Editorial

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It is Time to Incorporate Artificial Intelligence in Radiology Residency Programs

Kwan Hoong Ng[1,2], Cher Heng Tan[3,4]

[1]Department of Biomedical Imaging, Faculty of Medicine, Universiti Malaya, Kuala Lumpur, Malaysia
[2]Faculty of Medicine and Health Sciences, UCSI University, Springhill, Negri Sembilan, Malaysia
[3]Department of Diagnostic Radiology, Tan Tock Seng Hospital, Singapore
[4]Lee Kong Chian School of Medicine, Nanyang Technological University, Singapore

Take-home point

With the surge of interest in the development and application of artificial intelligence (AI) in radiology, we propose that know-how on the development and clinical evaluation of AI models needs to be incorporated in radiologist training curricula to prepare our specialty to lead in the new era of radiology practice augmented by AI.

Keywords: Artificial intelligence; Curriculum; Education; Radiology; Residency

There has been a surge of interest in the development and application of artificial intelligence (AI) in radiology. It seems inevitable that AI will augment radiological services, from patient scheduling to image acquisition to image interpretation, for disease detection and prognostication [1,2]. The adoption of AI solutions is regulated. Currently, the Food and Drug Administration keeps a database of AI software and systems that have been approved for use in clinical settings [3]. In various facets within the realm of AI in radiology, there are still challenges and hurdles to overcome, including ethical issues, algorithm robustness, data governance, stakeholders' consensus, and legal liability [4].

Radiologists play a leading role in this service continuum. In addition to image interpretation, radiologists play an important role in deciding imaging and dosing protocols, workflow, and patient management. Traditionally, radiologists have been involved with the specification and configuration of imaging modalities and systems, such as radiology information systems and picture archiving and communication system (PACS). They are considered subject matter experts for such tasks. Radiologists are also often called upon to make business decisions on the procurement and implementation of equipment and digital workflow solutions. However, with the advent of AI-augmented solutions, can radiologists perform equally well in making decisions on the procurement and implementation of AI systems?

Without a sound understanding of the potential capabilities and pitfalls of AI, radiologists in the future will not be able to make informed choices to benefit their practice and patients in the best possible manner. Given the recency of AI applications, many radiologists are not yet well equipped with the necessary AI knowledge and skills to accomplish this. This begs a fundamental question: are radiology education and training programs preparing the younger generation by incorporating state-of-the-art advancements such that they can assume leadership roles in implementing AI in radiology?

Based on our review of publicly available information, AI has yet to be formally incorporated into major residency programs. However, there have been individual initiatives such as that by Lindqwister et al. [5].

Since the physics component of most radiology education syllabi covers informatics related topics such as digital image

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Corresponding author: Kwan Hoong Ng, PhD, Department of Biomedical Imaging, Faculty of Medicine, Universiti Malaya, ADD Lembah Pantai, Kuala Lumpur 50603, Malaysia.
• E-mail: ngkh@ummc.edu.my

processing and PACS, it seems logical and pragmatic to incorporate a module on AI fundamentals and applications as part of the new paradigm. Therefore, we propose the inclusion of topics such as:

1. Fundamental concepts of AI and machine learning: Here, learners will gain a broad understanding of machine learning in its various forms, including deep learning and machine learning, otherwise commonly termed as AI. The distinction between artificial generalized intelligence and narrow AI and the potential capabilities of AI should be covered. As a result, future radiologists/learners should be further educated about the strengths and weaknesses of current AI technologies to understand the subsequent modules that specifically cover AI in radiology.
2. Overview of AI in medicine and radiology: Here, the learners will apply their understanding of the fundamental concepts of AI and machine learning to the practice of medicine, such as image-based computer vision in radiology, pathology, and other clinical specialties (fundal photography and endoscopy), and text-based natural language processing for data mining and predictive analytics. An up-to-date review of regulations and ethical issues surrounding AI should be incorporated into the curriculum for learners to appreciate the complexity of real-world AI adoption. We suggest that an interactive discussion or case study format should be implemented to enhance the effectiveness of teaching and learning.
3. Clinical validation and application of AI models: Herein, learners will appreciate the role of AI in augmenting radiology clinical and operational workflows throughout the service continuum. Ethical considerations and risk mitigation techniques pertaining to the application of AI and real-world deployment of algorithms in radiology should be covered. Learners should further understand bias and be able to recognize and address these biases in their decision-making by applying guidelines that advocate for standardized approaches to randomized controlled trial evaluation of AI models [6]. As a practical example, the Korean Society of Thoracic Radiology issued a position statement on the use of AI-based software as a medical device for chest radiography [7].
4. Development of machine learning models for solving clinical problems: For more advanced learners, a deeper competency in AI, such as coding and the use of programming languages (e.g., R and Python), can be imparted. This opens up a new field of research and development for radiology, led by future radiologists, in solving issues of diagnostic accuracy, disease prediction, and workflow inefficiencies. For example, the American College of Radiology has set up AI-LAB™, which offers radiologists "tools designed to help them learn the basics of AI and participate directly in the creation, validation, and use of health care AI" [8].

Since AI is constantly evolving and new developments are being made every day, we propose that these mandatory didactic modules be supplemented by other opportunities for staying up-to-date, such as attending and presenting at journal clubs, webinars, workshops, and conferences. For example, the Radiological Society of North America offers a case-based AI course that provides radiologists with practical know-how on the application of AI in radiology [9]. Recently, the Asian Oceanian Society of Radiology Emerging Trends Committee organized a series of webinars to increase awareness among members of the ethical and real-world considerations in the adoption of AI [10].

Radiology educators and leaders should address the lack of coverage of AI know-how in our conventional curriculum. Now is the opportune time to implement AI in residency programs. A wait-and-see attitude will only jeopardize the progress of radiology in providing state-of-the-art healthcare services.

The clarion call has been sounded.

Conflicts of Interest

The authors have no potential conflicts of interest to disclose.

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ORCID iDs

Kwan Hoong Ng
https://orcid.org/0000-0002-8707-914X
Cher Heng Tan
https://orcid.org/0000-0003-3341-3111

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