Zooming in on AI-Based Image Interpretation

While the use of artificial intelligence in radiology eases workflows, it may also lead to a better and more precise understanding of disease. Predicting the course of cancer from imaging data could become a part of clinical routine in the next few years.

Text: Martin Lindner

Many experts believe that the increasing use of artificial intelligence (AI) in radiology will fundamentally change the interpretation of medical images. But which scenarios are realistic and tangible? A general idea is that AI-based image processing may not only accelerate and ease standard reading workflows, but could also lead to a more exact understanding of disease. One of the most fascinating perspectives lies in the prognosis of disease progression based on hitherto unused imaging information.

Leveraging AI for imaging workflows and reading

One example of the use of AI is provided by chest imaging. Many algorithm-based work steps have already been integrated into imaging results today or are at least conceivable in the future as routine solutions, says Michael Lell, MD, Professor and Chairman in the Department of Radiology and Nuclear Medicine at Klinikum Nuremberg, Germany. For example, image reconstructions from imaging data and radiological reporting are facilitated considerably by AI. Besides this, lung nodules and tumor foci can be precisely measured, lung volumes automatically quantified, and calcium scoring sped up.

Overall, machine algorithms support comprehensive chest imaging, confirms Razvan Ionasec, Product Manager Artificial Intelligence at Siemens Healthineers. Thus, the latest software technologies are in a position to independently recognize and to present color-coded anatomical structures and organ contours (e.g., lung lobes and the aorta) – something that makes multi-organ imaging simpler and more intuitive. Presumably such approaches could also allow multimodal, whole-body scans to be automatically evaluated in the future, says Ionasec.

Many of today's AI applications have assisting functions for radiologists and aim to facilitate cognitive steps in the interpretation of images, to avoid careless mistakes, and to improve the structure of the reading process. An obvious common scenario, for example, would be to have intelligent algorithms sort the ever-larger number of images according to abnormal findings and to offer the physician a work list prioritized by level of urgency, explains Lell.

Image-data based phenotyping of disease

However, the potential uses of AI go well beyond merely more efficiently shaped workflows. The approach also opens up new paths toward personalized imaging and therapy,

Proposed diffusion-weighted, high-b-value imaging for noncontrast breast cancer imaging.
Courtesy of R. Mann, Radboud Nijmegen, The Netherlands

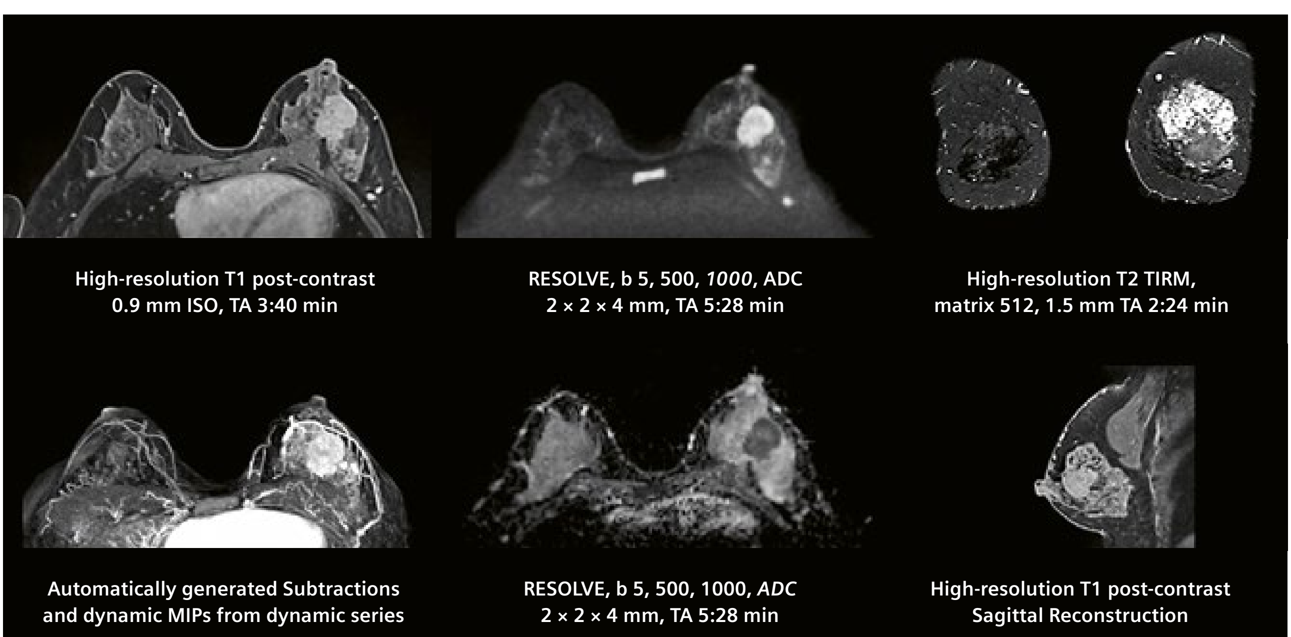
emphasizes Georg Langs of Computational Imaging Research Lab at Medical University of Vienna, Austria. One key to this is quantifiable imaging biomarkers (extracted from radiomics data), with which disease processes can be classified more precisely and in more detail. "AI can transform overwhelming data into structured data," says Langs.

Predicting cancer recurrence

Even more impressive is another example: Breast cancer imaging using MR. Today, radiologists already draw on various MR image characteristics to distinguish between benign and malignant lesions, for example, by the shape of the margins, the contrast enhancement, and the presence of edema.

However, such features of the MR image are usually not summarized in quantitative scores and are assessed only qualitatively. Moreover, many pieces of imaging information are just not visible to the human eye. In contrast, hundreds of mathematically definable individual imaging parameters can be evaluated with computerized analyses on a voxel base to determine, for example, signal and contrast behavior, surface morphology, and inner texture of a lesion. Using machine-learning algorithms, this may enable recognition of imaging signatures specific to a disease. This data-based approach to image interpretation is also known as radiomics.

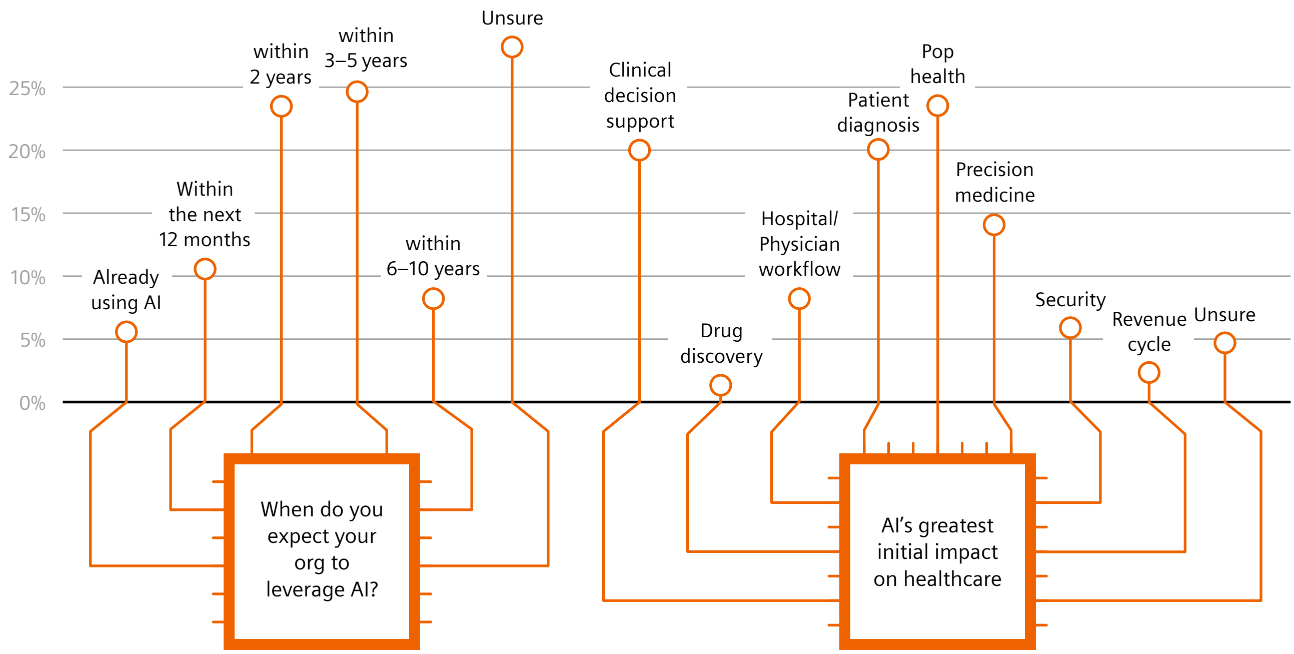
Several current studies are showing the potential of the approach. Particularly noteworthy is that even the risk of



Comprehensive, multiparametric breast MRI in a 39-year-old female with cancer of the left breast
Courtesy of AZ Sint-Maarten, Belgium

Artificial intelligence is arriving in healthcare

Survey of 85 healthcare executives in the U.S.



Source: Healthcare IT News, http://bit.ly/2p790oR

recurrence of breast cancer can be estimated based on the imaging data, as is possible today with molecular genetic tests.[1] This could open up possibilities for non-invasive image-based tumor profiling in the future. However, these very promising studies are still in their infancy. In five to ten years, it will be seen which part of this hype is worth it, and which was just hype. At the same time, it is now already clear that the significance of medical images is changing, from pictures in the original sense to "data and information carriers." The interpretation of images with the aid of artificial intelligence is likely to play a key role here. ●

Martin Lindner
is an award-winning science writer based in Berlin, Germany. After completing his medical studies and a doctoral thesis in the history of medicine, he went into journalism. His articles have appeared in many major German and Swiss newspapers and magazines.

References

[1] Li H, Zhu Y, Burnside ES, et al. (2016) MR Imaging Radiomics Signatures for Predicting the Risk of Breast Cancer Recurrence as Given by Research Versions of MammaPrint, Oncotype DX, and PAM50 Gene Assays. *Radiology* 281:382-391

Results and statements displayed in this article have been discussed during the European Congress of Radiology 2018 in Vienna, Austria.