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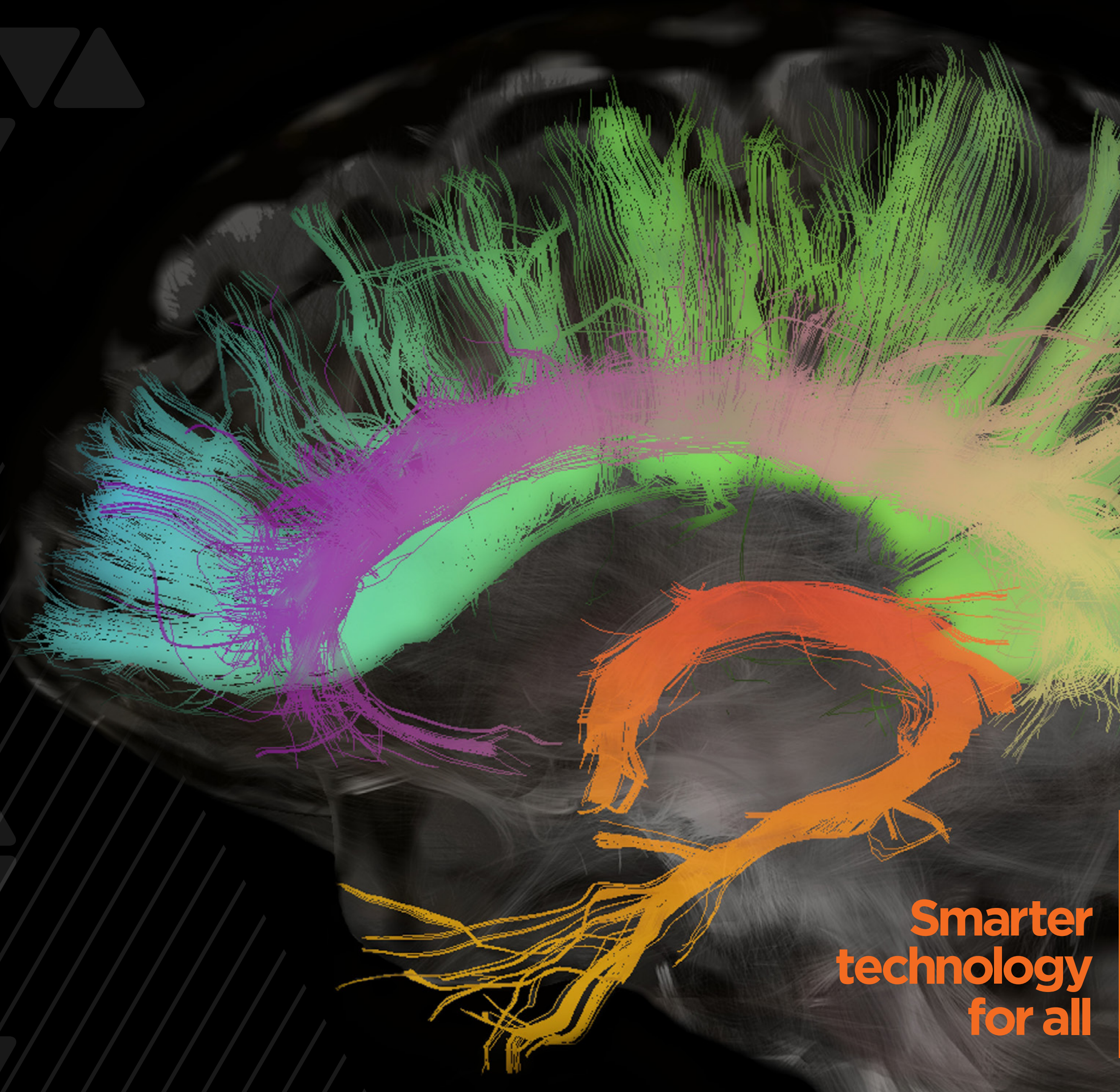
Health

Designing the next modality: What’s in store?

How computing power is driving innovation in medical imaging



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The innovation of imaging

Until Wilhelm Röntgen first observed the existence of X-rays in 1895, medical science had no way to see inside the human body without surgery. That Nobel Prize-winning discovery unlocked a new world of scientific opportunities, revolutionizing medicine and introducing the concepts of radiology and medical imaging.

It was another Nobel Prize-winning innovation in 1971 by Godfrey Hounsfield that paired X-ray imaging with the rapidly evolving technology of computers to assemble multiple images into a more detailed and diagnostically valuable picture through computerized tomography (CT) imaging.

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Cardiac MRI of heart showing aortic valve for diagnosis of heart disease.

The symbiosis of imaging and compute power

Since that time, advances in diagnostic imaging have been inextricably linked to advances in computing power. In addition to expanding the speed and flexibility of radiology workflows through the development of image management systems (e.g., RIS, PACS, VNA) and remote reading solutions, computer technology is constantly driving newer, better, faster diagnostic solutions.

For example, one innovative company recently developed a rapid MRI-based heart function scan that quantifies the effects of disease, drugs, and ischemia across 48 distinct heart segments in under 10 minutes.[2]

In this e-book, we'll take a deeper look at where the innovations in diagnostic imaging are happening and how computing power helps deliver the next generation of imaging solutions.

20% to 50%

Technology advances have impacted diagnostic scan interpretation workflows. Scan volumes in a typical radiologist's workload have increased by 20% to 50% in the past five years.[1]

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Where the growth is happening: Startups

The medical device industry as a whole is experiencing an explosion of innovation. Global patents related to medical devices tripled in the past 10 years, and technology cycle times have been cut in half in just five years. Artificial intelligence (AI) and machine learning (ML) are primary drivers of these increased cycles of innovation, and diagnostic imaging stands to substantially benefit due to the large amounts of data that imaging generates.[3] According to GE Healthcare, medical imaging generates 90% of a typical hospital's data — that is, a staggering 45 petabytes per year.[4]

The global medical imaging market is both large and steadily growing. Growing at more than 5% every year, it will exceed $43 billion by 2027.[5] A recent study of roughly 150 startup ventures in the medical imaging industry showed that the majority of these companies are focusing on AI and ML.[3] The study also notes that most of these companies specialize in a particular modality that generates large data sets on specific parts of the body:

- 22% Computed tomography
- 13% MRI
- 3% Nuclear
- 13% Mammography
- 9% Ultrasound

72%

of the AI and ML startups studied were using deep learning algorithms to help identify lesions or abnormalities in images. While AI and ML breakthroughs that displace radiologists aren't expected, some are anticipating significant efficiency and accuracy gains.

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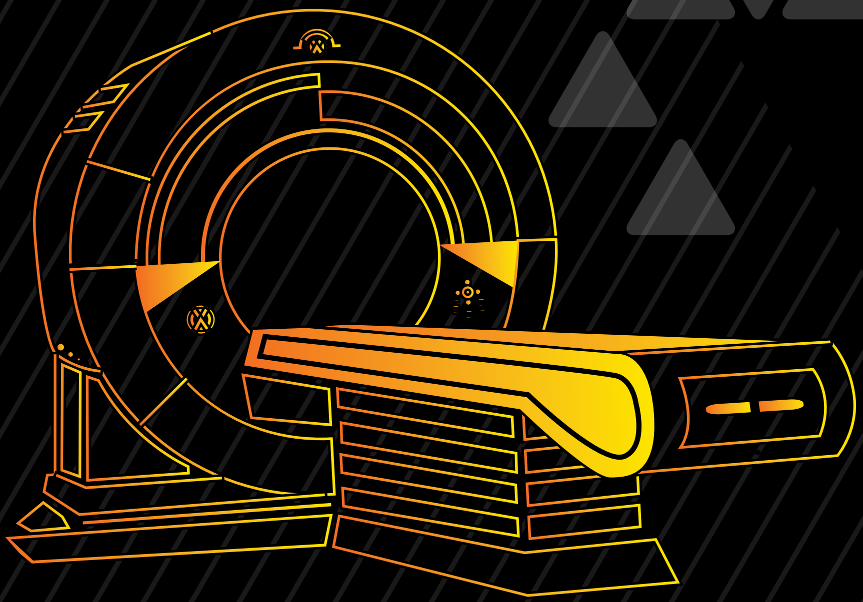
10x faster?

Researchers at NYU are studying how AI could increase MRI scan speeds by a factor of 10. If they succeed, patients will have a much more comfortable experience and could in some cases avoid radiation exposure from X-ray imaging.[6]



The value of modern modalities

As software startups leverage AI and ML to speed the diagnosis of disease, medical imaging modality manufacturers are evaluating ways AI can improve the performance of their devices to bring greater value to their customers.[7]

In addition to accelerating image reconstruction times and maximizing image clarity and fidelity, modality OEMs are investigating new ways to make their machines smarter and more efficient, producing a number of important benefits:

- **Reduced radiation exposure** — By improving the reconstruction of low-dose CT images, which tend to be noisy, AI helps limit the amount of radiation a patient receives from each study. This also reduces the patient's lifetime exposure risk.
- **Faster MRI scans** — To support faster image acquisition speeds, AI enhances under-sampled scans caused by the resulting decrease in data flow.
- **Fewer repeat scans** — AI detects whether the patient is positioned correctly and the technician has selected the correct protocol and scan angle, which helps avoid poor image quality and repeat scans.
- **Fewer scans overall** — By detecting abnormalities on the fly, AI optimizes the original scan in real time to gain additional data along with the initial target information.
- **Reduced operator variability** — AI guidance helps technicians ensure consistent image acquisition, particularly in ultrasound applications.

Simplifying the setup and operation of imaging hardware has the potential to bring significant benefits, especially in emerging markets where skilled imaging technicians and clinicians may be in short supply. With onboard AI, technicians have interactive guidance helping them position the machine and patient while ensuring they select the right settings for each study based on the patient's age, gender, disease, etc.[8]

New perspectives on 3D medical imaging

Accurate, detailed visualization is critical for planning medical procedures, especially for complex systems of the body like the cardiovascular and nervous systems. Seeing a tumor or structural defect from multiple angles helps physicians prepare for procedures much more effectively.

3D medical imaging is steadily and significantly evolving. As computing power continues to increase, diagnostic imaging will continue to contribute to improved patient outcomes. Recent examples of 3D medical innovation include:

1 Cinematic rendering

Developed at Johns Hopkins Medicine by Dr. Eliot Fishman, cinematic rendering produces photorealistic images by combining 3D CT or 3D MRI scans with volumetric visualizations and other computer-generated image technology. Cinematic rendering provides clinicians greater detail on the texture of tumors, helping determine whether the tumors are cancerous.[9]

2 Tomosynthesis

Also known as 3D mammography, tomosynthesis captures images at multiple angles and varying depths to create a 3D data set. This technology has been shown to improve care planning for breast cancer patients, particularly those in high-risk categories.[9]

3 Combining 3D imaging and printing

With the depth and accuracy of today's 3D medical imaging, hospitals are able to create accurate, patient-specific physical models of internal organs and structures, helping guide surgeons through complex procedures. For example, at the Henry Ford Hospital in Detroit, surgeons use 3D-printed models to test-fit heart valves before a procedure.[10]

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Innovation from the inside out

The computing power that drives innovation in medical imaging has to be fast, reliable, and built to last. Whether built into an imaging modality or part of an AI-driven image processing system, the demand for smarter, more advanced computing software and hardware intelligence has never been greater and is widely forecast to increase.

As clinicians, hardware manufacturers, and software companies continue to work together to build a smarter, more capable, more innovative future for medical imaging, we can only imagine the lifesaving potential these forthcoming breakthroughs will have on treating disease and injury — and bringing new hope for patients around the world.

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SOURCES

1 Levin D, Rao V, Parker L, et al. Continued growth in emergency department imaging is bucking the overall trends. J Am Coll Radiol

2 https://www.prnewswire.com/news-releases/new-rapid-cardiac-mr-imaging-helps-detect-and-manage-patient-heart-health-during-and-after-cancer-treatments-301106717.html

3 https://www.jacr.org/article/S1546-1440(18)31282-1/fulltext

4 https://www.gehealthcare.com/article/beyond-imagingthe-paradox-of-ai-and-medical-imaging-innovation

5 https://www.fortunebusinessinsights.com/industry-reports/medical-imaging-equipment-market-100382

6 https://www.popsci.com/AI-fast-MRI/

7 https://www.signifyresearch.net/medical-imaging/the-next-frontier-medical-imaging-ai-in-the-age-of-edge-computing/

8 https://www.itnonline.com/article/top-4-technologies-medical-imaging

9 https://healthtechmagazine.net/article/2018/07/how-3d-technology-transforming-medical-imaging-perfcon

10 https://www.merraine.com/5-future-trends-in-imaging-technology-to-watch/

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