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Early detection of eye disorders using AI

Voxeleron transforms what's possible in 3D ophthalmic image analysis using artificial intelligence, deep learning and a Dell Precision workstation

voxeleron

Biotechnology & Science | United States

Business needs

To provide ophthalmologists with greater clinical insight from ophthalmic imagery, Voxeleron needed an IT solution that could support the analysis of 3D images using artificial intelligence (AI). And it needed to accelerate deep-learning research to facilitate novel architectural experimentation in building AI models to improve diagnostic performance.

Solutions at a glance

- Dell Precision 7920 Tower workstation with 2 Intel® Xeon® SP Gold CPUs, 3 NVIDIA Quadro GV100 GPUs, 384GB of RAM and 13TB of storage

Business results

- Enables 3D analysis of ocular images using AI
- Drives an industry-leading discovery relating to eye disease progression
- Triples performance of all AI processes
- Allows for greater experimentation and improved outcomes
- Increases collaboration with leading global universities and medical centers
- Improves innovation including possible product options

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Daniel Russakoff
Co-founder and Principal Scientist, Voxeleron

Modern imaging equipment has dramatically improved patient outcomes through early detection of diseases. However, there's much room for improvement, especially when it comes to the analysis of 3D ocular images. That's because the retina is so incredibly complex that it's difficult to develop software tools that detect early indicators of disease onset and progression.

The founders and principal scientists of startup company Voxeleron, Daniel Russakoff and Jonathan Oakley, wanted to solve this problem by using artificial intelligence (AI). Initially, they developed machine-learning and deep-learning models for analyzing images captured by optical coherence tomography (OCT) machines. However, given the limitations of their high-performance desktops, they could only analyze the 3D images in 2D. "The best way to analyze OCT images is in their native 3D format," explains Oakley. "But our existing systems couldn't support such huge volumes of data and the millions of parameters that can result in building 3D models."

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Tripling the performance of AI processes—and gaining 3D insights

Oakley and Russakoff evaluated deep-learning workstations from Dell and Lambda Labs as well as cloud-computing resources from Amazon Web Services—and chose a Dell solution. "When it comes to managing deep learning and other forms of machine learning, I put the Dell Precision 7920 Tower on the top of the list," says Russakoff. "It's a true AI machine. Along with having the number of NVIDIA Quadro GV100 GPUs we wanted, the Precision 7920 also has the right amount of RAM to power 3D AI models." The new workstation, which was affectionately named Homer by Oakley and Russakoff, delivers more than three times the performance of the company's previous AI desktop. Oakley says, "We're doing all sorts of analysis now with our Precision workstation that just wasn't possible before."

Greater experimentation leads to better results

Voxeleron realized immediate improvements in AI architecture runtimes and results. "Within two weeks of having the new Dell Precision workstation and its NVIDIA Quadro GV100 cards, I was able to improve the accuracy of a deep-learning model we were working on for a conference," explains Russakoff. "If we had chosen a subscription-based Amazon model, it would have cost hundreds of dollars to experiment with parameters and weights, so I would have likely given up much earlier." Oakley says, "And, overall, our extra costs would have been well into the thousands by now. That ability to experiment and make mistakes means we can innovate faster. And by keeping data onsite, we're also able to collaborate with researchers whose data-transfer agreements don't allow putting data in the public cloud."

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Industry-first insight relating to AMD progression

Russakoff and Oakley have built 3D AI models that can help improve the diagnosis of glaucoma and the progression of age-related macular degeneration (AMD). "We've established a preliminary connection in changes of the retina and the conversion from dry to wet AMD using deep learning and our Dell Precision tower," Russakoff explains. "The results we're realizing using our deep-learning approach are clearly better than what's out there today, and what others have accomplished before."

Creating new opportunities and diagnostic tools

Improving the depth, breadth and accuracy of models has led to greater collaboration with researchers at some of the world's leading universities and medical organizations, along with numerous product concepts. For example, there's interest in creating an OCT scanning machine that's available to the general public in pharmacies and other stores, like blood pressure machines, so people can quickly check their eye health and seek treatment faster for developing conditions. Russakoff says, "We're also excited to find ways to give ophthalmologists better triage tools, especially in areas where specialists are not available, to help more people prevent the loss of their eyesight from disease."
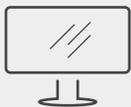
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