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(G) A Novel Estimate of the Positron Displacement on Image Resolution in Quantitative Nuclear Medicine

Wednesday, May 29, 2024 10:30 AM (15 minutes)

Purpose: In quantitative nuclear medicine, the displacement of the positron before annihilation induces a loss of spatial resolution. As the size of the detectors decreases, this effect becomes non-negligible. In this presentation, I shall address a method of quantifying the displacement of the positron, especially its impacts on the segmentations in dynamic acquisitions. This method takes into account the specific radionuclide, through its spatial distribution, and the physical dimensions of the voxels.

Method: Using Monte Carlo simulations, it was possible to validate an analytical solution to the loss of spatial resolution in nuclear medicine. This was computed using the estimated displacement of the positron within a voxel of the image.

Since many reconstruction schemes are commercial, only the resulting image can be used. The present method is applicable to the post-processed image, with minimal information about the reconstruction schemes within the clinical device. It is thus applicable to a wide variety of images and can be used for already acquired acquisitions.

The whole process is included in the TRU-IMP graphical user interface.

Results: This method of quantifying the loss of resolution takes into account the radionuclide used through its displacement and the size of the voxels.

The process was used on phantom and pre-clinical acquisitions in the context of segmentation. The results are coherent with expectations, in the sense that a bigger segmented volume reduces this loss of resolution, as the central volume is still conserved.

Future Work: Future works will be twofold: trying to investigate the impact of a magnetic field on this loss of resolution, especially in the context of PET-MRI; developing a method of segmentation using this analysis as a loss function.

Keyword-1

Nuclear Medicine

Keyword-2

Positron Range Estimation

Keyword-3

Segmentation

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