

Word Count: 499

Declaration

I, Neslihan Isleyen, confirm that my submission for the MMS Section of Imaging Judith Adams essay competition 2023 is my own work, is not copied from any other person's work (published or unpublished), and has not previously been submitted to the Manchester Medical Society or elsewhere. I understand that if I am found to have plagiarised work, any prizes will be rescinded and I may be barred from entering in future competitions with the Manchester Medical Society.

Title: What is the most significant advancement in medical imaging in the last 10 years?

Introduction

Artificial Intelligence (AI), a term introduced by John McCarthy in 1955, is defined as "the science and engineering of creating intelligent machines" (McCarthy 1955). AI functions by gathering and pre-processing data, selecting suitable algorithms, training models on the data, validating their accuracy, and using them for predictions or decisions.

In the field of radiology, AI has brought about a transformative impact, reshaping the way we interpret, diagnose, and treat diseases. The seamless integration of AI into radiology holds the potential for heightened precision, efficiency, and ultimately, enhanced patient outcomes.

Domains AI has revolutionised in Radiology

One of the most promising frontiers in healthcare innovation lies in the application of AI in medical imaging, encompassing but not limited to image processing and interpretation. AI-driven algorithms can accurately analyse medical images, detecting and highlighting abnormalities, reducing the likelihood of human errors. Deep learning techniques enable AI models to learn from extensive datasets, recognising intricate patterns and subtle nuances. This provides radiologists with a valuable second opinion, resulting in more confident diagnoses and timely treatment plans. As an illustration, the implementation of an artificial intelligence deep convolutional neural network (DCNN) in the analysis of X-ray images has showcased its potential in enhancing the performance of radiologists when it comes to the detection of hip fractures, as evidenced by the study conducted by Mawatari et al. (2020).

Currently, there is a substantial workforce deficit of 29%, and projections suggest that this shortage will intensify, reaching a critical 40% by 2027 (Royal College of Radiologists [RCR], 2023). The existing supply-demand imbalance has contributed to heightened levels of stress among clinical radiologists, with 49% of them reporting burnout (RCR, 2023). The radiology workflow, characterised by its complexity and time-consuming nature, has seen substantial improvements through the integration of AI. This integration has notably enhanced efficiency by automating routine tasks like image pre-processing and initial screening, thereby streamlining radiologist's daily processes.

Image fusion represents the process of combining the information acquired from different imaging modalities. The fusion process is employed to enhance image accuracy and facilitate the detection and evaluation of medical conditions by preserving and enhancing the relevant features (Tawfik et al., 2020). An example of this is the Dual-Branch Generative Adversarial Network (DBGAN), an advanced AI system built on deep learning algorithms capable of merging the dense, bony structures from a CT scan with the soft tissue details found in an MRI image (Zhai et al., 2023). As CT and MRI scans each have their own strengths and limitations, the application of AI enables radiologists to synergistically merge both scan types, harnessing the advantages of each imaging modality.

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Conclusion

The future of radiology is closely linked to ongoing advancements in AI technology. Through the utilisation of AI, radiologists can augment their capabilities, resulting in refined image interpretation, more efficient workflows, and personalised patient care. As AI algorithms continue to progress, the integration of human expertise with AI-generated insights holds the potential to revolutionise radiology, making it a more precise, streamlined, and patient-centred field.

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