

MEETING ABSTRACT

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Attenuation correction synthesis for hybrid PET-MR scanners: validation for brain study applications

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In this work, we further validate a CT and attenuation map (μ -map) synthesis algorithm [1].

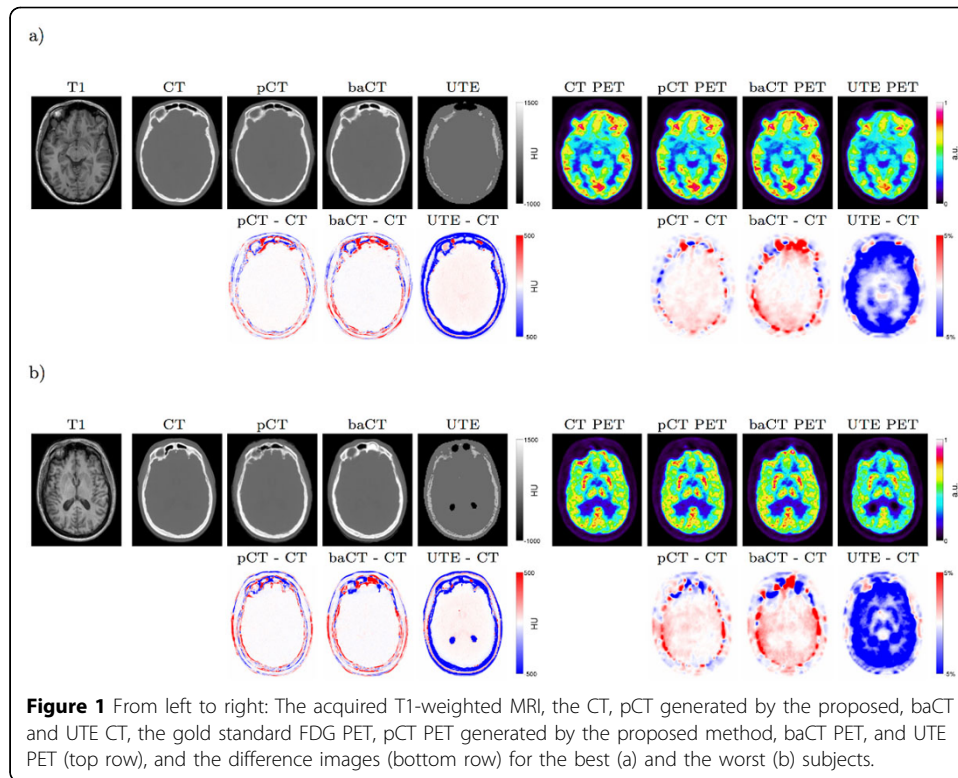
The CT synthesis method relies on a pre-acquired set of aligned MRI/CT pairs from multiple subjects. Each MRI from the database is non-rigidly registered to the target MRI. The CTs in the database are then mapped using the same transformation to the target MRI. A local image similarity measure between the target MRI and the set of registered MRIs is used as a surrogate of the underlying morphological similarity. Finally, the synthetic CT is generated using a voxel-wise weighting scheme, and converted to linear attenuation coefficients by a piecewise linear transformation.

Following the proposed method, a pseudo CT (pCT) was generated using only the MRI of the subject and compared to the ground truth CT, validating the accuracy of the CT synthesis. A PET image (PET_{pCT}) was then reconstructed with an off-line version of the Siemens Healthcare reconstruction software using the pCT μ -map, and compared with the gold standard PET reconstructed using the CT μ -map.

We validated our method for brain-related applications with 16 subjects and compared our solution to: a simpler atlas-based method, named the best-atlas method,

Table 1 Average and SD of the mean absolute residual $\left(MAR = \left(\sum_V |GT_v^{CT} - I_v^{CT}| \right) / V \right)$ **and mean residual** $\left(MR = \left(\sum_V (GT_v^{CT} - I_v^{CT}) \right) / V \right)$ **between the ground truth CT and both the pseudo CT, best-atlas CT (baCT) and UTE CT (left column); average and SD of the relative MAR and relative MR between the gold standard CT PET and both the pseudo CT, best-atlas CT and UTE PETs (right column).**

		CT (HU) - Head			PET (%) - Brain		
		pCT	baCT	UTE	pCT	baCT	UTE
MAR	Average	107	128	218	2.35	3.03	12.72
	SD	11.8	13.3	23.2	0.71	0.49	1.55
MR	Average	-7.2	18.0	-143	0.70	0.88	-12.61
	SD	14.9	16.3	35.0	1.32	1.45	1.60



obtained using a global similarity measure to select, from the database, the most similar template; and to the prototype version of a UTE-based method currently implemented on the first software versions of the Siemens Biograph mMR hybrid PET/MR scanners. The results presented in Table 1 demonstrate that the mean residual estimated between the PET_{pCT} and the gold standard PET is significantly smaller compared to the other methods. More accurate results are reached with the proposed method compared to the best-atlas method, which demonstrates the advantages of synthesising CTs at a local scale instead of a global scale (Figure 1).

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