

Title: Geoffrey Hinton

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Geoffrey Everest Hinton (born 6 December 1947) is a British-Canadian computer scientist , cognitive scientist , and cognitive psychologist known for his work on artificial neural networks , which earned him the title "the Godfather of AI". [9]

Hinton is University Professor Emeritus at the University of Toronto . From 2013 to 2023, he divided his time working for Google (Google Brain) and the University of Toronto before publicly announcing his departure from Google in May 2023, citing concerns about the many risks of artificial intelligence (AI) technology. [10] [11] In 2017, he co-founded and became the chief scientific advisor of the Vector Institute in Toronto. [12] [13]

With David Rumelhart and Ronald J. Williams , Hinton was co-author of a highly cited paper published in 1986 that popularised the backpropagation algorithm for training multi-layer neural networks, [14] although they were not the first to propose the approach. [15] Hinton is viewed as a leading figure in the deep learning community. [21] The image-recognition milestone of the AlexNet designed in collaboration with his students Alex Krizhevsky [22] and Ilya Sutskever for the ImageNet challenge 2012 [8] was a breakthrough in the field of computer vision. [23]

Hinton received the 2018 Turing Award , together with Yoshua Bengio and Yann LeCun for their work on deep learning. [24] They are sometimes referred to as the "Godfathers of Deep Learning" [25] [26] and have continued to give public talks together. [27] [28] He was also awarded, along with John Hopfield , the 2024 Nobel Prize in Physics for 'See Tfd' foundational discoveries and inventions that enable machine learning with artificial neural networks . [29] [30]

In May 2023, Hinton announced his resignation from Google to be able to "freely speak out about the risks of A.I." [31] He has voiced concerns about deliberate misuse by malicious actors , technological unemployment , and existential risk from artificial general intelligence . [32] He noted that establishing safety guidelines will require cooperation among those competing in use of AI in order to avoid the worst outcomes. [33] After receiving the Nobel Prize, he called for urgent research into AI safety to figure out how to control AI systems smarter than humans. [34] [35] [36]

Education

Hinton was born on 6 December 1947 [37] in Wimbledon , England, and was educated at Clifton College in Bristol. [38] In 1967, he enrolled as an undergraduate student at King's College, Cambridge , and after repeatedly switching between different fields, like natural sciences , history of art , and philosophy , he eventually graduated with a Bachelor of Arts degree in experimental psychology at the University of Cambridge in 1970. [37] [39] He spent a year apprenticing

carpentry before returning to academic studies. [40] From 1972 to 1975, he continued his study at the University of Edinburgh , where he was awarded a PhD in artificial intelligence in 1978 for research supervised by Christopher Longuet-Higgins , who favored the symbolic AI approach over the neural network approach. [39] [41] [42] [40]

Career and research

After his PhD, Hinton initially worked at the University of Sussex and at the MRC Applied Psychology Unit . After having difficulty getting funding in Britain, [40] he worked in the US at the University of California, San Diego and Carnegie Mellon University . [37] He was the founding director of the Gatsby Charitable Foundation Computational Neuroscience Unit at University College London . [37] He is currently [update] [43] University Professor Emeritus in the Department of Computer Science at the University of Toronto , where he has been affiliated since 1987. [44]

Upon arrival in Canada, Geoffrey Hinton was appointed at the Canadian Institute for Advanced Research (CIFAR) in 1987 as a Fellow in CIFAR's first research program, Artificial Intelligence, Robotics & Society. [45] In 2004, Hinton and collaborators successfully proposed the launch of a new program at CIFAR, "Neural Computation and Adaptive Perception" [46] (NCAP), which today is named "Learning in Machines & Brains". Hinton would go on to lead NCAP for ten years. [47] Among the members of the program are Yoshua Bengio and Yann LeCun , with whom Hinton would go on to win the ACM A.M. Turing Award in 2018. [48] All three Turing winners continue to be members of the CIFAR Learning in Machines & Brains program. [49]

Hinton taught a free online course on Neural Networks on the education platform Coursera in 2012. [50] He co-founded DNNresearch Inc. in 2012 with his two graduate students Alex Krizhevsky and Ilya Sutskever at the University of Toronto's department of computer science. In March 2013, Google acquired DNNresearch Inc. for \$44 million, and Hinton planned to "divide his time between his university research and his work at Google". [51] [52] [53]

Hinton's research concerns ways of using neural networks for machine learning , memory , perception , and symbol processing. He has written or co-written more than 200 peer-reviewed publications. [1] [54]

While Hinton was a postdoc at UC San Diego, David E. Rumelhart and Hinton and Ronald J. Williams applied the backpropagation algorithm to multi-layer neural networks. Their experiments showed that such networks can learn useful internal representations of data. [14] In a 2018 interview, [55] Hinton said that " David E. Rumelhart came up with the basic idea of backpropagation, so it's his invention". Although this work was important in popularising backpropagation, it was not the first to suggest the approach. [15] Reverse-mode automatic differentiation , of which backpropagation is a special case, was proposed by Seppo Linnainmaa in 1970, and Paul Werbos proposed to use it to train neural networks in 1974. [15]

In 1985, Hinton co-invented Boltzmann machines with David Ackley and Terry Sejnowski . [56] His other contributions to neural network research include distributed representations , time delay neural network , mixtures of experts , Helmholtz machines and product of experts . [57] An accessible introduction to Geoffrey Hinton's research can be found in his articles in Scientific American in September 1992 and October 1993. [58] In 2007, Hinton coauthored an unsupervised learning paper titled Unsupervised learning of image transformations . [59] In 2008, he developed the visualization method t-SNE with Laurens van der Maaten. [60] [61]

In October and November 2017, Hinton published two open access research papers on the theme of capsule neural networks , [62] [63] which, according to Hinton, are "finally something that works well". [64]

At the 2022 Conference on Neural Information Processing Systems (NeurIPS), Hinton introduced a new learning algorithm for neural networks that he calls the "Forward-Forward" algorithm. The idea of the new algorithm is to replace the traditional forward-backward passes of backpropagation with two forward passes, one with positive (i.e. real) data and the other with negative data that could be generated solely by the network. [65] [66]

In May 2023, Hinton publicly announced his resignation from Google. He explained his decision by saying that he wanted to "freely speak out about the risks of A.I." and added that a part of him now regrets his life's work. [10] [31]

Notable former PhD students and postdoctoral researchers from his group include Peter Dayan , [67] Sam Roweis, [67] Max Welling , [67] Richard Zemel , [41] [2] Brendan Frey , [3] Radford M. Neal , [4] Yee Whye Teh , [5] Ruslan Salakhutdinov , [6] Ilya Sutskever , [7] Yann LeCun , [68] Alex Graves , [67] Zoubin Ghahramani , [67] and Peter Fitzhugh Brown . [69]

Honours and awards

Hinton is a Fellow of the US Association for the Advancement of Artificial Intelligence (FAAAI) since 1990. [70] He was elected a Fellow of the Royal Society of Canada (FRSC) in 1996, [71] and then a Fellow of the Royal Society of London (FRS) in 1998 . [72] He was the first winner of the Rumelhart Prize in 2001. [73] His certificate of election for the Royal Society reads:

Geoffrey E. Hinton is internationally known for his work on artificial neural nets, especially how they can be designed to learn without the aid of a human teacher. He has compared effects of brain damage with effects of losses in such a net, and found striking similarities with human impairment, such as for recognition of names and losses of categorisation. His work includes studies of mental imagery, and inventing puzzles for testing originality and creative intelligence. It is conceptual, mathematically sophisticated, and experimental. He brings these skills together with striking effect to produce important work of great interest. [74]

In 2001, Hinton was awarded an honorary Doctor of Science (DSc) degree from the University of Edinburgh . [39] [75] He was awarded as International Honorary Member of the American Academy of Arts and Sciences in 2003. [76] Also, in this year he was elected a Fellow of the US Cognitive Science Society . [77] He was the 2005 recipient of the IJCAI Award for Research Excellence lifetime-achievement award. [78] He was awarded the 2011 Herzberg Canada Gold Medal for Science and Engineering . [79] In that same year, he also was awarded an honorary DSc degree from the University of Sussex [39] In 2012, he received the Canada Council Killam Prize in Engineering. In 2013, he was awarded an honorary doctorate from the Université de Sherbrooke . [39] [80] Hinton was elected an Honorary Foreign Member of the Spanish Royal Academy of Engineering in 2015. [39]

In 2016, Hinton was elected an International Member of the US National Academy of Engineering "for contributions to the theory and practice of artificial neural networks and their application to speech recognition and computer vision". [81] [82] He received the 2016 IEEE/RSE Wolfson James Clerk Maxwell Award . [83] In 2016, he furthermore won the BBVA Foundation Frontiers of Knowledge Award in the Information and Communication Technologies category, "for his pioneering and highly influential work" to endow machines with the ability to learn. [84]

Together with Yann LeCun , and Yoshua Bengio , Hinton won the 2018 Turing Award for conceptual and engineering breakthroughs that have made deep neural networks a critical component of computing. [85] [86] [87] Also in 2018, he became a Companion of the Order of Canada (CC). [88] In 2021, he received the Dickson Prize in Science from the Carnegie Mellon University [89] and in 2022 the Princess of Asturias Award in the Scientific Research category, along with Yann LeCun , Yoshua Bengio , and Demis Hassabis . [90] In the same year, Hinton received an Honorary DSc degree from the University of Toronto . [39] In 2023, he was named an ACM Fellow , [91] elected an International Member of the US National Academy of Sciences , [92] and received Lifeboat Foundation 's 2023 Guardian Award along with Ilya Sutskever. [93] In 2023, he was named a Highly Ranked Scholar by ScholarGPS for both lifetime and prior five years. [94]

In 2024, he was jointly awarded the Nobel Prize in Physics with John Hopfield "for foundational discoveries and inventions that enable machine learning with artificial neural networks." [95] His development of the Boltzmann machine was explicitly mentioned in the citation. [29] [96] When the New York Times reporter Cade Metz asked Hinton to explain in simpler terms how the Boltzmann machine could "pretrain" backpropagation networks, Hinton quipped that Richard Feynman reportedly said: "Listen, buddy, if I could explain it in a couple of minutes, it wouldn't be worth the Nobel Prize." [97] That same year, he received the VinFuture Prize grand award

alongside Yoshua Bengio , Yann LeCun , Jen-Hsun Huang , and Fei-Fei Li for groundbreaking contributions to neural networks and deep learning algorithms. [98]

In 2025 he was awarded the Queen Elizabeth Prize for Engineering jointly with Yoshua Bengio , Bill Dally , John Hopfield , Yann LeCun , Jen-Hsun Huang and Fei-Fei Li . [99] He was also awarded the King Charles III Coronation Medal . [100]

Views

Risks of artificial intelligence

In 2023, Hinton expressed concerns about the rapid progress of AI . [32] [31] He had previously believed that artificial general intelligence (AGI) was "30 to 50 years or even longer away." [31] However, in a March 2023 interview with CBS , he said that "general-purpose AI" might be fewer than 20 years away and could bring about changes "comparable in scale with the industrial revolution or electricity ." [32]

In an interview with The New York Times published on 1 May 2023, [31] Hinton announced his resignation from Google so he could "talk about the dangers of AI without considering how this impacts Google." [101] He noted that "a part of him now regrets his life's work". [31] [11]

In early May 2023, Hinton said in an interview with BBC that AI might soon surpass the information capacity of the human brain. He described some of the risks posed by these chatbots as "quite scary". Hinton explained that chatbots have the ability to learn independently and share knowledge, so that whenever one copy acquires new information, it is automatically disseminated to the entire group, allowing AI chatbots to have the capability to accumulate knowledge far beyond the capacity of any individual. [102] In 2025, he said "My greatest fear is that, in the long run, it'll turn out that these kind of digital beings we're creating are just a better form of intelligence than people. [...] We'd no longer be needed. [...] If you want to know how it's like not to be the apex intelligence, ask a chicken. [103]

Existential risk from AGI

Hinton has expressed concerns about the possibility of an AI takeover , stating that "it's not inconceivable" that AI could "wipe out humanity" . [32] Hinton said in 2023 that AI systems capable of intelligent agency would be useful for military or economic purposes. [104] He worries that generally intelligent AI systems could "create sub-goals" that are unaligned with their programmers' interests. [105] He says that AI systems may become power-seeking or prevent themselves from being shut off, not because programmers intended them to, but because those sub-goals are useful for achieving later goals . [102] In particular, Hinton says "we have to think hard about how to control" AI systems capable of self-improvement . [106]

Catastrophic misuse

Hinton reports concerns about deliberate misuse of AI by malicious actors, stating that "it is hard to see how you can prevent the bad actors from using [AI] for bad things." [31] In 2017, Hinton called for an international ban on lethal autonomous weapons . [107] In 2025, in an interview, Hinton cited the use of AI by bad actors to create lethal viruses one of the greatest existential threats posed in the short term. "It just requires one crazy guy with a grudge...you can now create new viruses relatively cheaply using AI. And you don't need to be a very skilled molecular biologist to do it." [108]

Economic impacts

Hinton was previously optimistic about the economic effects of AI, noting in 2018 that: "The phrase 'artificial general intelligence' carries with it the implication that this sort of single robot is suddenly going to be smarter than you. I don't think it's going to be that. I think more and more of the routine things we do are going to be replaced by AI systems." [109] Hinton had also argued that AGI would not make humans redundant: "[AI in the future is] going to know a lot about what you're probably going to want to do... But it's not going to replace you." [109]

In 2023, however, Hinton became "worried that AI technologies will in time upend the job market" and take away more than just "drudge work" . [31] He said in 2024 that the British government

would have to establish a universal basic income to deal with the impact of AI on inequality. [110] In Hinton's view, AI will boost productivity and generate more wealth. But unless the government intervenes, it will only make the rich richer and hurt the people who might lose their jobs. "That's going to be very bad for society," he said. [111]

At Christmas 2024 he had become somewhat more pessimistic, saying that there was a "10 to 20 percent chance" that AI would be the cause of human extinction within the following three decades (he had previously suggested a 10% chance, without a timescale). [112] He expressed surprise at the speed with which AI was advancing, and said that most experts expected AI to advance, probably in the next 20 years, to be "smarter than people ... a scary thought. ... So just leaving it to the profit motive of large companies is not going to be sufficient to make sure they develop it safely. The only thing that can force those big companies to do more research on safety is government regulation." [112] Another "godfather of AI", Yann LeCun , disagreed, saying AI "could actually save humanity from extinction". [112]

Politics

Hinton is a socialist . [113] He moved from the US to Canada in part due to disillusionment with Ronald Reagan –era politics and disapproval of military funding of artificial intelligence. [40]

In August 2024, Hinton co-authored a letter with Yoshua Bengio , Stuart Russell , and Lawrence Lessig in support of SB 1047 , a California AI safety bill that would require companies training models which cost more than US\$100 million to perform risk assessments before deployment. They said the legislation was the "bare minimum for effective regulation of this technology." [114] [115]

Personal life

Hinton's first wife, Rosalind Zalin, died of ovarian cancer in 1994; his second wife, Jacqueline "Jackie" Ford, died of pancreatic cancer in 2018. [9] [116]

Hinton is the great-great-grandson of the mathematician and educator Mary Everest Boole and her husband, the logician George Boole . [117] George Boole's work eventually became one of the foundations of modern computer science. Another great-great-grandfather of his was the surgeon and author James Hinton , [118] who was the father of the mathematician Charles Howard Hinton .

Hinton's father was the entomologist Howard Hinton . [37] [119] His middle name comes from another relative, George Everest , the Surveyor General of India after whom the mountain is named. [40] He is the nephew of the economist Colin Clark , [120] and nuclear physicist Joan Hinton , one of the two female physicists at the Manhattan Project , was his first cousin once removed. [121]

Hinton injured his back at age 19, which makes sitting painful for him. He has dealt with depression throughout his life. [122]

References

Further reading

Rothman, Joshua (20 November 2023). "Why the Godfather of A.I. Fears What He's Built" . The New Yorker . pp. 29– 39.

External links

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Colin Atkinson

David Barker

Jean Beggs

Harshad Bhadeshia

David Keith Bowen
Roger Cashmore
Andrew Casson
Thomas Cavalier-Smith
David W. Clarke
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1901: Röntgen

1902: Lorentz / Zeeman

1903: Becquerel / P. Curie / M. Curie

1904: Rayleigh

1905: Lenard

1906: J. J. Thomson

1907: Michelson

1908: Lippmann

1909: Marconi / Braun

1910: Van der Waals

1911: Wien

1912: Dalén

1913: Kamerlingh Onnes

1914: Laue

1915: W. L. Bragg / W. H. Bragg

1916

1917: Barkla

1918: Planck

1919: Stark

1920: Guillaume

1921: Einstein

1922: N. Bohr

1923: Millikan

1924: M. Siegbahn

1925: Franck / Hertz

1926: Perrin

1927: Compton / C. Wilson

1928: O. Richardson

1929: De Broglie

1930: Raman

1931

1932: Heisenberg

1933: Schrödinger / Dirac
1934
1935: Chadwick
1936: Hess / C. D. Anderson
1937: Davisson / G. P. Thomson
1938: Fermi
1939: Lawrence
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1943: Stern
1944: Rabi
1945: Pauli
1946: Bridgman
1947: Appleton
1948: Blackett
1949: Yukawa
1950: Powell
1951: Cockcroft / Walton
1952: Bloch / Purcell
1953: Zernike
1954: Born / Bothe
1955: Lamb / Kusch
1956: Shockley / Bardeen / Brattain
1957: C. N. Yang / T. D. Lee
1958: Cherenkov / Frank / Tamm
1959: Segrè / Chamberlain
1960: Glaser
1961: Hofstadter / Mössbauer
1962: Landau
1963: Wigner / Goeppert Mayer / Jensen
1964: Townes / Basov / Prokhorov
1965: Tomonaga / Schwinger / Feynman
1966: Kastler
1967: Bethe
1968: Alvarez
1969: Gell-Mann
1970: Alfvén / Néel

1971: Gabor
1972: Bardeen / Cooper / Schrieffer
1973: Esaki / Giaever / Josephson
1974: Ryle / Hewish
1975: A. Bohr / Mottelson / Rainwater
1976: Richter / Ting
1977: P. W. Anderson / Mott / Van Vleck
1978: Kapitsa / Penzias / R. Wilson
1979: Glashow / Salam / Weinberg
1980: Cronin / Fitch
1981: Bloembergen / Schawlow / K. Siegbahn
1982: K. Wilson
1983: Chandrasekhar / Fowler
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1985: von Klitzing
1986: Ruska / Binnig / Rohrer
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1989: Ramsey / Dehmelt / Paul
1990: Friedman / Kendall / R. Taylor
1991: de Gennes
1992: Charpak
1993: Hulse / J. Taylor
1994: Brockhouse / Shull
1995: Perl / Reines
1996: D. Lee / Osheroff / R. Richardson
1997: Chu / Cohen-Tannoudji / Phillips
1998: Laughlin / Störmer / Tsui
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2000: Alferov / Kroemer / Kilby
2001: Cornell / Ketterle / Wieman
2002: Davis / Koshiba / Giacconi
2003: Abrikosov / Ginzburg / Leggett
2004: Gross / Politzer / Wilczek
2005: Glauber / Hall / Hänsch
2006: Mather / Smoot
2007: Fert / Grünberg
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2011: Perlmutter / Schmidt / Riess
2012: Wineland / Haroche
2013: Englert / Higgs
2014: Akasaki / Amano / Nakamura
2015: Kajita / McDonald
2016: Thouless / Haldane / Kosterlitz
2017: Weiss / Barish / Thorne
2018: Ashkin / Mourou / Strickland
2019: Peebles / Mayor / Queloz
2020: Penrose / Genzel / Ghez
2021: Parisi / Hasselmann / Manabe
2022: Aspect / Clauser / Zeilinger
2023: Agostini / Krausz / L'Huillier
2024: Hopfield / Hinton

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David Baker (United States)
Demis Hassabis (United Kingdom)
John M. Jumper (United States)
Han Kang (South Korea)
Geoffrey Hinton (Canada/United Kingdom)
John Hopfield (United States)
Victor Ambros (United States)
Gary Ruvkun (United States)
Daron Acemoglu (Turkey/United States)
Simon Johnson (United Kingdom/United States)
James A. Robinson (United Kingdom/United States)

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Alan Perlis (1966)
Maurice Wilkes (1967)
Richard Hamming (1968)
Marvin Minsky (1969)
James H. Wilkinson (1970)

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Edsger W. Dijkstra (1972)
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1984: Antonio Garcia-Bellido
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2025: Mary-Claire King

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