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Editorial

Heliyon medical imaging: Shaping the future of health

The field of medical imaging has dramatically changed this century. Important developments in imaging camera systems, both in radiology and in nuclear medicine, took place. In radiology, besides improvements in ultrasound, CT, and MRI systems, photo-counting CT (PCCT) represents a recent technological milestone. PCCT enables higher spatial resolution, energy resolved imaging, and spectral-postprocessing, leading to improved contrast-to-noise ratio, artifact and potential dose reduction as well as elimination of electronic noise. Initial clinical results are promising, and there is a vast increase in the number of publications on PCCT [1].

Historically, the field of nuclear medicine has pioneered many innovations. Since the year 2000, however, this has resulted in an even more transformative landscape with breakthroughs in specific radiopharmaceuticals, the development of SPECT/CT, PET/CT, and PET/MRI hybrid camera systems, and an exponential growth in theranostics. A recent game changer was introduced a couple of years ago with the implementation of large-axial-field-of view PET/CT camera systems, with a significant improvement in sensitivity and image quality, resulting in lower administered activity doses, and/or reduction in scan acquisition time to even a couple of minutes. This not only leads to a higher patient throughput, but also to the possibility to scan children or critically-ill patients, to study organ axes, and to use PET as a non-invasive tool for drug development and precision medicine [2].

A new branch in the field of medical imaging is optical imaging. This technique relies on the electromagnetic spectrum to visualize cellular and molecular function through a tracer-based approach. Nowadays, optical imaging is mainly used in the surgical theatre or during endoscopy to provide real-time molecular information, but its potential for periprocedural use is undeniable [3].

All these techniques play an invaluable role in tumour imaging, for staging, biopsy guiding, therapy prediction, therapy guiding, and early therapy evaluation. But the value is not only clear for oncology, also in other domains like neurology, cardiology, and infectious diseases, molecular imaging techniques lead to personalized and precision medicine, transforming the medical landscape.

These innovations in medical imaging have not only illuminated new paths to clinical insights and treatment modalities but also resulted in an exponential surge in data [4]. Artificial intelligence (AI) and machine learning (ML) in medical imaging have marked a notable transformation in healthcare [5–8]. These advanced technologies are not only enhancing diagnostic accuracy but also bridging critical gaps in the understanding and treatment of complex diseases, particularly at the intersection of medical health.

AI and ML algorithms excel in the analysis of vast amounts of imaging data, identifying patterns, and predicting outcomes with remarkable precision [9,10]. In dental medicine, for example, these technologies can diagnose dentomaxillofacial diseases [11], detect early signs of dental caries [12], periodontal diseases [13], and even oral cancers from photographic images [14]. This early detection is important for prompt and effective treatment, improving patient outcomes significantly. Moreover, the relationship between systemic diseases and dental pathology is gaining increasing attention. Research indicates the relations among diabetes, cardiovascular diseases, pneumonia, and oral symptoms [15]. AI-driven analysis of dental images can thus serve as a non-invasive diagnostic tool for systemic diseases, providing a dual benefit in both medical and dental contexts.

The application of AI in medical imaging is not limited to diagnosis alone; it extends to treatment planning and monitoring [16,17]. Furthermore, AI and ML are unveiling new insights into the interplay between communicable, non-communicable diseases, and mental health [18]. By analyzing large datasets from diverse populations, these technologies can identify previously unrecognized links and risk factors, leading to more comprehensive prevention strategies and targeted treatments. For example, the correlation between chronic infections and cancer risk [19] can be better understood through AI-driven data analysis, facilitating early interventions and reducing disease burden.

AI in medical imaging represents a paradigm shift towards personalized healthcare [20–22]. As AI technology continues to evolve, it holds the promise of not only enhancing diagnostic and therapeutic capabilities but also fostering a deeper understanding of the complex systems underlying human health. The future of healthcare lies in this synergy of technology and medical expertise, paving

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the way for breakthroughs that were once deemed unattainable.

The *Heliyon Medical Imaging* section aims to promote the publication of high-quality papers that significantly contribute to new developments in the field of medical imaging, papers that use imaging for diagnosis and treatment, and papers that focus on AI and ML with the use of imaging camera systems. By encouraging rigorous research and innovative studies, this section seeks to advance the understanding and application of these technologies in clinical practice. Additionally, the section aspires to highlight discoveries that enhance the prevention and treatment of both communicable and non-communicable diseases, thereby driving forward the frontiers of medical science and improving patient outcomes globally.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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