AbstractID: 9067 Title: Attenuation Correction for Hybrid PET-MRI System by Deformable Image Registration

Purpose: To develop an accurate patient-specific PET attenuation coefficients map to be used in hybrid MRI-PET systems for brain tumor imaging. The attenuation maps are obtained by warping a general (atlas) CT dataset to the patient-specific MRI dataset using a deformable registration model.

Method: Patient MR images and the atlas CT images are registered using a B-Spline deformable model and the Mattes formulation of the mutual information metric as registration criterion. The registration establishes a voxel-to-voxel correspondence that maps each voxel in the CT atlas voxels to the MRI dataset, creating an artificial, individualized CT scan of the patient's anatomy as observed in the MRI dataset. To evaluate the accuracy of the deformable-based attenuation correction, ten clinical brain tumor cases are studied with MR-CT image sets. For each case an artificial CT is computed by warping the atlas to the MRI datasets. This artificial CT is compared to the true patient's CT in terms of geometrical accuracy of the deformation module as well as a voxel-to-voxel comparison of HU units.

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Results: In all cases, mapping form the atlas CT to the individual MR was achieved with great geometrical accuracy as visually judged using the qualitative visual inspection tools. The mean distance between the artificial and true CT's external contour and bony anatomy was 1 mm and 1.5 mm, respectively. In terms of HU unit comparison, the mean voxel-to-voxel difference was less than 5%.

Conclusion: Attenuation correction for hybrid MRI-PET scanners can be easily achieved by individualizing an atlas CT to the MRI dataset using the BSpline deformable model, with no user interaction required. The method provides clinical accuracy while eliminating the need for an additional CT scan for PET attenuation correction.