

Yann LeCun

Yann LeCun is considered a living legend in Deep Learning and AI due to his wealth of contributions to these fields. Through his work in academia and industry, LeCun has revolutionised Deep Learning and enabled many of the advanced AI applications that we use in our daily lives. Indeed, the prestigious prizes and lavish praise which he has received from his peers demonstrate the importance of his contributions. In 2014, he won the IEEE Neural Network Pioneer Award and in 2018, he won the Turing Award for “*conceptual and engineering breakthroughs that made deep neural networks a critical component of computing*” (ACM, 2019). He shared this award with Yoshua Bengio and Geoffrey Hinton, a trio often referred to as the “*Godfathers of AI*” (Shead, 2019). In this biography, I will examine LeCun’s career as he persevered with his research and made ground-breaking contributions to the field of AI despite scepticism from the scientific community during the “AI Winter”.

LeCun was born in the suburbs of Paris in 1960. His father, employed as an engineer, instilled an early love for electronics and mechanics in him (ACM, 2018). Indeed, LeCun first became interested in the topic of Machine Intelligence at age ten when he saw the super-intelligent AI *Hal9000* in Stanley Kubrick’s *2001: A Space Odyssey* (Tverdohle, 2015). LeCun pursued his passion in university, as he earned a *Diplôme d’Ingénieur*, roughly equivalent to a Master’s degree, from the *ESIEE Paris* in 1983. However, it wasn’t until he embarked upon his PhD at Sorbonne University that he made his first critical contributions to the field of Deep Learning. In his PhD thesis, “*Modeles connexionnistes de l’apprentissage*” (LeCun, 1987), translated as “*connectionist learning models*”, LeCun introduced the back-propagation algorithm.

The back-propagation algorithm was a revolutionary method for training certain types of *neural networks*. Neural networks are computer systems that “reflect the behavior of the human brain, allowing computer programs to recognize patterns and solve common problems in the fields of AI, machine learning, and deep learning” (IBM, 2020). Neural networks gained significant interest in the computer science community when first introduced, as their ability to recognise patterns in data without human intervention seemed to beckon a golden age of AI. Unfortunately, interest in neural networks quickly dissipated, as the computing resources and datasets required to train them weren’t available. Moreover, fine-tuning the neural network was a long, complex process. Research funding became sparse and conferences were reluctant to accept papers on the topic. LeCun’s back-propagation algorithm provided an efficient way to train and fine-tune neural networks.

Upon completing his PhD, LeCun spent one year as a research associate at the University of Toronto on a post-doctoral fellowship. Subsequently, he joined AT&T Bell Laboratories, a world-renowned research and scientific development company, in 1988. At Bell Labs, LeCun pioneered the Convolutional Neural Network. This was a new neural network architecture, inspired by the connections between neurons seen in the visual cortex of the brain. Using LeCun’s back-propagation algorithm, this neural network could train itself to recognise visual patterns in images without human intervention. Today, Convolutional Neural Networks are indispensable in our daily lives, as they power a vast variety of Computer Vision applications, from facial recognition to driverless cars.

LeCun also paved the way for significant advances in Optical Character Recognition (OCR), the process of converting an image of text into machine-encoded text. In 1993, LeCun demonstrated LeNet 1, the “first convolutional network that could recognize handwritten digits with good speed and accuracy” (LeCun, 2014). Indeed, when LeCun tested LeNet 1 on images of zipcode digits provided by the US Postal Service, he found that the neural network had a phenomenally low error rate of ~1% and a reject rate of ~9% (LeCun, et al., 1990). LeCun made further contributions to the field of OCR with the development of a new neural network architecture, called the *graph transformer network*. Using this neural network, LeCun built an OCR software for bank checks (LeCun, et al., 1997). This software would be adopted by banks across the globe to read cheques, with this technology “*reading between 10 and 20% of all the checks in the US in the early 2000s*” (LeCun, 2015).

LeCun's research helped to end the “AI Winter” of the ‘80s and ‘90s and ushered in a new era of research and funding into AI. Thanks to LeCun's work, governments and businesses could see the potential of AI and use it to solve real problems. As fellow AI researcher Geoffrey Hinton stated, “He kind of carried the torch through the dark ages” (Hernandez, 2014). LeCun reaped the rewards of his work, as he became the head of the Image Processing Research Department at AT&T Labs-Research in 1996. In 2003, LeCun left AT&T Labs-Research to become a professor of Computer Science at the Courant Institute of Mathematical Sciences in New York University. While at NYU, LeCun continued to research and teach “machine learning, AI, data science, computer vision, robotics, computational neuroscience, and knowledge extraction from data” (LeCun, 2021). In 2008, he became a Silver Professor and in 2013 he became the Founding Director of the NYU Centre for Data Science. Today, the NYU Center for Data Science has over 65 associate and affiliate faculty and 48 PhD students.

Over the past decade, the popularity of Deep Learning has exploded, as firms worldwide have sought to use this technology to train AI using their vast stores of data. As a result, Mark Zuckerberg handpicked LeCun to become the first director of Facebook AI Research (Hernandez, 2014). In 2018, LeCun would leave this post to become the VP & Chief AI Scientist at Facebook. Under LeCun's tenure, Facebook has made significant advances in the field of AI. For example, Facebook's object detection software for images, Mask R-CNN, won the International Conference on Computer Vision's award for Best Paper in 2017 (Facebook, 2018). This software has continued to improve and today it is used in several production applications for Facebook. Despite this success, Facebook's AI Research team faces scrutiny over the ethical concerns of their work. Facebook's algorithms are accused of spreading misinformation, failing to identify hate speech, and enabling malicious actors to influence elections.

In conclusion, LeCun leaves a tremendous legacy in the fields of Deep Learning and AI. His development of OCR applications using neural networks enabled a renaissance within the field, as they demonstrated a successful real-life use case for neural networks. Indeed, LeCun's contributions with papers on the back-propagation algorithm and Convolutional Neural Networks were also critical in the widespread adoption of Deep Learning, particularly for image analysis. After LeCun's contributions helped to end the “AI Winter”, he continued his research from a prestigious professorship at NYU and a powerful position as Facebook's Chief AI Scientist. His academic publications have received over 218,000 citations, with over 180,000 of these citations coming since 2016 (Google Scholar, 2021). As his peers have repeatedly stated, he truly is one of the “Godfathers of AI”.

Bibliography

ACM, 2018. *Yann LeCun Biography*. [Online]

Available at: https://amturing.acm.org/award_winners/lecun_6017366.cfm

[Accessed 25 October 2021].

ACM, 2019. *Fathers of the Deep Learning Revolution Receive ACM A.M. Turing Award*. [Online]

Available at: <https://www.acm.org/media-center/2019/march/turing-award-2018>

[Accessed 25 October 2021].

Brown, B., 2011. *Why there's no Nobel Prize in Computing*. [Online]

Available at: <https://www.networkworld.com/article/2177705/data-center-why-there-s-no-nobel-prize-in-computing.html>

[Accessed 24 October 2021].

Facebook, 2018. *FAIR turns five: What we've accomplished and where we're headed*. [Online]

Available at: <https://engineering.fb.com/2018/12/05/ai-research/fair-fifth-anniversary/>

[Accessed 29 October 2021].

Google Scholar, 2021. *Yann LeCun*. [Online]

Available at: <https://scholar.google.com/citations?user=WLN3QrAAAAAJ&hl=en>

[Accessed 28 October 2021].

Hernandez, D., 2014. *Facebook's Quest to Build an Artificial Brain Depends on This Guy*. [Online]

Available at: <https://www.wired.com/2014/08/deep-learning-yann-lecun/>

[Accessed 26 October 2021].

IBM, 2020. *Neural Networks*. [Online]

Available at: <https://www.ibm.com/uk-en/cloud/learn/neural-networks>

[Accessed 26 October 2021].

LeCun, Y., 1987. *Modeles connexionnistes de l'apprentissage*, Paris: Universite P. et M. Curie (Paris 6).

LeCun, Y., 2014. *Convolutional Network Demo from 1993* [Interview] 2014.

LeCun, Y., 2015. *Biographical Sketch*. [Online]

Available at: <http://yann.lecun.com/ex/bio.html>

[Accessed 28 October 2021].

LeCun, Y., 2021. *LinkedIn*. [Online]

Available at: <https://www.linkedin.com/in/yann-lecun-0b999/>

[Accessed 28 October 2021].

LeCun, Y. et al., 1990. *Handwritten Digit Recognition with a Back-Propagation Network*, s.l.: NIPS.

LeCun, Y., Bottou, L. & Bengio, Y., 1997. *Reading checks with multilayer graph transformer networks*, Munich: IEEE.

Shed, S., 2019. *The 3 'Godfathers' Of AI Have Won The Prestigious \$1M Turing Prize*. [Online]

Available at: <https://www.forbes.com/sites/samshead/2019/03/27/the-3-godfathers-of-ai-have-won-the-prestigious-1m-turing-prize/?sh=36258f28549b>

[Accessed 25 October 2021].

Tverdohleb, V., 2015. *Top Minds Share What Inspired Them To Get Into The Field of Artificial Intelligence*. [Online]

Available at: <https://www.itechpost.com/articles/15471/20150731/top-minds-share-what-inspired-them-to-get-into-the-field-of-artificial-intelligence.htm>

[Accessed 25 October 2021].