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ARTIFICIAL INTELLIGENCE IN MEDICAL IMAGING

A Threat or An Opportunity

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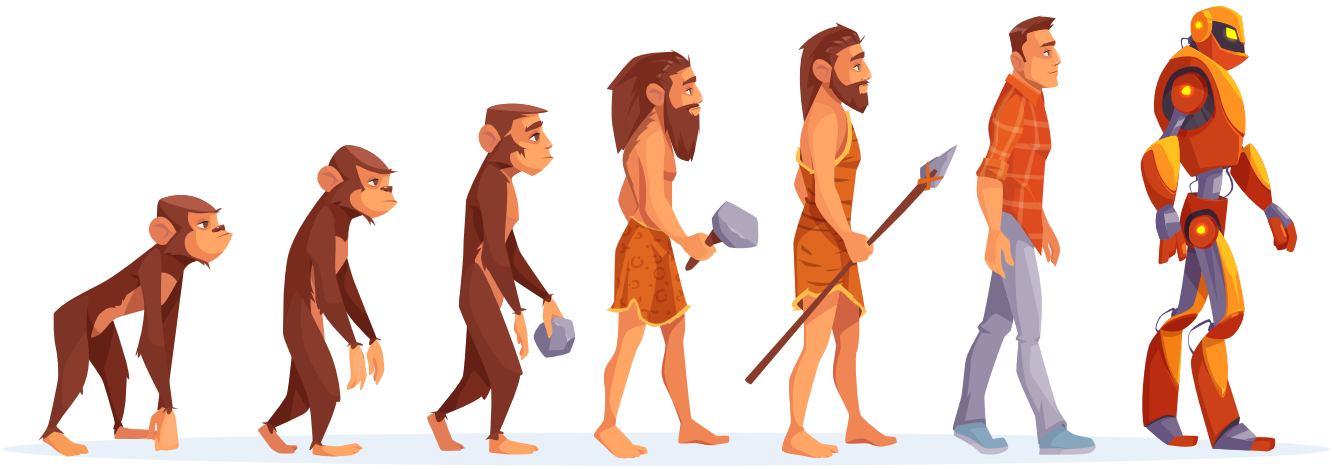
Horse-drawn carriages were a primary mode of transportation with the invention of the chariot around 2000 BCE until the advent of the first steam-powered automobile in 1769. Imagine the anxiety of manufacturers that came with the inevitable shift to horseless carriages. Forward-thinking industrialists were quick to seize the opportunity, transitioning to produce wheels for automobiles instead of wagons. Yes, disruptive technologies have always been game-changers. Similarly, when it comes to the use of disruptive technologies like artificial intelligence (AI) in medical imaging emerge, it is clear that the advancement will bolster the role of the radiology personnel, instead of replacing their jobs.



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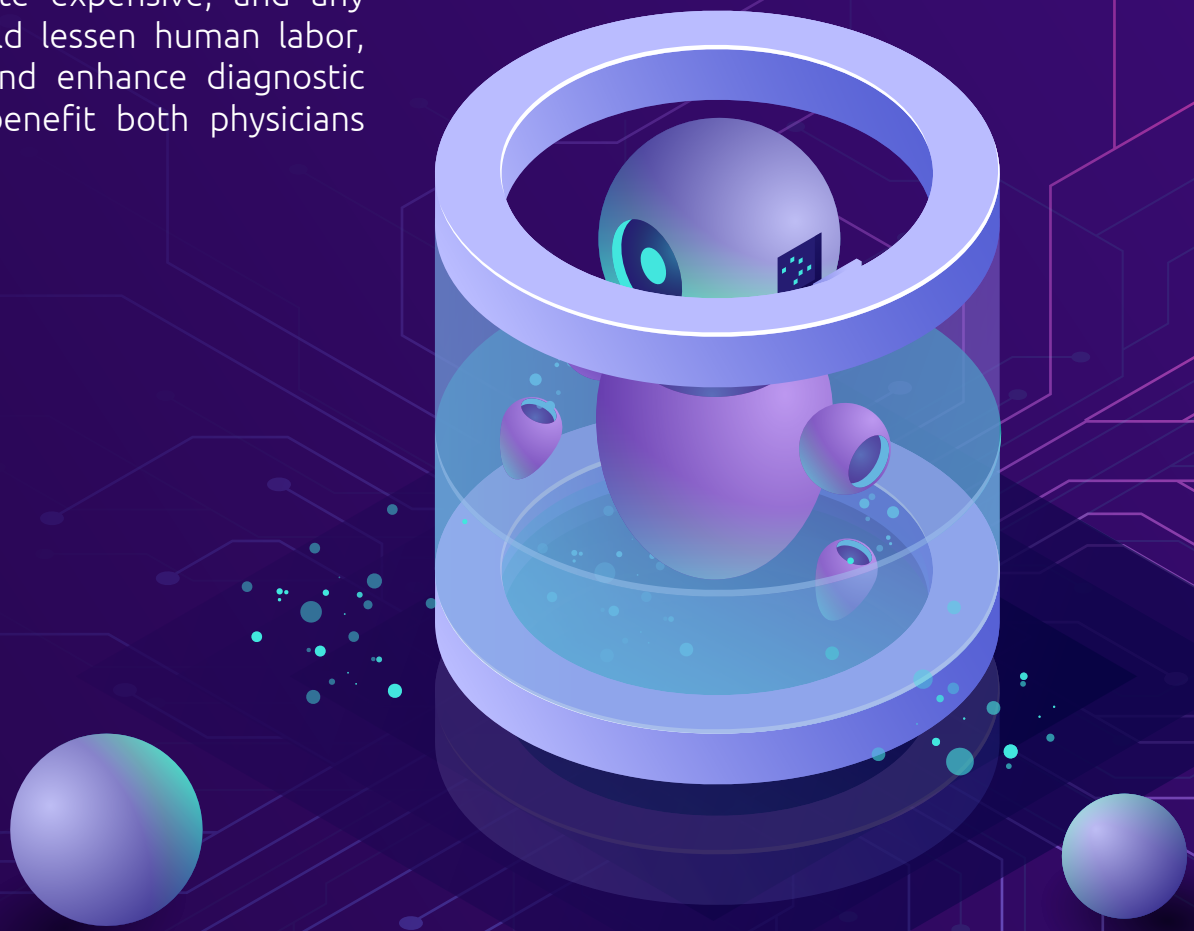
AI Will Change Radiology, but Won't Replace Radiologists

Recent advances in AI algorithms have led to the thinking that AI may soon replace human radiologists. Researchers have developed advanced deep learning neural networks that are capable of identifying pathologies in radiological images like potentially cancerous lesions and bone fractures. In many cases, they are more reliable than an average radiologist. For the most part, the best systems are currently on par with human performance and are used in research settings.

That said, deep learning is advancing rapidly, and is comparatively a better technology than approaches that have been previously used in medical image analysis. This is likely to portend a future where AI plays a critical role in radiology. Radiological practice benefits from systems that can read and interpret multiple images almost instantaneously, because the number of images has increased exponentially, over the last decade, than the number of radiologists. Hundreds of images can be taken for an individual patient's disease or injury. Imaging and radiology are quite expensive, and any solution that could lessen human labor, minimize costs, and enhance diagnostic accuracy would benefit both physicians and patients alike.



Radiologists Who Use AI Will Replace the Ones Who Don't

Radiologists do much more than simply reading and interpreting images. Like any other AI system, a radiology AI system performs single tasks. Deep learning models are trained for specific image recognition tasks, such as lung nodule detection from chest CT or brain bleed from MRI.

For instance, HaiLTH's fully automated, real-time solution is designed to assist radiologists in the detection of sub-millimeter pulmonary nodules during the review of X-rays and CT examinations anytime, anywhere. It is intended to alert radiologists regarding regions of interest (ROI) that may have initially been overlooked. Detection of sub-millimeter lung nodules using X-ray and CT Scans operates on a novel automated pulmonary nodule detection framework with an intuitive convolutional neural network (CNN).

The four-step approach to ICH treatment involves the following:

1. Reading the CT scan report by the AI agent
2. Detecting the presence of sub-millimeter lung nodules
3. Generating & transferring one-pager reports highlighting affected lung area image
4. Generating report of existing CT Scan/ X-ray for denoting change in status of nodules

Similarly, HaiLTH's Intracranial Hemorrhage (ICH) algorithm automatically detects suspected brain bleeds based on CTs. ICH is a major public health issue, accounting for more than two million strokes worldwide. This tool constantly provides timely detection of people at high risk of brain bleeding events anytime, anywhere. The algorithm comprises a unique neural network architecture specifically developed to identify intracranial hemorrhage.

The five-step approach to ICH treatment involves the following:

1. Reading the CT Scan report by the AI agent
2. Detecting existance of brain bleed
3. Generating & transferring one-pager reports highlighting specific bleed area/s
4. Starting treatment immediately in case of a brain bleed
5. Prompt follow-up by RAD365's proprietary emergency teleradiology report

But several thousands of narrow-detection tasks are necessary to correctly identify every potential finding in medical images, and only a few of these can be accomplished by AI currently. Furthermore, the job of image interpretation encompasses just one set of tasks which radiologists perform. They also consult with other physicians on diagnosis and treatment, treat diseases (for example providing local ablative therapies), perform image-guided medical interventions (interventional radiology), define technical parameters of imaging examinations to be carried out (tailored to the patient), relate findings from images to other medical records and test results, discuss procedures and outcomes with patients, and other activities. Even in the unlikely event that AI took over image readings and interpretations, most radiologists could redirect their focus to these other essential activities.

Integrating AI into the Clinical Practice

Clinical processes for employing AI-based image work need to go a long way in order to be ready for daily use. Recent reports from the American College of Radiology (ACR) found that different imaging technology vendors and deep learning algorithms are focused on different aspects of the use cases they address. Even among deep learning–based nodule detectors that are approved by the FDA, there were different foci: the probability of a lesion, the probability of cancer, a nodule's location or its feature. Such distinct foci make lead to difficulties in embedding deep learning systems into our current clinical practices. Therefore, defining inputs and outputs for the vendors of deep learning software needs to be accomplished. The ACR is working toward a holistic collection of use cases — by disease type, modality, and body parts — for which clinical processes, image requirements, and explanation of outputs are consistent and well-defined with current and future clinical operations. To build a comprehensive repository of use cases, therefore, will take several years, expanding the role for radiologists in the AI-led world.

The Evolution of Skills in the Age of AI

Just as automobiles did not replace transportation jobs but opened up opportunities in the field. The same is true of today's autonomous vehicles and the changes required in automobile regulation and insurance. Changes in health insurance and medical regulation for automated image analysis will need to be worked out. Who is responsible, for instance, if a machine misdiagnoses a case — the physician, hospital, imaging technology vendor, or the data scientist who developed the algorithm? AI radiology machines will need to become substantially better than human radiologists and not just as good as to drive the regulatory changes needed.

It should be apparent, then, that the next time you get an MRI, your images are less likely to be viewed solely by an AI algorithm. Radiologists, like financial planners, accountants, lawyers, or any other professional who are deploying AI to have some job tasks performed by the smart machines, will experience changes, rather than replacement of jobs. And for the same reason, they'll have to develop new skills and adapt to changing work processes. The radiologists whose jobs are likely to be threatened are the ones who'd refuse to adopt AI. The substantial medical and productivity benefits to be gained from deploying AI may indicate that radiologists can spend more time doing what many of them find fulfilling: consulting with physicians regarding the diagnosis and possible treatment strategies.