Integration of Diffusion and Perfusion Images of Human Breast Cancer by Registration and Dissimilarity Based Clustering

Purpose:

To introduce a new patient-specific pipeline for the integration of breast diffusion and perfusion MRI for surgical planning.

Material and methods:

We propose a two-step process for the integration of information derived from DCE-MRI and DW-MRI modalities. First, voxel-wise dissimilarity-based clustering is performed on DCE images to identify different tumoral subregions, which are then projected to the DW-MRI following a patient-specific registration protocol consisting of a preliminary multiresolution rigid transformation followed by an elastic B-Spline deformation focused on the lesion area. The probability density functions in the ADC map of the subregions are then extracted and compared through non-parametric testing (Wilcoxon-signed-rank test, \( p=0.05 \)). The pipeline was demonstrated using DCE-MRI and DW-MRI acquired from 7 patients, ranged in age 42-70 (median 48 years), affected by primary ductal carcinoma.

Results:

Non-parametric tests show that subregions corresponding to different clusters in the DCE volume have statistically different characteristics, which indicates the consistency of the information obtained from the two modalities while providing a posterior validation of the registration method.

Conclusion:

In this work we have employed dissimilarity-based representations instead of classic features to integrate the information provided by both diffusion and perfusion MRI images of the breast. Preliminary results are quite promising and suggest the exploitation in future works of this combined information in the registration process through the definition of an ad-hoc objective function. Moreover, after spatial registration, the diffusion information can be incorporated into the classification process yielding a truly multimodality integration of imaging data.