**Deep Learning-Based Whole Body PET Image Correction Toward Quantitative Imaging**

Zohreh Shahpouri1, Yazdan Salimi2, Habib Zaidi2, Isaac Shiri3

1. Hanze University of Applied Science, Groningen, The Netherlands
2. Division of Nuclear Medicine and Molecular Imaging, Geneva University Hospital, Geneva, Switzerland
3. Department of Cardiology, Inselspital, Bern University Hospital, University of Bern, Switzerland, Bern, Switzerland

**Introduction:** Recent advancements in deep learning (DL) offer significant advantages in PET imaging, particularly in enhancing attenuation scatter correction (ASC) and artifact correction. However, practical implementation remains challenging due to variations in scanner types and radiotracer distribution. We aim to develop an Integrated Multi-Center DL Model (IMCM) to address direct ASC in PET images and evaluate its performance in correcting image artifacts.

**Methods:** A total of 270 clean and artifact-free images were selected from a collection of over 2000 patient images undergoing 68Ga and 18F-FDG PET/CT scans across seven centers. Three centers were designated for external testing: one for 68Ga data (Ex-center) and two for 18F-FDG data (Rt-center). A dedicated 3D-UNet model employing a deep supervision strategy was trained on artifact-free images from four centers. The model's performance was then evaluated quantitatively and qualitatively for artifact correction on three external test sets.

**Results:** For the internal centers, the IMCM model achieved a Mean Error (ME) of -0.56±0.74, a Mean Absolute Error (MAE) of 1.28±0.37, 2.90±0.58, and a Structural Similarity Index (SSIM) of 0.93±0.03. For the external test sets, IMCM yielded an ME of -1.92±0.58 and -0.54±0.13, an MAE of 2.38±0.76 and 0.69±0.12, and an SSIM of 0.89±0.03 and 0.78±0.10 for the Ex-center and Rt-center, respectively. IMCM successfully corrected motion and halo artifacts in both 68Ga data and 18F-FDG images

**Conclusion:** The developed model effectively addressed variations in scanner types and radiotracers, demonstrating its adaptability, generalizability, and effectiveness in different clinical environments for direct ASC and artifact correction. This study highlighted the potential of DL to provide accurate, artifact-free PET images, offering a promising alternative to CT-based ASC.

**Keywords:** Deep learning, attenuation scatter correction, CT-less PET

A collage of x-ray images of the body

Description automatically generated