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EDITORIAL

Opportunities & Challenges of Artificial Intelligence in Radiology Application

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Artificial intelligence (AI) is an important emerging technology that has the potential to transform radiology. Over the last 5 years, the application of AI in this field has risen significantly, eliciting considerable interest from both scientists and practicing radiologists. AI involves the creation of computer system that is capable of performing tasks which usually requires human inference, such as learning, problem-solving, reasoning, and interpretating complex information.[1] The primary advantage of AI includes automating repetitive tasks, decision-making, analyzing large sets of data and enabling personalization. AI systems achieve this through computational power and by using previous data and algorithms.

The field of radiology originated with the identification of X-rays using a cathode ray tube. Subsequently, it advanced significantly by the introduction of modern technologies, such as computed tomography (CT) and magnetic resonance imaging (MRI) along with sonography, nuclear imaging and integrated hybrid systems.[2] Radiology encompasses both technological innovation and its adoption into clinical practice. Thus, the continual advancement of new imaging technology has been the major driving force in the field and emphasizes the importance of exploring the applications of AI in this context.

The scope of AI application in radiology is extensive. Currently there are over 200 specialized commercial tools available that utilize AI applications in radiology.[3] In general, the application of AI in radiology can be categorize into two major areas: tasks involving interpretation and non-interpretative functions.

The interpretative function of AI includes almost all subspecialties of radiology, such as cardiovascular imaging, neuroimaging, breast imaging and musculoskeletal imaging. Its uses include lesion detection, characterization and classification; tumor characterization and segmentation; identification of intracranial bleeding; detection of major vessel occlusions; identification of fractures, lung nodules, pneumonia and pneumothorax; performing segmentation of Liver, genitourinary structures and other; as well as assessment of coronary calcium score, coronary angiography, plaque analysis and estimating fractional flow reserve, etc. These applications work across all imaging modalities including X-ray, CT scans, MRI, sonography and nuclear medicine procedures.

Consequently, non-interpretative applications of AI are equally important in the context of radiology. These include tools that improve workflow efficiency, support clinical protocols, manage scanner and helps with patient scheduling and facilitate structured reporting using natural language processing (NLP). In case of image acquisition, AI can significantly enhance raw and processed image quality, lower radiation doses in CT examinations and shorten MRI scan times.[4]

However, evaluation and validation of the effectiveness of AI remain a major challenge for its successful implementation in radiology. Validation is crucial to ensure that AI performs reliably and is applicable in real life clinical settings.[5] Van Leeuwen et al. in their study noted that although there are numerous promising AI tools available on the market for use in radiology, there is a lack of peer-reviewed studies supporting their effectiveness for the majority of these products (64%).[3]

For successful Implementation of AI in radiology, multidisciplinary expertise is necessary. This may

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be difficult for smaller organizations which might lack the capacity to recruit non-medical professionals essential for supporting AI-related research and deployment in clinical practice. Insufficient training and education could consequently result in unequal adoption of AI across various countries.

Another significant challenge highlighted by Sit et al. was that radiologists lacking appropriate knowledge of AI often express concern about the technology, particularly regarding its potential impact on their profession.[6] However, Langlotz argues that its very unlikely for AI to replace radiologists, instead those adopting AI into their practice may gain an advantage over others.[7] Thus, successful AI integration requires not just adopting new technology, but also educating and training of the current workforce.

Nonetheless, there is significant potential for advancing the field of radiology by incorporating AI- both for interpretative function and in supporting non-interpretative uses. Though challenges remain, Pesapane et al. noted that the potential of AI has generated considerable enthusiasm and momentum within the discipline.[8] The growing number of studies testing new AI applications demonstrates increasing scientific interest in this area.

The use of AI in radiology has several practical benefits, such as improving diagnostic accuracy, reducing workload and giving radiologists extra time to focus on patient care and communication. With the assistance of AI, radiologists can deliver more consistent and accurate diagnoses ultimately improving patient outcomes through the support of advanced technologies.

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