

# Comparison of Synergistic and Single Modality Anatomically-Informed Structural Priors for Yttrium-90 PET and SPECT Reconstruction

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This research presents a synergistic method for the combined reconstruction of PET/CT and SPECT/CT data, aimed at improving image quality for Selective Internal Radiotherapy (SIRT) in treating unresectable liver tumours using Yttrium-90 ( $^{90}\text{Y}$ ) microspheres. Given the challenges posed by sparse positron emissions in PET and the wide energy spectrum and electron range of bremsstrahlung X-rays in SPECT, our method takes advantage of information shared between modalities during the reconstruction process. We used a smoothed directional total nuclear variation (dTNV) prior using anatomical information from a CT and reconstructed images using the block-sequential regularised expectation maximisation (BSREM) algorithm. Data used in this research involved a ( $^{90}\text{Y}$ )-filled NEMA phantom scanned by Mediso's AnyScan Triple Modality scanner. This technique was benchmarked against reconstructions using the channel-specific directional total variation prior, again using CT for anatomical information. Synergy yielded enhancements in image quality for both modalities, especially for SPECT reconstructions.

## Field

Software and quantification

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