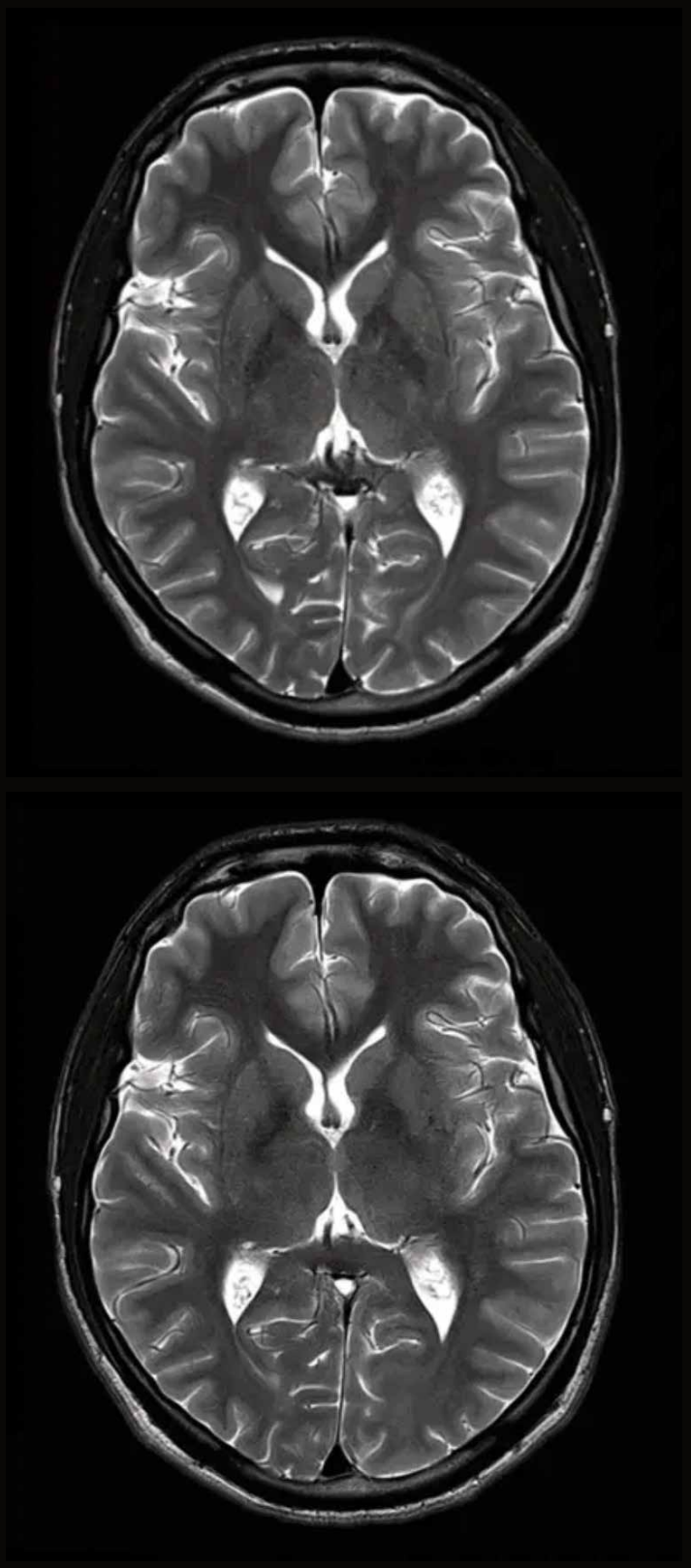
AI reconstruction of MR data enables faster scans and better images

UCLA Radiology has begun implementing an AI-powered enhancement to image acquisition and reconstruction to select MRI studies that speeds the imaging process while preserving or even improving the quality of the acquired images. Called “Deep Resolve” by its developer, Siemens Healthineers, the software employs convolutional neural networks to enhance image reconstruction from faster MR scans — up to 70% faster for some studies. Deep Resolve replaces the software originally used in the scanner and becomes part of the imaging protocol, rather than an additional step in the workflow.



T2 weighted axial image of the brain, without Deep Resolve (top) and with Deep Resolve (bottom).

At the UCLA Radiology clinics where the AI protocols have been implemented, wait times for patient appointments are down to about a quarter of what they typically were prior to the implementation.

"Normally, when we would implement something new that would make image acquisition faster, we'd lose resolution or we'd lose image quality," explains Debbie LaBrie, director of MRI operations for UCLA Radiology. "But with this technology, that's not the case. It's a win-win."

Using vast datasets to reconstruct and enhance images, the artificial intelligence algorithms eliminate the noise introduced by accelerated scanning protocols. The resulting images are as clear — or clearer — than those generated by conventional MR software from data acquired using slower scans. Deep Resolve integrates multiple AI algorithms, which can be selectively applied to meet individual needs.

The AI includes algorithms to:

- Apply customized noise maps to improve signal-to-noise in a way that optimizes individual elements of each image rather than relying on an overall noise filter applied indiscriminately to the whole image
- Utilize an iterative process that applies a deep neural network using physical MRI models and data-driven models alternating with a data consistency step in each iteration
- Enhance imaging using a convolutional neural network trained on tens of thousands of pairs of low- and high-resolution data covering a wide range of anatomies
- Combine smart acquisition and deep learning reconstruction in an extremely fast neuro exam to deliver all relevant neuro contrasts and orientations simultaneously

The shorter scan times help to improve the patient experience. "There are many patients who do not love the experience of being in an MRI machine," says Nancy Yen, radiology manager. "We see a lot of spine patients in our clinic, and they can't lie still for that long, so every minute that we're able to shave off helps." Yen notes that a typical cervical spine study that took 25 minutes before implementing Deep Resolve has been reduced to about six minutes.

In addition, the shorter scan times free up the equipment for more scans per day, reducing the wait times patients experience in scheduling appointments. At the UCLA Radiology clinics where the AI protocols have been implemented, wait times for patient appointments are down to about a quarter of what they typically were prior to the implementation.

Bryan Yoo, MD, associate clinical professor of diagnostic neuroradiology, medical director of MRI and medical director of the Mobile Stroke Unit, was one of the physicians asked to evaluate the Deep Resolve images when the department first began experimenting with the AI algorithms. "To my surprise, when you compare the images side by side with traditional MRI scans, the noticeable improvements that I've seen with the images are the signal to noise ratio is improved — meaning that the contrast of the images is greater — and the images are of higher resolution and sharper," states Dr. Yoo." This technology has the potential to improve our diagnostic capabilities as radiologists." Dr. Yoo also stresses the value of the speed advantage offered by Deep Resolve. He explains, "Being able to scan more efficiently allows us to create more time slots to increase our access to allow patients to get scanned."

To date, UCLA Radiology has implemented Deep Resolve on three MRI scanners in its Palos Verdes and Manhattan Beach clinics, with plans to continue rolling it out on 10 further MRI scanners in five other UCLA Radiology locations. Not all MRI scanners are able to be used for the AI protocols, and not all scan types have yet been FDA approved with Deep Resolve, though UCLA radiologists expect that FDA will approve the remaining AI protocols soon.