

# **BIDH5003 Foundations of Digital Health**

## **Title: Impact of Artificial Intelligence on the Role of Radiologists**

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## The Role of Radiologists

A main component of healthcare involves the diagnosis and treatment of patients, both of which are actively contributed by radiologists. The primary responsibility of radiologists is working with medical imaging data, including X-rays, computed tomography (CT scans), magnetic resonance imaging (MRI scans), PET scans and ultrasounds, for the purpose of detecting, diagnosing and treating patients with injuries or diseases. Radiologists play a crucial role in the prevention of diseases, evaluation of patients' health over time and providing treatment for diseases with radiation [1]. A study by Bennani et al. examined one of the imaging data, which is chest radiography [2]. The study highlighted the challenges associated with detecting abnormalities in chest radiographs due to superimposition of bone structures, uneven image quality and low contrast resolution. Radiologists, who are professionally trained to analyse imaging data like chest radiographs, are responsible in overcoming these challenges and provide reports or treatments to patients accordingly. However, due to the advances in imaging technology, there has been a significant associated increase in demand for medical imaging [3]. To adapt to this technology expansion, automated technologies have been integrated into radiologists' workflow to increase efficiency and throughput.

## AI Solutions, Objectives, Target Audience

The primary objective of integrating AI into radiologists' workflow is to enhance diagnostic accuracy, streamline workflow efficiency and improve patient outcomes. Derevianko et al. stated that AI serves as an optimising tool to assist radiologist in identifying abnormalities within imaging data, generating a diagnosis, choosing a customised patient protocol, tracking dose parameters, estimating radiation risks and minimising diagnostic errors [4].

The target audiences for these AI-based solutions are:

1. Radiologists: interpret imaging data and perform radiology interventions
2. Patients: receive diagnoses or treatment from radiologists
3. Radiology technologists: conduct radiology exams, such as x-rays and CT scans [5]

Flory et al. observed that AI-based algorithms have the capability to detect abnormalities in imaging data and prioritize these findings for review by radiologists [3]. In Haenssle et al.'s study, a computer achieved a 95% accuracy in diagnosing skin cancer while dermatologists were only 86.6% accurate [6]. This demonstrates that AI-based solutions can streamline radiologists' work, reduce their workload and provide highly accurate results.

Moreover, an AI-based algorithm was shown to reduce the turnaround times of outpatient chest radiographs from over 7 days to less than 3 days. Certain AI/ML techniques have been shown to enhance the quality of imaging data, thereby decreasing rescan and recall rates. By reducing imaging times and improving image quality, AI can:

- Mitigate errors in radiologists' diagnoses caused by poor imaging data quality.
- Enhance patient experience by delivering highly accurate results and reducing treatment time.
- Reduce workload of radiology technologists by avoiding unnecessary rescans or recalls on imaging data.

Furthermore, deep learning can perform auto-segmentation on malignant masses, relieving radiologists of tedious and time-consuming tasks and allowing them to focus on information assessment and integration. [3]

All these examples collectively presented AI's potential within the radiology field.

## Positive Impacts

Radiologists are responsible for analysing large volumes of imaging data daily, often within darkened rooms. Spieler et al. reported that the dim working environment contributes significantly higher risk of burnout among radiologists compared to other physicians [7]. Additionally, Taylor-Phillips et al.'s study has demonstrated clear evidence that the heavy workload can result in cognitive fatigue of radiologists, particularly towards the end of lengthy shifts. This fatigue introduces medical errors and increases the risk of overlooking abnormalities in imaging data [8]. To address this issue, Derevianko et al. proposed a solution by introducing AI to provide an initial analysis before passing it on to radiologists to review. This method has proven to significantly reduce radiologists' cognitive fatigue. This can also reduce the time spent by radiologist on interpreting imaging data, thereby potentially decreasing burnout rates. However, it is also noted that reliance on AI for analysis could lead to a degradation of radiologists' interpretative skills as they no longer need to regularly use their analysis skills. Over-reliance on AI might reduce their attention and perceptive skills, thus compromising patient safety. Therefore, a balance between AI and human reliance must be explored in order to maximise the benefits of AI in radiography [4].

In addition, AI can be used as a second opinion to enhance radiologists' confidence when diagnosing or planning treatments. This is especially beneficial for junior radiologists, as it aids their learning process and understanding of complex medical imaging techniques and principles [9]. However, another study indicates that radiologists are prone to automation bias when making decisions using AI, regardless of their experience level. This is due to radiologists being overly reliant on AI and blindly following its output. Although AI may assist novice radiologists to perform on a similar level of experienced radiologists, introducing AI early into their training may potentially lead to deskilling, where they struggle to make accurate decisions without AI assistance [10].

## Negative Impacts

Ezekiel Emanuel, associated with the Affordable Care Act, has predicted that computers could replace radiologists within the next 4-5 years [11]. This prediction suggests that AI poses a significant threat to radiologists' job opportunities. Tang added that retaining radiologists' roles is costly due to their high level of skill, whereas AI tools are much more cost-effective. Although some radiologists may retain their roles, it seems unlikely that this will be sufficient to prevent job losses [12]. On the other hand, Liu et al. suggested that the rise of AI solutions could create more opportunities for radiologists. Radiologists are essential for leading AI innovations by providing input and guiding data scientists and AI developers in building effective solutions. The global market size for AI in medical imaging is estimated to grow to \$10.14 billion by 2027, creating new opportunities for exploration and innovation [13]. A study has shown that a radiologist-AI combination has the combination of radiologists and AI yields the best performance compared to either radiologists or AI alone. This finding indicates that a "partnership" between AI systems and radiologists, rather than "replacement", is optimal [14].

Due to the introduction of AI into the radiology workflow, the market for radiology services have changed significantly and has increased demands on radiologists. Studies have proven that radiologists who use AI will replace radiologists who do not [15]. Radiologists are now expected to acquire the newest techniques to work with AI solutions, and those who fail to adapt to the changes or have not learned the new techniques may struggle in the current job market [16]. According to Waymel et al., 73.3% of radiologists are estimated to have insufficient information on AI solutions [17]. Additionally, radiologists also need to learn to interpret and trust AI outputs while maintaining their clinical judgement. These complex human-AI interactions add more responsibility and stress on radiologists [18].

# Recommendations

## 1. Radiologist should decide which AI solution to adapt

Rubin has strongly advised that radiologists should become educated consumers when selecting AI solutions to be integrated into their workflow. Several questions should be considered before adapting an AI tool:

- Does the AI tool meet the clinical needs according to the radiologist's practices?
- Is the performance of the AI tool, when evaluated using case data from the radiologist's own practice, up to standard?
- What are the potential problems associated with over-reliance on the AI tool?
- Can radiologists maintain their clinical skills after the adoption of the AI tool?

Ultimately, the responsibility of patient care lies with radiologists, not AI systems. The optimal selection of AI tools can maximize their benefits to radiologists<sup>[19]</sup>. For these reasons, it is recommended that hospitals consult and respect radiologists' opinions on their choice of AI tools and provide support during implementation.

In practice, integration of AI applications into the radiology workflow can be very complex and expensive, depending on the specific AI applications utilised. Effective communication between hospitals and radiologists is essential to find the optimal balance in selecting which AI tools to invest in and which not to.

## 2. Provide training/education of new AI solutions to radiologists

To ensure that radiologists' knowledge aligns with the rapidly growing AI technologies, education is required to equip radiologists with the skills to handle AI-enabled technologies efficiently and safely in their clinical practice. Van et al. suggested that AI education should be implemented at the undergraduate level to sufficiently prepare students for the work environment. However, participants in van et al.'s study identified cost and limited information in course advertisements as the main challenges in recruiting new students or radiologists to these programs. It has been suggested that magnifying the course's unique selling points and increasing its depth could attract more radiologists to enrol. It is recommended that hospitals, the government, and educational institutions provide additional funding to support radiologists' further education on AI solutions.<sup>[20]</sup>

## 3. Radiologists should have the last say

A study has indicated that patients prefer human interaction when discussing their scan images, as they want to fully understand their results and engage in their care. It has been noted that some patients feel intimidated by the unknown AI tools used and lack trust in the results produced by these tools. Additionally, concerns have been raised about the absence of human empathy if human interactions are excluded from the process. By having a radiologist explain the results, patients are more likely to maintain a positive attitude towards AI technology.<sup>[4]</sup> Furthermore, AI tools cannot be held responsible for incorrect predictions, as they do not meet the criteria for full moral action, such as freedom and consciousness. Radiologists who used the AI tools will be responsible for any AI mistakes<sup>[21]</sup>. Therefore, it is essential for radiologists to verify all AI predictions before presenting the results to patients and take responsibility for the final diagnosis.

## 4. Establish continuous communication with developer of AI tools

The radiology department or the hospital should always maintain communication with the organisation who develops the AI tools used. The developers should provide radiologists with clear explanations on how the system works and its strengths and weaknesses. AI highly depends on its

training data, and overfitting of the data may lead to fatal misdiagnoses. By understanding the system thoroughly, radiologists can critically review the results and adjust the findings if necessary <sup>[22]</sup>. Any questions by the radiologists should also be cleared through communication with the developer company to avoid any misunderstanding of the system.

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