.

Enigma, device used by the German military command to encode strategic messages before and during World War II. The Enigma code was first broken by the Poles, under the leadership of mathematician Marian Rejewski, in the early 1930s. In 1939, with the growing

likelihood of a German invasion, the Poles turned their information over to the British, who set up a secret code-breaking group, known as Ultra, under mathematician Alan M. Turing.

Expert system, a computer program that uses artificial intelligence to solve problems within a specialized domain that ordinarily requires human expertise. The first expert system was developed in 1965 by Edward Feigenbaum and Joshua Lederberg of Stanford University in California, U.S. Dendral, as their expert system was later known, was designed to analyze chemical compounds. Expert systems now have commercial applications in fields as diverse as medical diagnosis, petroleum engineering, and financial investing.

Flowers, Tommy, British engineer who led the developers of Colossus, one of the first electronic digital computers, which broke complex codes used by the Germans during World War II and thus enabled the Allies to gain valuable military information; the use of Colossus was said to have shortened the war by two years

Gödel, Kurt, Gödel also spelled Goedel   (born April 28, 1906, Brünn, Austria-Hungary [now Brno, Czech Rep.]—died Jan. 14, 1978, Princeton, N.J., U.S.), Austrian-born mathematician, logician, and philosopher who obtained what may be the most important mathematical result of the 20th century: his famous incompleteness theorem, which states that within any axiomatic mathematical system there are propositions that cannot be proved or disproved on the basis of the axioms within that system; thus, such a system cannot be simultaneously complete and consistent.

Incompleteness theorem, in foundations of mathematics, either of two theorems proved by the Austrian-born American logician Kurt Gödel. In 1931 Gödel published his first incompleteness theorem··· This theorem established that it is impossible to use the axiomatic method to construct a formal system for any branch of mathematics containing arithmetic that will entail all of its truths. In other words, no finite set of axioms can be devised that will produce all possible true mathematical statements, so no mechanical (or computer-like) approach will ever be able to exhaust the depths of mathematics. The second incompleteness theorem follows as an immediate consequence, or corollary, from Gödel's paper··· The second incompleteness theorem shows that a formal system containing arithmetic cannot prove its own consistency. In other words, there is no way to show that any useful formal system is free of false statements.

King, Ada, countess of Lovelace, original name Augusta Ada Byron, Lady Byron   (born December 10, 1815, Piccadilly Terrace, Middlesex [now in London], England—died November 29, 1852, Marylebone, London), English mathematician, an associate of Charles Babbage, for whose prototype of a digital computer she created a program. She has been called the first computer programmer.

Neural network, a computer program that operates in a manner analogous to the natural neural network in the brain...A distinguishing feature of neural networks is that knowledge

is distributed throughout the network itself rather than being explicitly written into the program. The network then learns through exposure to various situations. Neural networks are able to accomplish this because they are built of processing elements (artificial neurons) grouped into layers

Stored-program concept, Storage of instructions in computer memory to enable it to perform a variety of tasks in sequence or intermittently. The idea was introduced in the late 1940s by John von Neumann, who proposed that a program be electronically stored in binary-number format in a memory device so that instructions could be modified by the computer as determined by intermediate computational results. Other engineers, notably John W. Mauchly and J. Presper Eckert, contributed to this idea, which enabled digital computers to become much more flexible and powerful. Nevertheless, engineers in England built the first stored-program computer, the Manchester Mark I, shortly before the Americans built EDVAC, both operational in 1949.

Turing, Alan, in full Alan Mathison Turing (born June 23, 1912, London, England—died June 7, 1954, Wilmslow, Cheshire), British mathematician and logician, who made major contributions to mathematics, cryptanalysis, logic, philosophy, and biology and to the new areas later named computer science, cognitive science, artificial intelligence, and artificial life...Turing was a founding father of modern cognitive science and a leading early exponent of the hypothesis that the human brain is in large part a digital computing machine. He theorized that the cortex at birth is an "unorganised machine" that through "training" becomes organized "into a universal machine or something like it." A pioneer of artificial intelligence, Turing proposed (1950) what subsequently became known as the Turing test as a criterion for whether a machine thinks.

Turing machine, hypothetical computing device introduced in 1936 by the English mathematician and logician Alan M. Turing. Turing originally conceived the machine as a mathematical tool that could infallibly recognize undecidable propositions—i.e., those mathematical statements that, within a given formal axiom system, cannot be shown to be either true or false.

Turing test (Imitation game), in artificial intelligence, a test proposed (1950) by the English mathematician Alan M. Turing to determine whether a computer can "think"...Turing predicted that by the year 2000 a computer "would be able to play the imitation game so well that an average interrogator will not have more than a 70-percent chance of making the right identification (machine or human) after five minutes of questioning." No computer has come close to this standard.

Ultra, Allied intelligence project that tapped the very highest level of encrypted communications of the German armed forces, as well as those of the Italian and Japanese armed forces, and thus contributed to the Allied victory in World War II. At Bletchley Park, a British government establishment located north of London, a small group of code breakers

developed techniques for decrypting intercepted messages that had been coded by German operators using electrical cipher machines, the most important of which were the Enigma and, later in the war, the sophisticated Tunny machine. The flood of high-grade military intelligence produced by Bletchley Park was code-named Ultra (from "Top Secret Ultra"). According to some experts, Ultra may have hastened Germany's defeat by as much as two years.

Von Neumann, John, original name János Neumann (born December 28, 1903, Budapest, Hungary—died February 8, 1957, Washington, D.C., U.S.), Hungarian-born American mathematician. As an adult, he appended von to his surname; the hereditary title had been granted his father in 1913. Von Neumann grew from child prodigy to one of the world's foremost mathematicians by his mid-twenties. Important work in set theory inaugurated a career that touched nearly every major branch of mathematics.