

Is Artificial Intelligence (AI) the solution to saving ophthalmologists' time?

How data scientists at Roche are using next-generation tools to help raise the standard of care for millions of people living with vision impairment

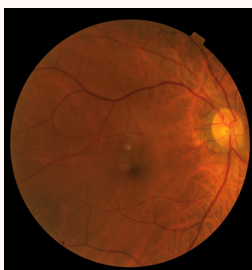
1.8 billion people will be living with vision impairments by 2025.¹ It's a shockingly high number, and one that will only continue to rise thanks to an ageing population and an increasing number of people living with conditions like diabetes, which can lead to vision problems. That's 1.8 billion people affected by the day-to-day impact of vision loss, as well as the knock-on effect on all their families, friends and caregivers. It's easy to see how the impact on society and the healthcare system could easily spiral out of control.



"That's why recent advances in artificial intelligence and machine learning are so urgently needed and expected to benefit the field of ophthalmology," explains Daniela Ferrara, MD PhD FASRS, who is Principal Medical Director at Genentech and Assistant Professor of Ophthalmology at Tufts University. *"These AI-based tools that enable advanced retinal imaging analysis*

can help reduce disease burden in real-world clinical practice, by saving time and empowering patients and clinical experts to make more informed decisions. For example, the tools have the potential to enable early and precise diagnosis and may help us to predict disease progression."

Additionally, Daniela shares that, despite witnessing huge progress in the development of new therapies over the past few years, the process continues to be challenging. *"When deployed in clinical trials, AI-based tools can accelerate drug development and increase our chances to successfully deliver innovative new treatment options for patients."*



Which is exactly why Roche continues to invest in the development of artificial intelligence (AI) and machine learning (ML) tools and algorithms for ophthalmology. One example of an AI tool Roche has developed, looks at the different layers of retinal images known as OCT (optical coherence tomography) via a process called image segmentation. By looking

at these images in segments, the tool can quickly and reliably identify potential biomarkers, which in turn can help with diagnosis and inform care choices.² Other ML tools have been developed including segmentation, which Roche is also using in geographic atrophy (GA) and diabetic retinopathy (DR) studies. *"It typically takes up to 30 minutes for an experienced physician to analyse one 3D retinal scan using OCT, but AI tools can analyse the full data set in seconds,"* explains Daniela, *"By using tools, we could free up ophthalmologists' time, speed up diagnosis and hopefully help raise standards of care."*



"We have one of the broadest retina pipelines in ophthalmology and by developing AI and ML models in house, we can gather results from our clinical trials much faster. This has benefits, not only in terms of speeding up the delivery of potential new treatments, but also by freeing up investigator time and reducing the costs associated with running

trials and analysing data," says Sascha Fauser, Global Head of Ophthalmology at Roche Pharma Research and Early Development (pRED), who is another a big advocate for the potential of AI and ML in ophthalmology. Roche is working with top-notch scientists alongside some of the largest data generation capabilities and datasets to advance the company's efforts in this space.

"Roche is currently using AI models in 17 clinical studies using OCT segmentation, 12 programmes using GA segmentation, and 11 using DR segmentations. We are already getting results and it was great to have data on some of these programmes presented at ARVO," adds Daniela.

One study presented at ARVO showed that ML tools were able to predict vision improvements after four and 24 weeks of treatment for diabetic macular edema (DME), as measured by best corrected visual acuity (BCVA).³ The study showed that after week 25, the ML predictions were less reliable with researchers concluding that more advanced modelling, new input features, or larger data sets may be needed to improve the longer-term application of the tool.³

"Working with AI and ML isn't without its challenges," acknowledges Sascha, especially when it comes to ensuring that algorithms are effective and inclusive – properly representing the patient community. Despite these hurdles, the opportunities are vast for both patients and ophthalmologists. *"AI can help us get a deeper understanding of the disease biology behind whether a patient does or does not respond to the standard of care. Ultimately, this will allow us to deliver multiplicative rather than incremental benefits to patients. Personally, I am excited to see what the future holds for AI and ML in ophthalmology."*

1. Burton MJ et al. The Lancet Global Health Commission on Global Eye Health: vision beyond 2020. *The Lancet Global Health*. 2021 Feb;9(4): E489-E551. doi: 10.1016/S2214-109X(20)30488-5.
2. Moraru AD et al. Artificial intelligence and deep learning in ophthalmology - present and future (Review). *Experimental and Therapeutic Medicine*. 2020 Oct;20(4):3469-3473. doi: 10.3892/etm.2020.9118.
3. Kikuchi Y et al. Predicting functional outcomes for different treatment durations of faricimab in diabetic macular edema (DME). *The Association for Research in Vision and Ophthalmology 2024 Annual Meeting*. Seattle Washington, US. May 07. 3754 – B0417.