ID contributo: **36** Tipo: **Poster**

Attenuation Correction for Hybrid MR/PET Scanners: a Comparison Study

martedì 19 maggio 2015 16:00 (1O 30m)

Attenuation correction of PET data acquired in hybrid MR/PET scanners is still a challenge. Different methods have been adopted by several groups to obtain reliable attenuation maps (mu-maps). In this study we compare three methods: MGH, UCL, Neural-Network. The MGH method is based on an MR/CT template obtained with the SPM8 software. The UCL method uses a database of MR/CT pairs. Both generate mu-maps from MP-RAGE images. The feed-forward neural-network from Juelich (NN-Juelich) requires two UTE images; it generates segmented mu-maps. Data from eight subjects (S1-S8) measured in the Siemens 3T MR-BrainPET scanner were used. Corresponding CT images were acquired. The resulting mu-maps were compared against the CT-based mu-maps for each subject and method. Overlapped voxels and Dice similarity coefficients, D, for bone, soft-tissue and air regions, and relative differences images were calculated.
The true positive (TP) recognized voxels for the whole head were 79.9% (NN-Juelich, S7) to 92.1% (UCL method, S1). D values of the bone were D=0.65 (NN-Juelich, S1) to D=0.87 (UCL method, S1). For S8 the MHG method failed (TP=76.4%; D=0.46 for bone). D values shared a common tendency in all subjects and methods to recognize soft-tissue as bone. The relative difference images showed a variation of -10.9% - +10.1%; for S8 and MHG method the values were -24.5% and +14.2%.
A preliminary comparison of three methods for generation of mu-maps for MR/PET scanners is presented. The continuous methods (MGH, UCL) seem to generate reliable mu-maps, whilst the binary method seems to need further improvement. Future work will include more subjects, the reconstruction of corresponding PET data and their comparison.

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Classifica Sessioni: Session 8 - Poster Session I

Classificazione della track: 3 - Advances in MR-PET and MR-SPECT software and quantification