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P2.50: Enhancing accuracy of effective atomic number mapping with deep learning-based conversion: A promising alternative to dual-energy CT

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Effective atomic number (Zeff) is a critical parameter in radiation therapy and nondestructive testing applications. Although dual-energy computed tomography (DECT) is widely utilized for the determination of Zeff, it is associated with several limitations, including increased patient exposure and substantial equipment costs. To overcome these challenges, we propose a novel approach that employs a deep learning model (RegGAN) to achieve accurate Zeff calculation. This method involves the conversion of low-energy CT to high-energy CT, followed by Zeff map generation. In this study, we conducted an in-depth comparative analysis between the RegGAN-based conversion technique and traditional DECT methodologies, evaluating their respective accuracy and noise reduction capabilities. Our experimental results showed that the proposed RegGAN-based conversion method outperformed DECT in terms of Zeff mapping accuracy (approximate 10% improvement). Furthermore, the RegGAN model showed superior performance to alternative deep learning models, such as U-Net, GAN, and Cycle-GAN. Of particular note, the proposed method effectively mitigated noise in high-energy image, leading to enhanced Zeff accuracy. Our findings suggest that the deep learning-based conversion technique presents a promising alternative to DECT, providing a more precise and cost-effective solution for Zeff mapping in radiation therapy and nondestructive testing applications.

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