IN MY OPINION

COMPUTER VISION TRANSFORMING HEALTH IMAGING: A LOOK AHEAD

By Dr. Anjali Agrawal, Consultant Radiologist, Teleradiology Solutions

Teleradiology Solutions is a leading global Teleradiology and Telehealth company which specializes in Emergency Nighthawk, Subspecialty Services, 3D Imaging, Artificial Intelligence and many more.

Computer vision is a rapidly developing discipline of Artificial Intelligence (AI), which strives to mimic the human visual system. This field of AI encompasses various automated processes that extract information from the images, analyse and then develop a spontaneous understanding of the data with an ability to classify objects or determine relatedness between images. In some areas such as fine interpretation of retinal images or subtle wrist fractures, this has superseded the best of human vision, which is subject to variable performance under adverse conditions & fatigue. Automated detection of findings & analyses would thus be a huge leveller in terms of variabilities in expertise, experience, accessibility and affordability of humans. While computer vision is far from perfect as of now, the scope is tremendous.

Radiology & pathology are largely image-based diagnostic specialties. They are integral tools in the clinical decision-making process, guide current management and help predict the overall outcomes in terms of quality & longevity of life. At least in radiology, the data generated is largely digital or may be convertible into a digital format. These images are essentially a visually understandable representation of the data pertaining to human anatomic to molecular anatomy, functions and dysfunctions, captured by the huge armamentarium of imaging equipment. The imaging specialist needs to detect the warning signs of disease, differentiate them from the huge spectrum of normalcy in the human body, perform a multimodal correlation to provide a wholesome information on the disease characteristics, to reach a radiologic diagnosis or a set of diagnostic possibilities. This process involves a tedious task of scrolling through thousands of images requiring utmost attention, as the findings relevant to the patient's problem may be subtle and get camouflaged in the deluge of data.

Overall increased imaging volumes are both physically & mentally challenging to the radiologist, leading to a spate of professional burnout within a short span of active practice. In this barrage of data, the human cognition is limited by what meets the eye on the images. However, as we all know, digital images have a lot more information & data embedded in them, beyond the human perception. The advanced AI software tools may add an entirely new dimension to image analysis based on quantitative parameters, not possible for the

radiologist. For instance, tumor quantification for treatment initiation & response is a tedious job with a human manually segmenting the tumor on each cross-sectional image, which could add up to a hundred. This task may be successfully performed by automated segmentation tools. Various parameters beyond gross anatomical features and not entirely discernible to the human eye, such as shape, pixel density/intensity, texture analysis of a lesion may be assessed by 'intelligent machines'. The data emanating from the field of genomics and various quantitative parameters from the digital images are propelling the specialty into new fields of collaborative diagnostics, such as radiogenomics & radiomics, making diagnostics more precise & personalized. Unlike, the human eye, computer vision has no established preferences for data display, and can get the job done without any distortion or dilution of details, that an image display system may entail.

In the long-term, one is looking at development of higher cognitive functions impacting complex decision making, such as combining the interdisciplinary data with the imaging data to arrive at the most likely diagnosis

These changing paradigms in healthcare delivery certainly challenge the traditional approaches to diagnostics. The immediate benefits are being reaped in improving the workflow. There is a huge shortage of radiologists worldwide and more so, in India. The training & skill refinement cycle of a radiologist is long compared to the actual productive years. And then, detection & interpretation skills are not equal. AI tools would help radiologists become more accurate by providing a 'second read,' more efficient by making accurate lesion detections & quantifications, and more productive overall. Computer vision can help triage cases on the PACS worklist to ensure that the most critical get the most immediate attention. Busy practices, such as ours, are in the process of integrating AI tools with PACS, so that a preliminary report is generated before even the radiologist evaluates the study. Based on the automated detection, the cases are prioritized on the worklist. A critical case like a head CT scan with bleed in the brain is flagged at the top and normal ones to the bottom. Thus, computer vision algorithms will have a major role in

◆ Dr. Anjali Agrawal

Intelligence Augmentation, by acting as lesion finders, and formulating a list of differential diagnoses. In the long-term, the horizon of which is anyone's guess, one is looking at development of higher cognitive functions impacting complex decision making, such as combining the interdisciplinary data with the imaging data to arrive at the most likely diagnosis, with recommendations for further work-up and prognosis.

Increasing automation of processes is good for all. Increased machine cognition would minimize the divide between the experienced and the not so, culminating in a more standardized patient care. However, a conceivably difficult but not entirely impossible outcome may also be displacement of the traditional radiologist or pathologist in the healthcare delivery chain and disruption of conventional practices & workforces. A new field of healthcare diagnostics may emerge with informatics, computer vision & AI training being an essential part of training and practice. The need to develop a synergy with the machines would no longer be optional, but critical to stay relevant. Soft skills such as effective communications, ability to lead and collaborate, in addition to domain knowledge, would be defining factors of a good diagnostician. si