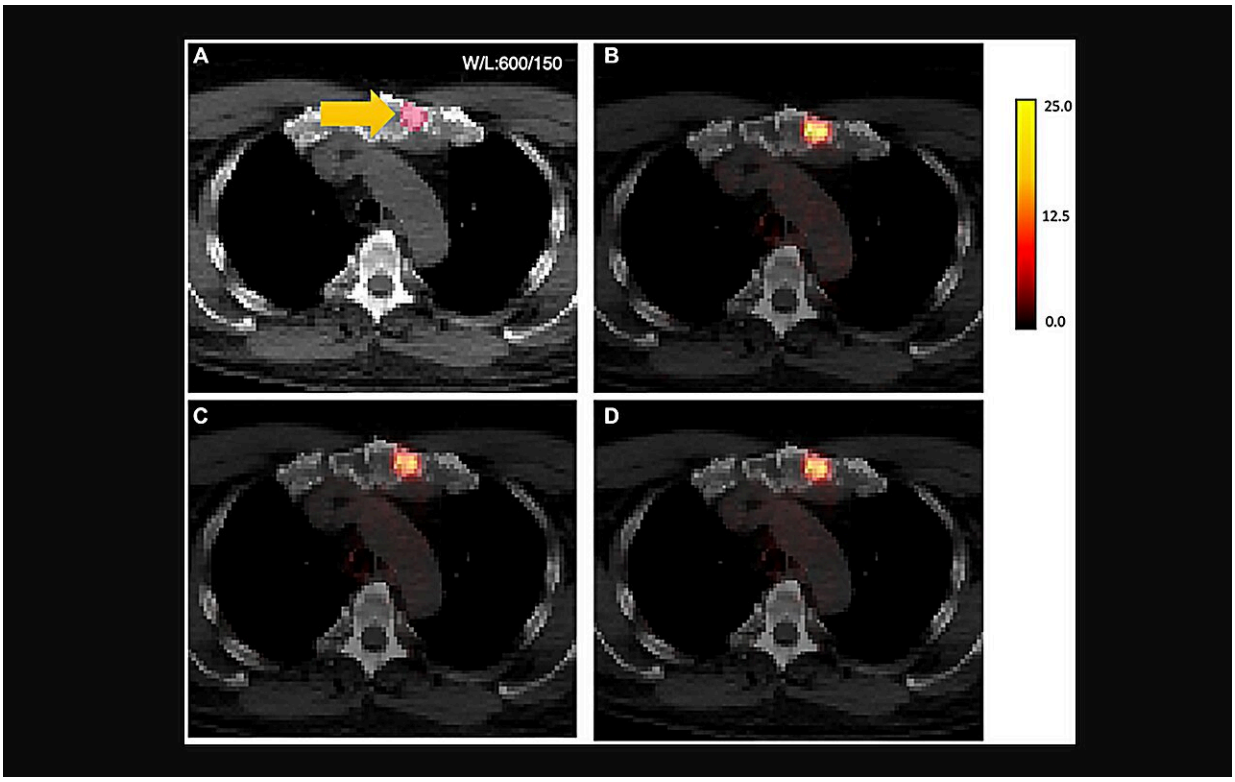
Study: Deep learning-based whole-body PSMA PET/CT attenuation correction utilizing Pix-2-Pix GAN

May 9 2024



AI-generated PET results shown overlaid on CT. Credit: *Oncotarget* (2024). DOI: 10.18632/oncotarget.28583

A new research paper was published in *Oncotarget*, titled "Deep learning-based whole-body PSMA PET/CT attenuation correction utilizing Pix-2-Pix GAN."

Radiation dosage limits the sequential PET/CT studies oncology patients can undergo during their treatment follow-up course.

In this new study, researchers from the National Institutes of Health's National Cancer Institute proposed an artificial intelligence (AI) tool to produce attenuation-corrected PET (AC-PET) images from non-attenuation-corrected PET (NAC-PET) images to reduce need for low-dose CT scans.

"AI-generated PET images have clinical potential for reducing the need for CT scans for attenuation correction while preserving quantitative markers and image quality in prostate cancer patients," write the researchers.

A deep learning algorithm based on 2D Pix-2-Pix generative adversarial network (GAN) architecture was developed from paired AC-PET and NAC-PET images. 18F-DCFPyL PSMA (prostate-specific membrane antigen) PET-CT studies from 302 prostate cancer patients split into training, validation, and testing cohorts (n = 183, 60, 59, respectively). Models were trained with two normalization strategies: Standard Uptake Value (SUV)-based and SUV-Nyul-based.

Scan-level performance was evaluated by normalized mean square error (NMSE), mean absolute error (MAE), structural similarity index (SSIM), and peak signal-to-noise ratio (PSNR). Lesion-level analysis was performed in regions-of-interest prospectively from nuclear medicine physicians. SUV metrics were evaluated using intraclass correlation

coefficient (ICC), repeatability coefficient (RC), and linear mixed-effects modeling.

Median NMSE, MAE, SSIM, and PSNR were 13.26%, 3.59%, 0.891, and 26.82, respectively, in the independent test cohort. ICC for SUVmax and SUVmean were 0.88 and 0.89, which indicated a high correlation between original and AI-generated quantitative imaging markers. Lesion location, density (Hounsfield units), and lesion uptake were all shown to impact relative error in generated SUV metrics (all p

"The Pix-2-Pix GAN model for generating AC-PET demonstrates SUV metrics that highly correlate with original images. AI-generated PET images show clinical potential for reducing the need for CT scans for attenuation correction while preserving quantitative markers and image quality," state the authors.

More information: Kevin C. Ma et al, Deep learning-based whole-body PSMA PET/CT attenuation correction utilizing Pix-2-Pix GAN, *Oncotarget* (2024). DOI: 10.18632/oncotarget.28583

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