ARTIFICIAL INTELLIGENCE IN RADIOLOGY: EMERGING TRENDS IN WEST AND THIRD WORLD RADIOLOGY PRACTICE, TWO POLES APART

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Introduction

Artificial intelligence (AI) is a reality now. It is becoming an integral part of our lives with each day passing. It is being deployed in web searches, self-driving vehicles and autopilot functioning of aero planes among others. With exponentially expansive digital imaging data combined with high processing computer hardware, AI is beginning to see its practical role in radiology now. It applies pattern recognition to medical images and utilizes this mechanism to identify different diseases. These tools and algorithms have been used for many years now by web search engines and tech giants such as Facebook to recognize similar facial features to match and identify people in a picture. In radiology, medical images are previewed by trained radiologists who specify any lesion or abnormality before they can be used by any computational AI algorithm for patterns recognition.

Now AI is using Deep learning algorithms. They are unlike the traditional pattern recognition algorithms and they can learn feature representations from images without predefined criteria set by radiologists. Deep learning can reduce the radiologist dependant manual preprocessing of the images. They improve with time as more data is available for them to process, so with more time, the system will show enhanced performance.

AI is already setting benchmarks in the radiological world and AI algorithms are becoming at par or in some instances excelling in comparison to radiologists in assessing complex patterns quantitatively in relatively shorter time duration but these are usually narrow task-specific commands. AI has a lot to contribute in the future. It can be integrated into the routine workflow and used as an early screening tool for common cancers such as lungs, breast, colon and liver. It can help differentiate between benign or malignant nodules, characterize lesions in a more standardized objective manner which can be reproduced.

Although we notice leaping advances of AI in the field of radiology, these advances are somewhat restricted to the developed countries. Most of the radiologists have minimal exposure and knowledge of AI in third world countries. Many factors are contributing towards this including lack of awareness towards this emerging technology, fear of being replaced by AI, limited number of vendors, resources and costly AI systems. All these reasons are delaying the inevitable use of AI in third world countries. The fear of being replaced by a machine is not new and has been present for more than a century. So now we come to the million-dollar question: *Is AI deep learning deep enough to replace radiologists in third world countries?* A short and reassuring answer to it is: *No, AI is not taking over, at least not for a few more decades.*

AI will indeed transform radiology but the panic and fear surrounding AI replacing radiologists are unfounded. With the advancement in technology, fear arises of machines taking human jobs. This has been going on for a whole century now and if we review the history in 1928 a headline was published in New York times stating "March of the Machine Makes Idle Hands" and almost after a century the panic is still there but machines are yet to take human jobs.[1]

Although AI is showing great potential and has much to contribute to radiology. It is unlike human intelli-

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gence. It is noted that most of AI performance is plateauing over the past few years and not up to the mark to be used as an independent diagnostic entity. Hence, only a handful of AI systems have been deployed in clinical settings. One reason for lack of incorporation of AI is its task-specific algorithms that do not generalize to other diseases and their inability to operate more than one task at a time. So although AI can pick one-minute nodule in an image, it can also miss a spectrum of other diseases. So even though AI has screened a scan, a radiologist needs to assess it afterwards for being falsely positive or if it warrants further investigation. The solution to this problem is the development of a complex AI system that runs hundreds of such narrow AI tasks to be able to look for more than one abnormalities in a scan like a trained radiologist. Radiologists use their experience and integrate it with other clinical findings to come to a conclusion.

Most of the AI are narrow category AI and are trained to execute singular tasks. It is very cumbersome to develop an AI system capable of detecting multiple abnormalities in an image. It would require a massive database of annotated images. In radiology, a cautious estimate of radiological findings in imaging modalities amounts in tens of thousands. Collection of all these radiological labeled images can take years and would be very expensive. Other factors making this more complicated are no availability of images and algorithms for rare diseases.

AI performance is generally measured against the performance of a trained radiologist for detection of a particular disease or a nodule. But if we turn the tables and compare AI to a young radiology doctor, AI performance and findings can be used to reduce near misses, improve the quality of diagnostic reports and provide a learning opportunity for radiology residents and fellows. Research done recently showed that use of deep learning model by junior doctors improved their performance and reduced reading time for pulmonary nodule detection.[2] Above research findings echo that AI can improve the performance of particularly inexperienced junior radiologists.

As AI finds its way into the radiology reporting section, Radiologists job is bound to change but for the better. A well-integrated AI system would augment radiologist and improve reporting quality, reduce errors, pick up minute details difficult for the human eye and provide characterized and feature identified images to the trained radiologists for review. This will lead to more reproducible standardized reporting. AI will enhance the workload more efficiently. Radiologists can use the AI autopilot for minor details such as organ volume determination or nodule detection, size measurement but they have to land this plane on their own. AI is there to improve the workflow rather than taking over. So radiologists would look for AI errors and shortcomings while enjoying the luxuries of an automated assistant.

As far as third world countries are concerned, we are a little behind the developed countries in resources and the availability of imaging modalities. There is still use of conventional hard copy film reporting in many under developed countries. Use of PACS and DICOM systems has not been introduced even at many levels especially remote areas. Situation makes it graver when it gets inevitable to change with the upcoming trends among older practicing imaging personals. Few people even do not have idea of how and to which extent AI can affect the imaging practices. Primary and secondary care centers radiologists have a vague idea of AI and its horizon for future prospects. In contrast to western countries where AI will be the future practice, third world countries will feel its impact a little later but AI is on its way whether one likes it or not. Most of Pre AI workflow would become obsolete and our jobs would be reorganized around it. Radiologists would have other important tasks of discussing diagnoses and management plans with clinicians to address then. Just as the internet and smart phones took over and changed the world, soon AI is going to be our new reality and it will only take those radiologists jobs who won't accept it.

Conflict of Interest: None.

References

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