Elastic Registration of Multimodal Prostate Images

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Founded by: Hungarian Scientific Research Fund (OTKA) - - CNK80370 [2]
National Innovation Office (NIH) [3]
EU and by the European Regional Development Fund within the project TAMOP-4.2.1/B-09/1/KONV-2010-0005

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Related projects:
- Recovering Diffeomorphic Shape Deformations without Correspondences [7]

Lifetime from: 2011
Lifetime to: 2012
Short description: A novel method for non-rigid registration of transrectal ultrasound and magnetic resonance prostate images based on a non-linear regularized framework.

Description:
A novel method is developed for non-rigid registration of transrectal ultrasound and magnetic resonance prostate images based on a non-linear regularized framework of point correspondences obtained from a statistical measure of shape-contexts. The segmented prostate shapes are represented by shape-contexts and the Bhattacharyya distance between the shape contexts is used to find the point correspondences between the 2D fixed and moving images. The registration method involves parametric estimation of the non-linear diffeomorphism between the multimodal images and has its basis in solving a set of non-linear equations of thin-plate splines. The solution is obtained from the minimization of image difference between the fixed and the transformed image, where the latter is represented by a set of non-linear thin-plate spline equations defined over the moving image. Image difference minimization leads to the maximum overlap of the fixed and the transformed moving images but, the gray-level transformation of the moving image does not produce clinically acceptable transformations of the anatomical targets. Therefore, the regularized bending energy of the thin-plate splines along with the localization error of established correspondences is jointly minimized with the fixed and transformed image difference. The registration accuracies of the proposed method are evaluated in 20 pairs of prostate mid-gland ultrasound and magnetic resonance images. The results obtained in terms of Dice similarity coefficient show an average of 0.980 ± 0.004, average 95% Hausdorff distance of 1.63 ± 0.48 mm and mean target registration and target localization errors of 1.60 ± 1.17 mm and 0.15 ± 0.12 mm respectively.

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Published on Informatikai Intézet (http://www.inf.u-szeged.hu)


Kategória: Medical Applications
Registration

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